BDJ Clinician's Guides

Mili Doshi
Andrew Geddis-Regan *Editors*

Oral Health and Dental Care in the Ageing Population

BDA
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BDJ Clinician's Guides

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This book is dedicated to the memories of Gordon Vincent Eyre Barker (AGR) & Katie Blake (MD)

Foreword

As the Chair of the British Society of Gerodontology, I was delighted to learn that Mili Doshi and Andrew Geddis-Regan were endeavouring to write a textbook on oral health care for older people, and I felt incredibly touched when asked to contribute to the foreword.

In the 1970s, I spent my teenage years living with my grandmother. Her older friends would regale tales about their past mouth care experiences; all wore complete dentures, usually acquired as a twenty-first birthday gift or for their weddings, taking advantage of the new National Health Service. Several lamented that biting an apple or eating lettuce when wearing dental protheses was a challenge, and couples would often muddle their dentures with hilarious consequences. These marvellous memories stoked my career-long interest in improving oral health care for older people.

Life-course directives for the population emphasise living a healthy and fulfilling life for as long as possible. It is predicted that a third of females born today in the UK will live to be 100 years old. These statistics are a stark reminder that future dental teams will be providing oral care to increasing numbers of older people. Yet, prominence continues to be given to children and younger adults. UK dental policymakers and educators recognise that this inequity needs to be addressed. Dental teams, associated health and social care workers and carers should have the requisite knowledge, training and skills to support and provide mouth care for older people, especially those living with frailty, that respects and is responsive to their values, needs and wishes.

Invited co-authors with vast experience and clinical expertise have contributed to the chapter themes, including palliative, end of life, domiciliary dental care, and age-specific oral health topics. As a result, the reader is provided with all relevant knowledge and information required for oral health prevention, management and treatment planning options, safe and appropriate dental care in the right environment. The whole dental team will benefit from reading this text and will be well supported to maintain and improve oral health care for older people.

Vicki Jones
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Preface

As dental professionals, we will be caring for an increasing number of older adults due to the demographic changes in global ageing. We will encounter older patients who have acquired more complex medical, social and dental health care needs throughout their lifetime. These patients will require patient-centred care by appropriately trained dental teams.

Maintaining good oral health in later life is essential for health and well-being. Poor oral health can profoundly disturb eating and speaking and is associated with malnutrition. A functioning aesthetically pleasing dentition plays a prominent role in social activity for older people. Frailty may disrupt previously established routines like everyday mouth care and attending dental appointments. This book aims to provide an evidence-based practical approach to older adults' oral health and dental care needs.

We have been delivering dental care for older people for many years in very different contexts—built-up South England and the rural North. The commonality, however, was our desire to ensure that dental care for older people was high quality and progressed at the same—or a faster—rate than the demographics of our population change. The changes in the needs and wishes of older people seen in specialist dental services have become increasingly evident with more complex dental, medical and psychosocial circumstances feeding into our working lives. Arguably, both the commissioning of dental services for older people and undergraduate and postgraduate training in gerodontology have not kept up to this rate of change. Older people—dentate or not—require holistic and tailored dental care, including quality prevention and high-quality treatment. In general, this can take place in general dental practice, yet community dental services and the specialities of special care dentistry and restorative dentistry are also well placed to provide care in complex scenarios. Clinicians in multiple settings are supporting and innovating in the care of older people in a way that suggests the needs of this group will be met over time if services are empowered to develop accordingly.

There are limited up-to-date resources available to support dental professionals providing care for older people, reflecting current professional and patient expectations. A focus on mouth care optimisation in all settings (MD) and figuring out how to offer appropriate treatment (AGR) led to a range of discussions regarding gerodontology and the dental care of older adults. Older people represent a diverse

group, from those who remain very healthy to those with debilitating conditions, and there is a need for a book that focuses on this wide range of individuals.

We thought the time was right to produce a resource for the whole dental team that described the care needs of older people, the changes in the population and patient cohorts we see and supported care for this group. We hope this work supports the scientific and practical considerations contributing to the oral health of older people and that the individuals receiving such care are at the centre of the treatment delivered.

UK Mili Doshi
UK Andrew Geddis-Regan

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About the Editors

Mili Doshi MBE, received her BDS (Hons) from Guys, Kings and St Thomas' Dental Institute, London, in 2001 and went on to gain Membership of the Faculty of Dental Surgery (MFDS), Royal College of Surgeons of England, in 2003. She completed an MSc in Sedation and Special Care, with Distinction, at Kings College London in 2007. Since 2014 she has worked as a Consultant in Special Care Dentistry with Surrey and Sussex Health Care Trust and is the clinical lead for the dental service at the Royal Hospital for Neurodisability. Prior to which she was Senior Dental Officer in Special Care with Bart's Health Community Dental Service (formerly Tower Hamlets Primary Care Trust) for 8 years. From 2015 to 2019 Mili was the Clinical Lead for Mouth Care Matters, whose programme sets out to improve oral health, and in 2018 received an MBE in recognition of her outstanding work. She was President of the British Society of Gerodontology in 2019. She is the author of a number of articles in peer-reviewed journals.

Andrew Geddis-Regan gained a BSc (Hons) in Primary Care (First Class) at the University of Leeds in 2012 and went on to complete his BChD Dental Surgery (Distinction) at the same university in 2014. He was awarded Membership of the Faculty of Dental Surgery (MFDS) and a Dean's Medal by the Royal College of Surgeons of Edinburgh in 2016. From 2017 to 2020 he was an NIHR Academic Clinical Fellow & Specialty Trainee (Special Care Dentistry) with Health Education North East, based at Newcastle University and Dental Hospital as well as other services across the North East of England. In this post Andrew completed a Diploma in Special Care Dentistry with the Royal College of Surgeons of England and a Postgraduate Certificate in Clinical Research. Andrew gained Membership in Special Care Dentistry with the Royal College of Surgeons of Edinburgh in 2019. In February 2020, he was added to the General Dental Council's Specialist List in Special Care Dentistry. He is currently a Doctoral Research Fellow at Newcastle University (funded by the National Institute for Health Research) and a Specialist in Special Care Dentistry with North Cumbria Integrated Care NHS Foundation Trust.

Demographic Changes in the Older Population

1

Tom W. Clayton

Learning Outcomes

- To understand the global trends in population growth and ageing.
- To identify the role of population health determinants of dental need over a patient's life course.
- To consider the current dental workforce and its suitability to meet the challenges of the future.
- To demonstrate an understanding of the interplay between comorbidity and oral ill-health.

Introduction

The fact that global populations are ageing is a success story for humanity and a testament to the power of modern medicine, public health, and social and economic development. Progress in these domains has helped to largely overcome premature deaths, many diseases, injuries, and the consequences of ill-hygiene. Along with population growth, technological innovation, international migration and urbanisation, ageing is one of the global demographic "megatrends" that will shape the course of economic development and public health during this century [1].

Population ageing is a global phenomenon. Over the next 30 years, the global number of older people is projected to more than double [2]. Subsequently, the proportion of older populations is predicted to increase as people live longer, along with ever-lowering fertility rates in nearly every country examined. These

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accelerating trends will impact population age structures. For instance, in 1990, the global population aged over 65 years was 328 million (6%), which has more than doubled to 727 million (9%) by 2020. This is predicted to increase further to over 1.5 billion (16%) by 2050 [2]. This contrasts starkly with a working age population that will see only modest growth and a youth population that will not change throughout this period [2].

Ageing is a cross-cutting issue with profound societal and economic implications, such as health and social care and state pensions. Population ageing will place increased financial pressure on systems that support older people. In countries with substantial public healthcare systems, including those in Europe and Latin America, population ageing will increase the financial pressure placed upon these systems, especially if current taxation and public spending patterns remain unchanged [2]. Contrastingly, in countries where such systems are comparatively small, such as those in Southern and South-Eastern Asia, individuals and their families will face greater pressure to finance their own healthcare during their later years. Despite this, older people are increasingly seen as important contributors to state development, whose abilities to support themselves and their societies need to be accounted for by policymakers at all levels [2].

Dentistry is an area of clinical practice that is particularly exposed to ageing and the effects of advances in hygiene, public health, and dental treatments. The demand for dental services in the future will be profoundly shaped by modern preventative dentistry, but it will also be affected by the long-term consequences of older patients not having had access to preventative services when they were younger.

This chapter will consider these changes and discusses population ageing throughout the world (with a particular emphasis on the systems in the UK), past and present dental needs, the relationship between age and dental need, and the wider implications of ageing trends on economies and healthcare.

Ageing Around the World

Population size and age distribution are affected by the economy, fertility rates, mortality rates, and migration. Fertility is the most important factor when considering population dynamics and growth [3]. Global fertility rates vary based on cultural, social, and economic development, with more industrialised societies having lower fertility rates. Furthermore, higher-educated groups and those with higher incomes tend to have lower fertility rates than their educational and socioeconomic counterparts [4].

The changes in mortality rates are attributed to the development of new technologies in agriculture, health, and sanitation, with consequent increases in the number of people surviving into adulthood, overall life expectancy, and therefore increasing overall population growth. There have been substantial increases in life expectancy on every continent since 1950. As the life expectancy at birth increases, improvements in survival at older ages account for a growing proportion in longevity [5]. International migration has also been a contributing factor to changing ageing

population structures in some countries; as migrants tend to be younger people of working age, high levels of inward migration tend to mitigate the effects of an otherwise ageing population. Over time, however, these migrants will themselves age and become part of an older population [6].

Although all countries have unique histories that have defined their present circumstances, the above factors will interact in a sequence called the demographic transition model. This model has been observed in western countries since the late eighteenth century and in most developing regions since the mid-twentieth century. The demographic transition model describes several stages in societal development. For instance, as societies become more economically developed, living standards improve, and mortality rates decline. This occurs because of improvements in health (especially access to maternal and paediatric care), education, sanitation, agriculture, and reduced exposure to direct or indirect workplace risk. This leads initially to rapid population growth, but eventually also to reduced fertility rates [7]. The drop in fertility rates could be due to the more frequent use of contraception, access to abortions, and empowered women making choices about their fertility. This ultimately leads to a stabilisation of both fertility and mortality rates, which subsequently stabilises the overall population, leading to economic and cultural development. In the final stage of this model, fertility rates fall below mortality rates, and populations begin to age, and this situation helps to describe why the global ageing population is increasing.

Globally, there were 727 million persons aged 65 years or over in 2020 [8]. Over the next 30 years, the global number of older people will increase to over 1.5 billion people by 2050. All regions will see an increase in the size of the older population between 2020 and 2050, but growth in the number of older people has been fastest—and will continue to be so—in Asia. Recent figures in Asia have shown that the number of people aged 65 years or over increased from 157 million in 1990 to 411 million (+162%) in 2020 [8], and the population is set to increase by more than double to 954 million by 2050, with the proportion of those over 65 years of age increasing to 18% [8].

By contrast, in 2020, Europeans were the oldest, with 19.1% of the total population aged 65 years and older; by 2050, the older population will make up more than a quarter (28.1%) of Europe's total population [8]. Across Europe, the oldest populations tend to be located in Mediterranean littoral states, such as Italy (22.8%) and Greece (22.0%), although Finland (21.8%) and Germany (21.5%) also have high proportions of older people [8]. The youngest populations in Europe are located in the Republic of Ireland (14.1%) and in Luxembourg (14.4%) [8].

Although their citizens are not as old as those in Europe, North Americans are the second oldest in the world, with 16.6% of the population of the United States aged over 65 years and 18.1% of the Canadian population aged over 65 years [2]. By 2050, over a fifth of the United States population will be over 65 years (22.4%), and a quarter of the Canadian population will be over 65 years [8]. These figures are in stark contrast with proportions observed in Mexico as 7.6% of its population is aged over 65 years, and 17% of its population will be over 65 years by 2050 [8].

The proportion of older people in Africa is a significant outlier. Not only does Africa have the youngest population of all, with just 3.5% of its population aged over 65 years, but high fertility rates are also likely to see the proportion of older people increase only to approximately 5.7% by 2050 [8]. Although this statistic represents a tripling in the absolute numbers of those aged over 65 years, an otherwise buoyant population indicates that much of the African continent will not experience the consequences of an ageing population [8]. For example, a total of 5.6 million people (2.7%) in Nigeria are aged over 65 years. By 2050, the number of people aged over 65 years will triple to 15.9 million; however, this number represents only 4% of the total population in Nigeria [8].

Ageing in the UK

The UK's population, along with most countries in the developed world, has been growing and ageing throughout the twentieth and early twenty-first centuries, which will continue to expand for the foreseeable future. In 2021 the UK had approximately 12.6 million people aged over 65 years (18.5%) [9], indicating that the average age is lower than those in the rest of Europe. Of the four UK countries, Wales is the oldest, with 21.2% of its population aged over 65 years, followed by Scotland (19.4%) and England (18.2%). Northern Ireland has a considerably younger population than any of the other UK countries, with 16.9% of its population aged over 65 years.

Within the UK, older populations are unevenly distributed, particularly in local areas with a low population density (i.e., rural and coastal regions) that tend to have an older population. Overall, in 2021, 24.8% of the population in rural towns were aged over 65 years, whereas coastal communities were markedly aged with 27.7% of their population over 65 years old [9]. Notably, in coastal cities, such as Bristol, Brighton, and Newcastle, the average age of residents was lower than the national average as 16.8% were over 65 years of age [9]. Consistently, younger populations are concentrated in larger towns and cities; for instance, in Greater London, only 12.2% are over 65 years old [9]. The distribution of the population aged over 65 is shown in Fig. 1.1.

Over the coming decades, ageing will be driven by a combination of factors. Many of those born during the "baby boom" of the 1950s and 1960s will begin to enter old age in 2022. Alongside this, improvements in life expectancy due to improved living standards and ongoing notable declines in fertility rates will all lead to an increase in the proportion of older people. This section will describe and discuss these effects. The changing UK population structure can be thought of as a kind of demographic climate change, presenting new opportunities and profound challenges for the economy, services and society at both national and local levels.

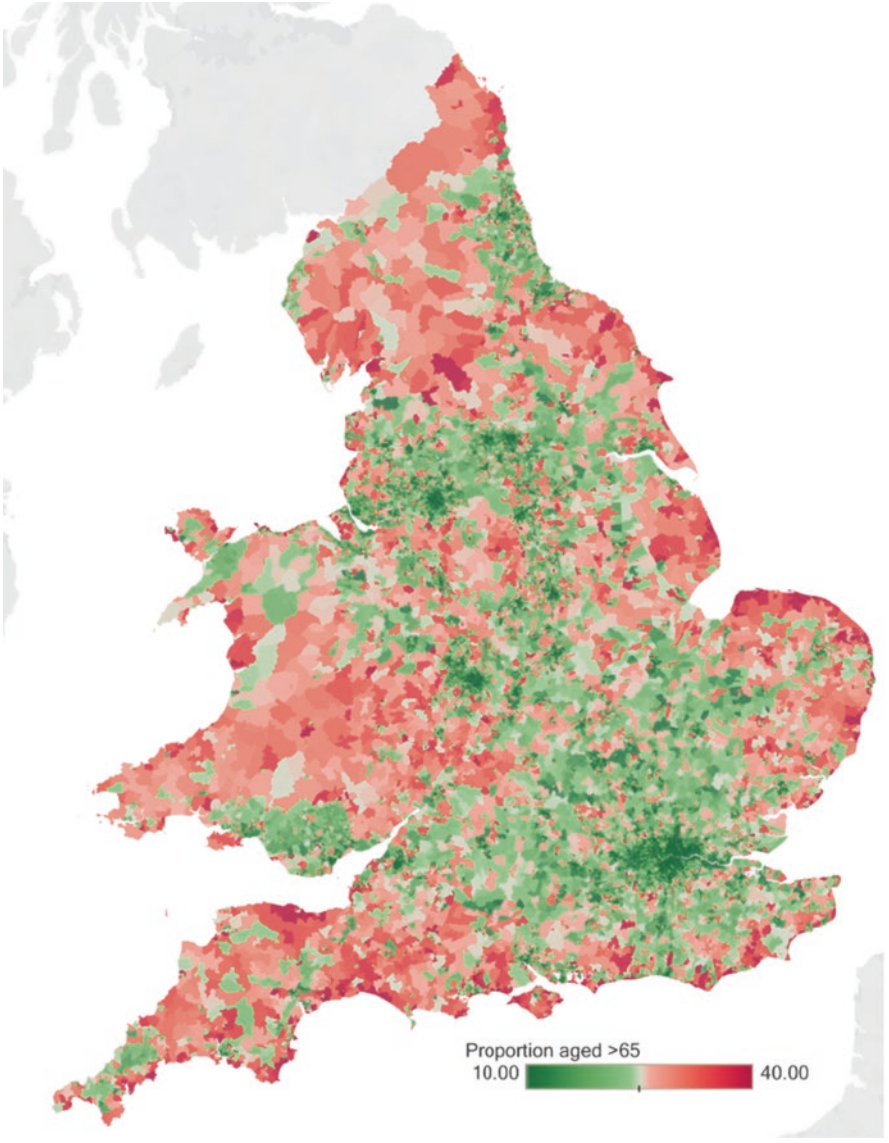

Fig. 1.1 The proportion of those aged over 65 in England and Wales

By 2060, approximately 26% (19.4 million) of all Britons will be of pensionable age [9]. The single fastest increase in the size of any one age group in the UK will be for those aged over 80 years old. In 2020, there were 3.4 million (5.1%), of whom 612,000 were over 90 years old; however, by 2040, the number of those over 80 years old is set to increase by 61%, i.e., 5.5 million people (with 1.17 million

aged over 90), thereby making up 7.6% of the total population [9]. As those in the "baby boom" cohort age into their 80s in the 2040s, we theorise that by the 2050s, the over 80s population will grow to 150% of its 2020 value at 8.5 million (11% of the total population). By contrast, over the same period, the population aged 20–39 years old will increase by 0.3%, whereas the population aged 40–64 years old will increase by 1.6% [9].

Figure 1.3 demonstrates the anticipated regional change in the proportion of people aged over 65 years.

Life expectancy has increased rapidly throughout the nineteenth and twentieth centuries because of improvements in nutrition, housing conditions, education, hygiene and sanitation. This trend is expected to continue into the future. For instance, boys born today have a life expectancy of 80.3 years, whereas girls have a life expectancy of 83.6 years. However, by 2050, the ages for boys and girls will increase to 84.5 and 87.2 years old, respectively, with 37.2% of boys and 43.3% of girls expected to reach 100 years old [9]. Given the extent to which the variables listed above affect the average life expectancy, it is also the case that those living in wealthier parts of the UK are predicted to live significantly longer than those living in poorer regions. The average life expectancy at birth for men in the most economically deprived geographies was 73.9 years, whereas those living in the least deprived areas had a life expectancy of 83.4 years. These effects from economic disparities may continue to widen further in the future [9].

In addition to the increase in life expectancy, there has been a marked decline in fertility since the mid-1960s. This has occurred especially since the introduction of oral contraceptives, and legislative events such as the Abortion Act 1967 led to people having greater control over their fertility. This autonomy has led people to choose to have fewer children and have those children later in life. In combination, these policy interventions have reduced total fertility rates in the UK from 2.93 children per woman (during the "baby boom" of the 1960s) to below 2.0 only 10 years later. Fertility rates since have ebbed and flowed and have coincided mainly with when the baby boom generation (and subsequent generations) have reached peak fertility (see Fig. 1.2) For instance, a peak in fertility from 2008 to 2014 has now subsided, and the number of births is set to fall each year until the early-to-mid 2030s, which would coincide with another period of recovery [9].

A final contributor is levels of international migration: migration to high-income countries generally sees a net inflow of younger, working age people and their dependents, and a little to no inflow (or a net outflow) of older people, have remained largely stable in the UK and are likely to continue for the foreseeable future [9]. Despite this, policymakers often assume that immigration is a reliable means of counteracting the effects of an otherwise ageing population. Although immigrants from countries with higher fertility rates tend to have larger families, fertility patterns tend to converge with those of the UK majority over time. As described earlier in this chapter, because an increasingly ageing population and declining fertility rates are global phenomena, the profiles of settled migrants are also likely to change.

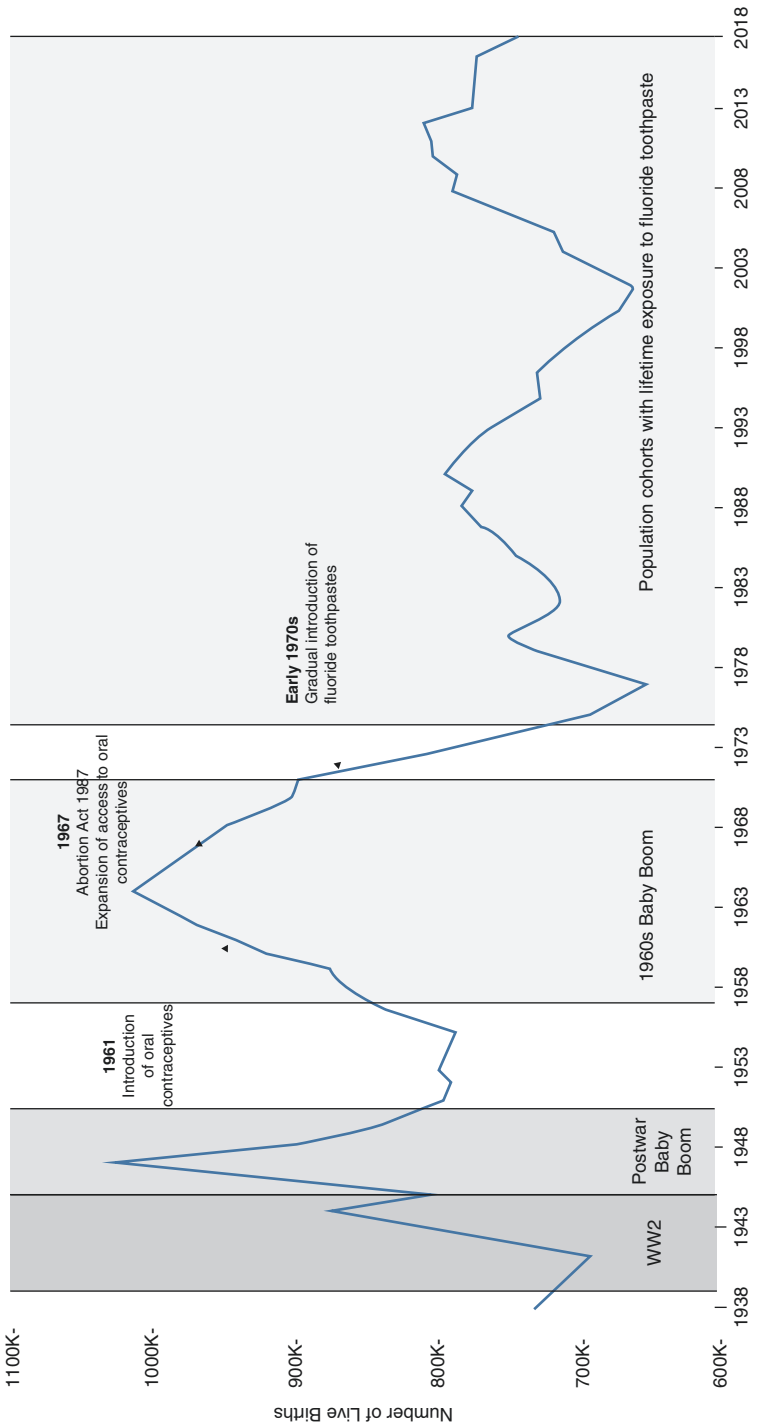

Fig. 1.2 Live Births in the UK 1938–2019

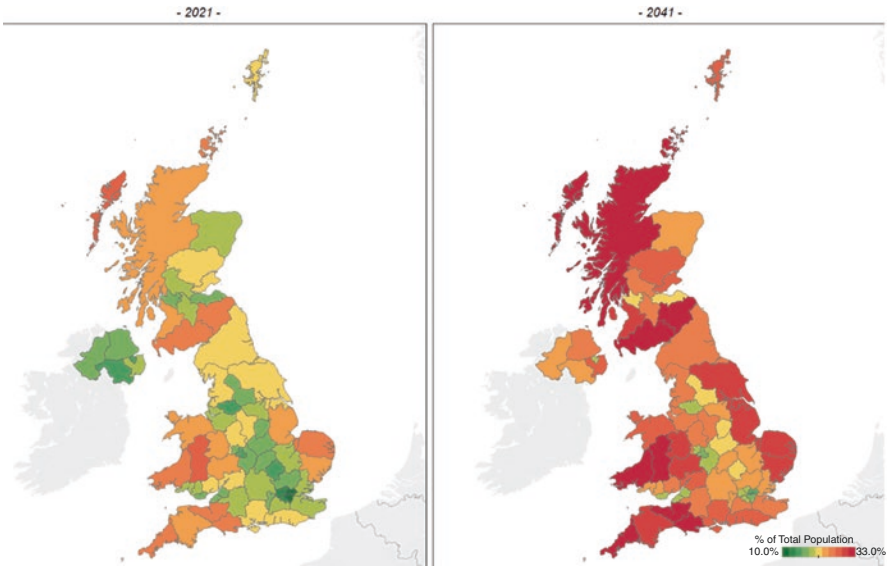

Fig. 1.3 Percentage of population aged over 65 in the UK in 2021 (left) and projected for 2041 (right)

Ageing, Oral Health, and Dentistry

As the proportion of older people among the population increases, the need to understand and manage the specific oral health needs will also increase. Over the last 50 years, improvements in dental public health, especially the access to fluoride toothpaste, have resulted in substantial changes to oral health and the dental needs of older people.

Before the mid-1950s, there was a profound disconnect between dental hygiene practices and oral health. This led to an unregulated consumer product market that produced a variety of "tooth powders" and soap-based "dentifrices". Unfortunately, none of these had any meaningful therapeutic value and some "tooth-cleaning fluids" such as Bleachodent and Tartaroff contained hydrochloric acid and were dangerous.

Research and development for toothpastes containing stannous fluoride began in 1950 by Proctor and Gamble and they also produced a prototype in 1952 that underwent clinical trials and was later marketed as "Crest" in 1956. Crest patented the use of stannous fluorides in 1969, yet other fluoride compounds, such as sodium fluoride and sodium monofluorophosphate, were used either singly or in combination. As a result, by the 1970s, nearly all commercially available toothpaste fluoride formulations contained therapeutically useful concentrations of fluoride (Fig. 1.4).

The most basic measure of oral health, that is, the retention of natural teeth over the course of an individual's life has improved enormously since 1968 when the first adults' dental health was surveyed. For example, in 1968, 37% of the population

Fig. 1.4 Early fluoridated toothpastes. (Image courtesy of the British Dental Association Library)

across England and Wales were edentate; moreover, over four-fifths of those aged over 65 years were edentate, and approximately one-fifth of those aged 35–44 years were also edentate. By 1988, the percentage of those in the population without teeth had lowered to 20% (66% of >65 years), and by 2009, only 6% of the population were edentate (22% of >65 years) [10].

Although far fewer people are edentulous now, approximately 2.7 million adults across England, Wales and Northern Ireland have no natural teeth. The distribution of edentulousness across age groups is shown in Fig. 1.5. Given the cumulative and age-dependent effects associated with tooth loss, there is a strong relationship between ageing and edentulousness, with 47% of adults over 85 years old were found to be edentate as compared with >0.5% of those aged 35–44 years old [10].

Although these improvements in tooth retention are a significant victory for dental public health leading to better oral function for millions, as the population ages, the demand for dental services will increase. Those over 45 years old continue to have worse dental health than their younger counterparts. It is likely that this cohort of people have retained a functional, though heavily restored dentition (see Figs. 1.6 and 1.9) and are likely to have a complex medical history; consequentially, they will require complex dental care and an effective prevention regime to maintain their natural teeth for the remainder of their lives, a benefit not experienced by previous generations [10].

Oral health extends not only to teeth but also to the gingivae and periodontium. Despite laudable reductions in the rate of tooth loss and edentulousness among those under 45 years old, there is room for improvement in regard to periodontal health (see Fig. 1.7) [10]. At the time of the last dental health survey in 2009, 83% of adults presented with evidence of periodontal disease. Although the survey's findings were informed to some extent by social class, 79% of those from

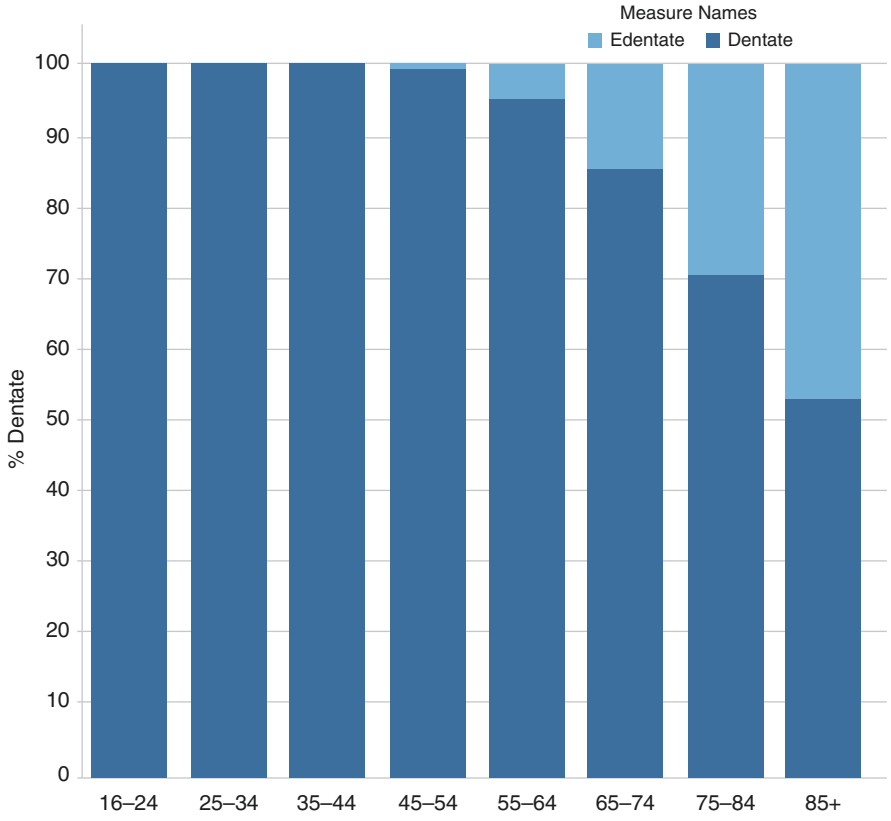

Fig. 1.5 Edentulism by age

managerial and professional occupations were found to have some pocketing, calculus or bleeding, and only 10% of the population had "excellent" oral health.[1]

To date, many people do not use fluoride toothpaste at the recommended concentration (1350–1500 ppm fluoride). While 76% of dentate adults used toothpaste containing 1350–1500 ppm fluoride, 18% of dentate adults used toothpaste containing 1000–1350 ppm fluoride and 6% dentate adults (as well as over 10% dentate adults <65 years) used toothpaste with either 550 ppm fluoride or no fluoride at all [10].

[1] Defined by 21 or more natural teeth; 18 or more sound and untreated teeth and roots; no decay detected at any site; no periodontal pocketing of 4 mm or more and no loss of attachment of 4 mm or more; no calculus or bleeding. Note: this definition of 'excellent' differs from generic definitions of oral health as a broader concept.

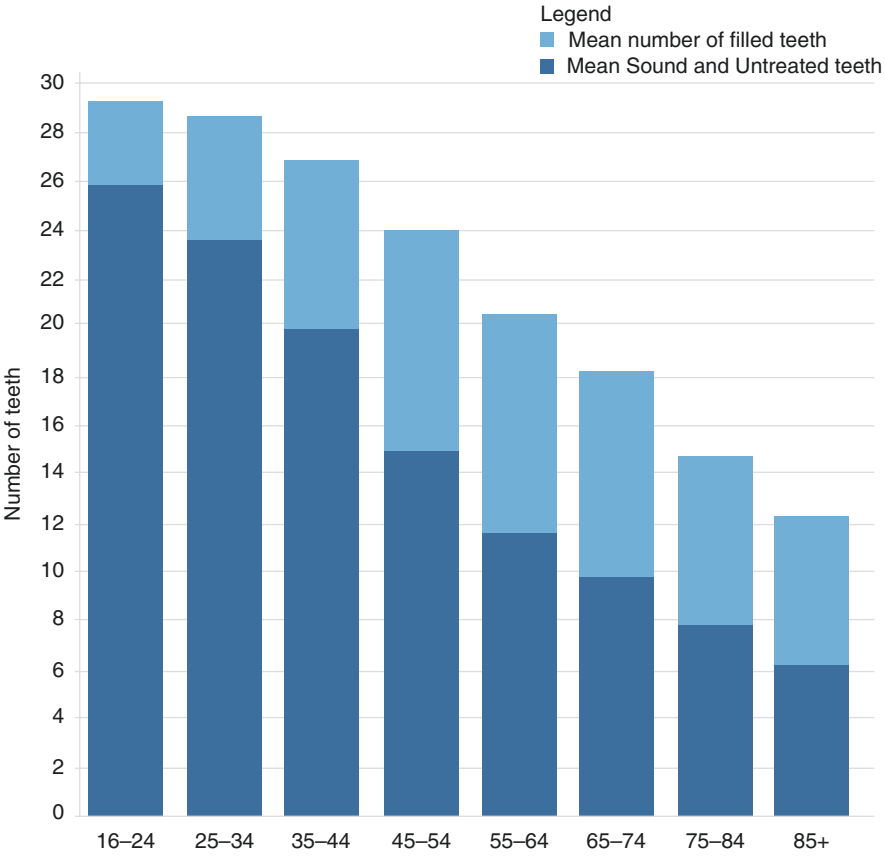

Fig. 1.6 Mean treated and untreated teeth by age

Future Demand for Dentistry

In addition to a thriving private dental sector, many UK dental services are comprised of free or subsidised dental services as commissioned for the public by each of the four devolved UK administrations. Whilst Scotland and Northern Ireland both employ a fee-per-item system, a large majority of all dental services in the UK are commissioned using Units of Dental Activity (UDAs). UDAs approximate the value of work involved in the delivery of a given course of treatment and are paid at various rates (called "bands") depending upon the complexity of the treatment.

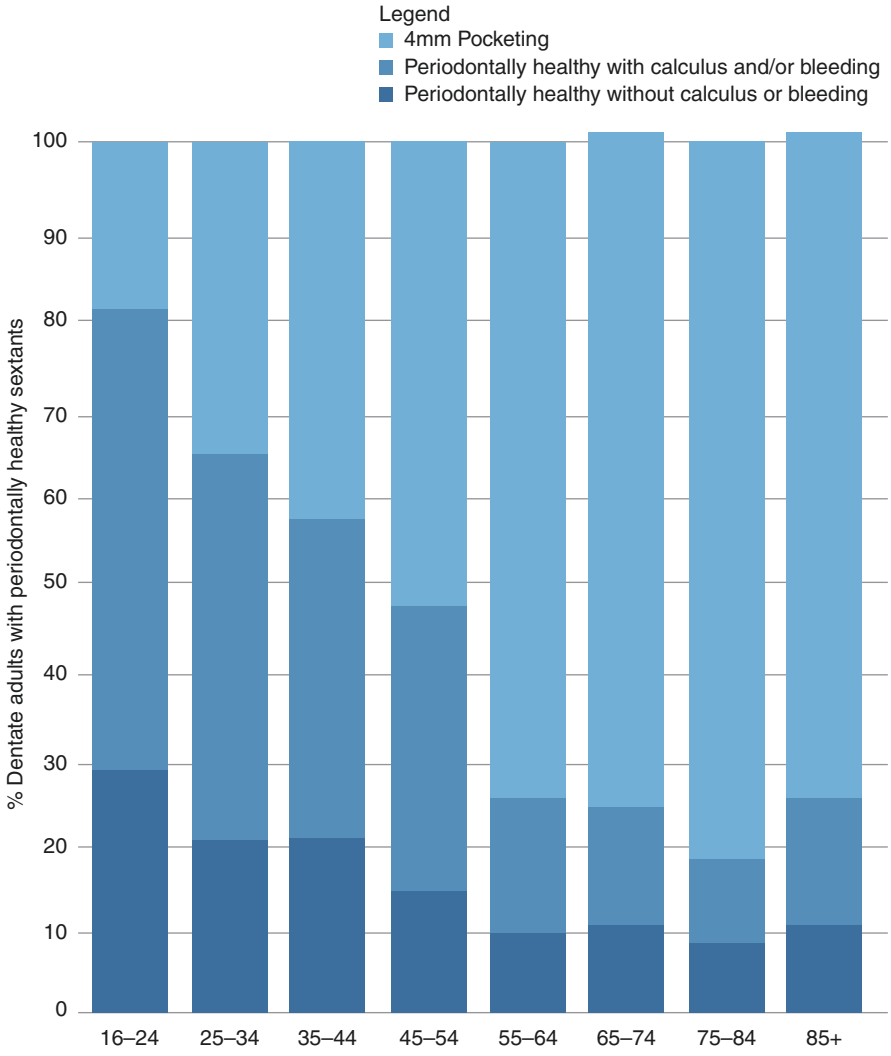

Fig. 1.7 Periodontal status by age

Figure 1.8 shows the rates of consumption of Units of Dental Activity (UDAs) by those of different ages, where

- Band 1 represents a clinical examination, radiographs, scaling and polishing, and preventative dental work, such as oral health advice.
- Band 2 represents a range of surgical or restorative treatments without a laboratory component e.g., fillings, root canal therapy, or extractions. Denture additions are also included in Band 2 charges.

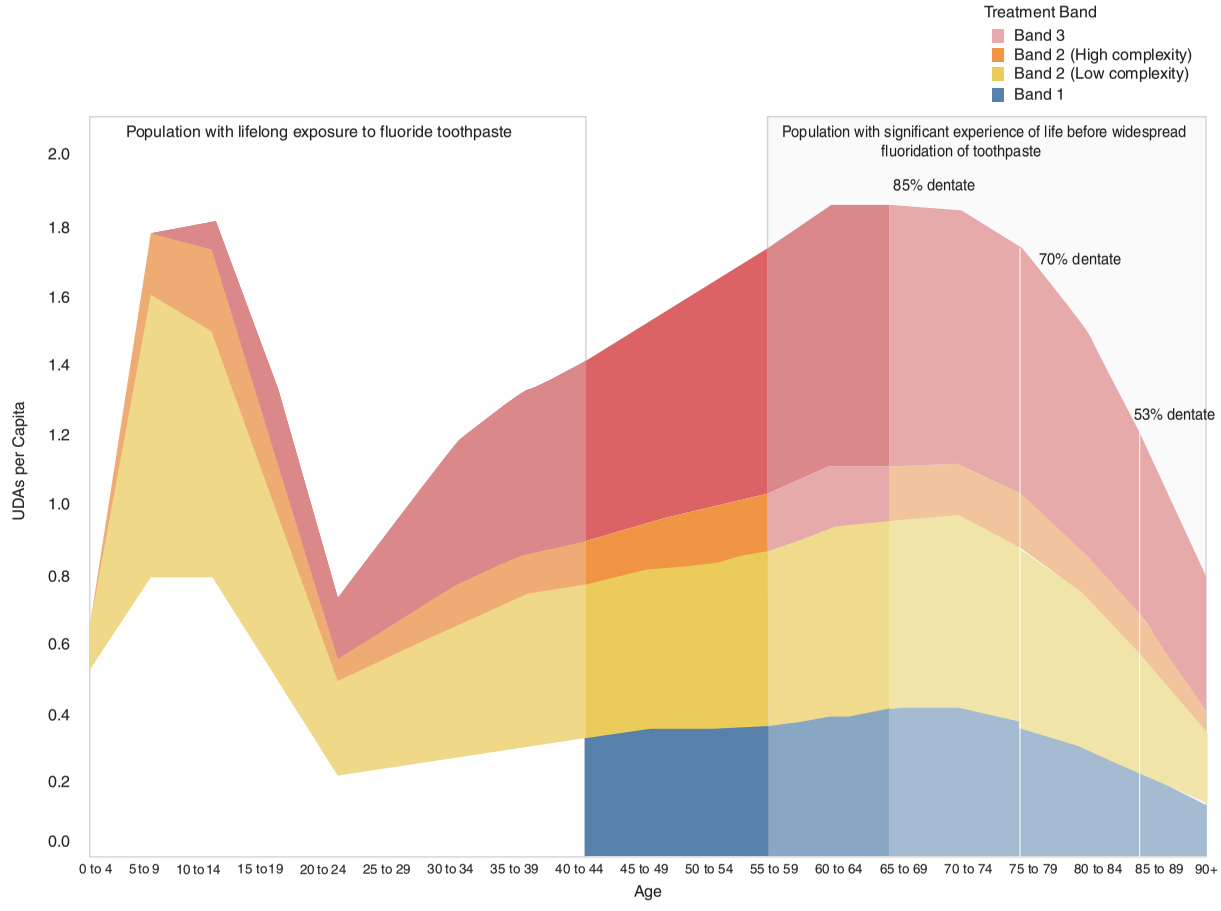

Fig. 1.8 Units of Dental Activity (UDAs) consumed per capita for different age groups in England 2017–2018

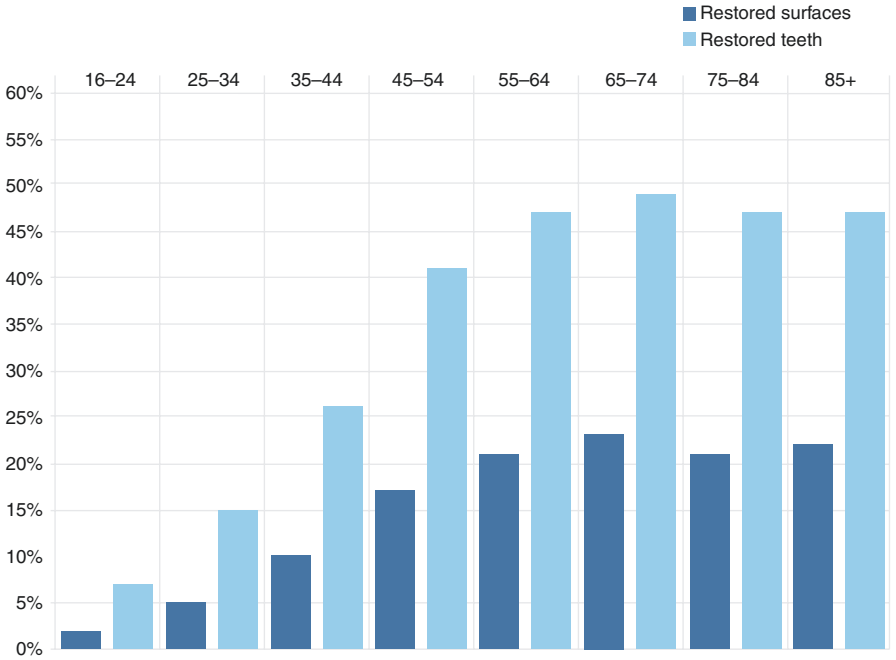

Fig. 1.9 Restored teeth and surfaces as a percentage of natural teeth and surfaces by age

- Band 3 represents complex treatments, including laboratory services, such as bridges, crowns, and dentures.

Although such work accounts for most of all dentistry carried out in the UK, it is important to note that this does not account for work within the private sector or work carried out in specialist hospital settings.

Numerous government policies determines the consumption of dental services. Older people are generally more likely to need dental care than younger people. Those in the oldest age groups, especially those aged over 85 (who are likely to have the fewest teeth) and young adults (such as those who no longer have access to free dentistry), use NHS dentistry the least [11].

It is predicted that cohorts comprising of those with lifelong use of fluoride toothpaste from adolescence will seek dental care to manage their larger number of heavily restored permanent teeth. This will increasingly replace the existing older population with high rates of edentulousness. This change will likely lead to an increase in the demand for dental care, especially for care associated with the ongoing maintenance requirements of heavily restored teeth.

The Dental Workforce

As of December 2021, there were 43,271 registered dentists and 71,293 Dental Care Professionals (DCPs) in the UK [12], up 0.6% and 0.9% from December 2020, respectively [13]. The number of registered dentists in England has risen at an average rate of approximately 0.9% growth per year since 2012, with numbers of DCPs growing at around 1.6% per annum [14]. Given that the number of undergraduate dental training places is largely fixed by the Department of Health and Social Care (DHSC), it is unlikely that trends in the supply of dentists will change significantly, though it is possible that exogenous shocks to workforce supply, such as the UK's departure from the EU, may affect the supply of dentists in the medium to long term.

Gerodontology Workforce

Dental care for older people with complex medical or cognitive issues is mostly provided by Community or Public Dental Services (in England/Wales and Scotland, respectively) and specialists in restorative and special care dentistry. Figure 1.10 shows the overall change in the dental workforce yet dental specialists make up only a small proportion of the overall dental workforce, with approximately one in ten dentists registered as a specialist in 2021 [12]. Of the 4440 dentists registered as specialists, 1415 (32%) were orthodontists, outnumbering the combined numbers of restorative dentists (307) and special care dentists (300) by more than a 2:1 ratio [12]. Moreover, in the 10 years since 2012, numbers of registered restorative

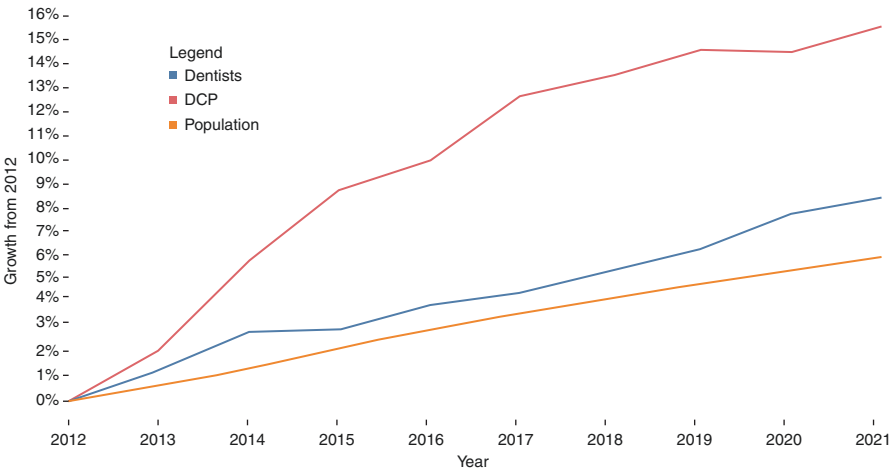

Fig. 1.10 Growth in registered dentists, DCPs and UK population 2012–2021

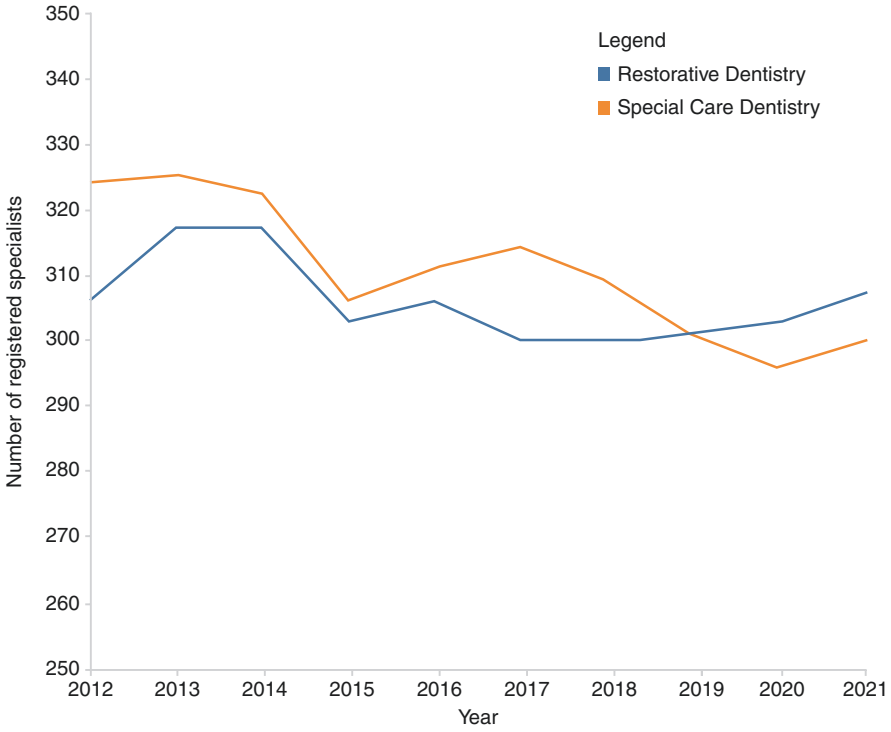

Fig. 1.11 Numbers of registered restorative and special care dentists 2012–2021

dentists and special care dentists (Fig. 1.11) have failed to keep pace with the substantial growth in the size of the population aged over 65. Although numbers of restorative dentists have increased by 1 (+0.3%), the number of special care dentists registered in the UK has actually decreased by 24 (−7.4%) in the period from 2012–2021. By contrast, the number of orthodontists rose by 4% in the same period [12].

These inequalities place older people at a significant disadvantage when accessing appropriate dental care [15]. Less data is available on the number of dentists and dental care professionals working within the specific community or public dental services, though the changes in demography and increased tooth retention into older age will only increase the demand for dentists with enhanced skills over the coming decades. Therefore, policy intervention is increasingly necessary if the needs posed by an ageing population are to be suitably met. This may mean an increased role for a more diverse dentistry workforce—with a greater role played by dental hygienists and therapists—as part of a wider focus upon preventative care. Furthermore, given that the baby boomer generation is not expected to reach life expectancy until the 2040s, it may also be prudent to increase the numbers of postgraduate training places in specialities relevant to gerodontology, as well as its share within

undergraduate curricula, as demand for such services will likely peak whilst the current cohort of undergraduate dentists are in their mid-career.

Wider Implications of Ageing Populations on Healthcare, Social Care, and the Economy

As discussed, demand for dental services will continue to grow as UK residents age. This raises the question of how other sectors will be affected by an increasingly aged population. The following sections discuss the potential implications of older populations on healthcare services, social care services, and the economy.

Implications of Ageing on Multimorbidity

With more people living longer, the likelihood of people developing multiple chronic diseases also increases. As the complexity of healthcare needs is compounded with each chronic condition, multimorbidity is one of the remaining challenges facing healthcare systems worldwide [16]. The delivery of healthcare services has historically remained focused on treating single diseases. This strategy of specialised, albeit compartmentalised, training and providing services is not sustainable in the long term as increasing rates of multimorbidity inadvertently cause services to become increasingly inefficient [17]. As the prevalence of multimorbidity is strongly associated with age [18] and as our ageing population increases over the next 20 years, the prevalence of diseases that are more commonly associated with older populations, such as hearing and vision impairments, dementia, diabetes, and strokes, will likely rise. As a result, the number of older people with four or more chronic diseases will double, and one-third of these will have mental health issues. Therefore, the extra years spent with multimorbidities in those over 65 years old will exceed the gains from the extension in the predicted life expectancy, which increases the demand on primary and secondary healthcare services [19].

There is increasing evidence of the association between several systemic health conditions and periodontal health. For example, blood sugar levels in people with diabetes can be raised even in the presence of moderate periodontitis [20, 21]. Certain musculoskeletal conditions, such as osteoarthritis and rheumatoid arthritis may negatively impact a patient's ability to maintain good oral health [22]. As the prevalence of such chronic diseases will likely continue to increase; it is essential that dentists are equipped with the competencies needed to manage the needs of those with complex multimorbidities [23].

Age-associated complex multimorbidities can affect a person's oral health in many ways. For instance, long-term conditions such as Parkinson's and dementia can make it more difficult to use a toothbrush, and many drugs commonly used by older people, such as anticholinergics [for urinary incontinence and Chronic Obstructive Pulmonary Disorder (COPD)] and levodopa (for Parkinson's disease), can lead to xerostomia [24, 25]. As many people in more vulnerable groups can face

barriers to accessing dental care, especially in urgent and domiciliary settings, truly integrated education and training models are needed. These should focus on multimorbidities, especially in terms of common social determinants, pathogenesis, treatment modalities, and impact, and the best ways to support the oral health needs of patients with multiple conditions. To provide preventative care and advice for patients with complex needs, it is essential to harness the preventative care potential that can be offered by dental professionals. Programmes that provide training to undergraduates or professionals that continue their education should promote the importance of communicating with other health professionals and their patients, especially when conveying crucial advice to patients living with complex health needs [26].

Implications of Ageing on Social Care Services

An ageing population will also substantially exert more demand on social care services. In 2018, an estimate by the London School of Economics' Personal Social Services Research Unit (PSSRU) suggested that the number of older people that will need social care could increase from 657,000 to 1,175,000 people from 2015 to 2040 [27].

By 2040, the number of older people that use publicly funded services (including direct payments) is set to rise from 406,000 to 728,000 (+79%), and 262,000 people will be users of residential care. Subsequently, the increase in population will also increase public expenditures on social services for older people from £7.2 billion to £18.7 billion (+159%). Similarly, the number of older users of privately funded social care services will rise from 251,000 to 447,000, of whom 280,000 will be users of residential care. An increase of private expenditures on social care services is expected from £6.3 billion to £16.5 billion (+163%). This rate of growth in social care spending is likely to significantly outstrip expected economic growth, particularly if rates increase from 0.8% of UK gross domestic product (GDP) to 1.4% [27].

Unfortunately, surveys of those living in social care settings suggest that their oral health outcomes are significantly worse than those of older people who do not live in social care [28]. As demand for social care is likely only to rise further, it is essential that carers are equipped to manage the oral health needs of their residents. Furthermore, dental services should adapt to an environment in which many more people are either in need of in-home care or are themselves living in residential care settings.

Implications of Ageing on Economies

Population age structures are most often described by demographers using the percentage of people aged 65 years and over. The old age dependency ratio (OADR) is the most common parameter used to discuss the challenges associated with providing social protection for ageing populations. The OADR represents the number of

people of pensionable age per 1000 people of working age (20–64 years old) and is often used as a proxy for the social and economic dependencies of the older population [2].

The UK's OADR has mainly remained consistent from the 1990s until the present, with figures ranging between 288 and 312. Although recent pension age reforms and policies that will be implemented over the next decade keep the dependency ratio stable over the short term, the OADR is expected to rise to 360 (+20%) by 2043. The implications of a rising OADR on the wider economy are predicted to be significant. For example, pensions are the greatest cost compared to other items of welfare expenditure; moreover, State Pensions accounted for 4.4% of the UK's Gross Domestic Product (GDP), whereas the spending budget for healthcare has nearly doubled from 73.5 billion to 166.7 billion (7.7% of GDP) between 1997 and 2018 after controlling for inflation [9].

Those of working age typically contribute more in tax than they consume in public services and welfare. In contrast, older residents consume more money and resources from pensions and health and social care than their tax contribution. As life expectancy continues to grow, so too will concerns regarding who will care for older people as their ability to carry out daily activities decreases. This problem is likely to be exacerbated further in countries with high degrees of migration in which younger people live too far from their ageing relatives and cannot provide daily assistance.

Nonetheless, an ageing population can provide many important economic opportunities to society. These opportunities range from those in the expanding voluntary and community sector as well as providing informal child or social care, i.e., ranging from the care of grandchildren to care provided by other family members. Moreover, given that many global economies have increasingly moved away from extractive and manufacturing industries for services-led economies, it may be increasingly viable in the future for older people to remain in the workforce for longer. However, this approach comes with drawbacks, including reducing the availability of informal care and other such activities and increasing the demand for more formal social care.

Conclusion

Population ageing is likely to pose a serious threat to established healthcare delivery models in the coming decades. In particular, people born before the widespread fluoridation of toothpaste are now often living with the legacy of disease from earlier in their lives. This group is likely to have a significant demand for dentistry as they enter the latter stages of their life course. Furthermore, despite immense improvements in dental outcomes across the population, several diseases, including periodontal disease and caries, remain a common concern and threat to oral health for more people for longer periods.

Ageing is also likely to have considerable implications across economies and societies. As multimorbidities become increasingly common, there will also be

additional financial pressure on public healthcare systems, social care services, and individuals and families. Workforce planners and other policymakers should consider the effect that ageing may have on the demand for services for older people and respond by appropriately reallocating resources, including by geography. Educationalists should consider increasing the proportion of undergraduate and postgraduate curricula set aside for gerodontology.

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A Mouth Through Time: Age-Related Changes to the Oral Tissues and Related Structures

2

Martin Ashley

Learning Outcomes

After reading this chapter, readers should be able to

- recognise the difference between physiological and pathological changes to the mouth;
- understand the epidemiology related to the ageing mouth;
- describe the effects of ageing on the teeth and related oro-facial tissues;
- appreciate the impact of genetics, lifestyle, and socio-economic factors on the mouth.

Introduction

We are all inevitably and constantly affected by time, and the mouth, like any other part of the body, changes as part of the ageing process. From a dental perspective, this starts with the rapid antenatal and childhood development of the mouth and dentition, through the processes of physical and behavioural maturation, leading into the adult decades, where the gradual physiological changes occur almost too slowly to be individually recognised. Alongside these inevitable developments are the accumulation of dental diseases, pathological changes and adverse incidents. As we enter our later years, the effect of genetics, lifestyle, and socio-economic factors become magnified, and we age with a mouth that accurately reflects the dental history we have experienced.

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The opportunity for dental professionals to meet and provide care for patients at every stage of life will provide an insight into the ageing process and its impact on oral health. It is now unusual for a person to receive care from one dental professional throughout their career of perhaps 40 years. This could span the early years from birth to parenthood or the later decades towards old age, but never a person's entire lifespan. Therefore, the dental professional's view of the ageing process is actually the effect of time on the population they have the privilege to care for, created by adding together glimpses from each individual person they meet.

This professional view gives an experience that, along with education, equips the dental professional with the ability to understand and manage the wide variety of dental conditions that patients present with. Only with an appreciation of the rapid early developmental stages and gradual ageing processes can the dental professional deliver care appropriate for the person and any condition affecting them. The impact of the ageing process can increase rapidly and dramatically in a person's later years of life, and dental professionals need to both use long-term preventive methods (as explored in Chap. 5) and be prepared to react at short notice to any sudden deterioration in oral health.

These two parallel and closely linked processes, inevitable physiological changes, and generally preventable pathological change (described in Table 2.1) have been extensively researched and are now much better understood. As a result, the dental health of individuals within any population over recent centuries has reflected progress in society, science, and healthcare. The easier access to sugar and other processed foods and drinks has dramatically altered our experience of dental caries. On the other hand, the use of fluoridated toothpaste has contributed to people retaining their teeth in older age. Tobacco use has had a causative relationship with mouth cancer and periodontal disease. Science and engineering have enabled the dental profession to evolve rapidly and painlessly deliver long-lasting restorations and preventative therapies. We now simply expect to live well and keep healthy teeth for longer than previous generations due to public health and social care measures.

Table 2.1 Pathological and physiological age-related changes

Physiological changes	Pathological changes
Increasing enamel mineralisation	Dental caries and periodontal disease
Tooth wear due to function	Tooth wear due to parafunction and acidic diet
Formation of secondary dentine	Formation of tertiary dentine
Reduced pulp vascularity	Loss of pulp vitality due to caries or trauma
Reduction in alveolar bone density	Reduction of periodontal attachment
Reduction in skin thickness, elasticity, and muscle tone	Angular cheilitis
	Mucocutaneous diseases and malignant diseases of the oral mucosa
	Medication and radiation related reduction in saliva flow
	Tooth loss due to dental caries or periodontal disease
	Temporo-mandibular joint disorders

It is easier to consider the effect of physiological and pathological changes on the different oral tissues, even though they exist in close harmony with each other, within the same mouth. Knowledge and understanding of age-related changes within the oral cavity is important for dental professionals when planning patient-centred dental intervention and preventive care.

For each decade between 1968 and 2009, the Adult Dental Health Survey reported on the dental condition of the population, with the 2009 survey covering England, Wales, and Northern Ireland. For the 2009 survey, over 11,000 people were interviewed and over 6000 were examined. Some population groups, such as those residing in nursing and care environments were excluded, so the results are unlikely to represent people in these sectors. The surveys demonstrate that there has been a continued improvement in adults' oral health, but for many people in old age or older middle age, their dental needs remain very complex [1, 2]. Chapter 1 provides a comprehensive summary of these changes; it also projects that as the current UK population ages, within a few decades, loss of teeth, unhealthy teeth and unhealthy periodontal tissues will be much less common for those in older age. However, extensively restored dentitions will be prevalent, and management may increase in complexity.

Hard Tissues and Age-Related Changes

Teeth

Our teeth are the most notable feature of our mouth and essential for dental appearance and a number of oral functions, such as chewing and speaking. An adult is likely to develop 32 teeth, symmetrically arranged as eight teeth in each quadrant of the mouth consisting of two incisors, a single canine, two premolars, and three molars. Figures 2.1 and 2.2 show the structures of single and multi-rooted teeth. Each root can be considered as a natural tube, containing the *root canal* extending from the *pulp chamber* within the crown of the tooth (labelled as 'd' in Figs. 2.1 and 2.2) to the root end. Variations in the number of roots on a tooth and the number of root canals within each root often occur. The root canal contains the living tissue, often called the *dental pulp* or the *nerve* (labelled as 'f' in Figs. 2.1 and 2.2). This tissue consists of numerous nerve fibres, blood vessels, cells of the immune system, and cells involved in the tooth's development and natural repair processes.

Overall, the outer layer of the crown consists of *enamel* (labelled 'a' in Figs. 2.1 and 2.2), and the inner structure of the crown and almost all of the root structure consists of *dentine* (labelled as 'b' in Figs. 2.1 and 2.2). The outer surface of the root consists of a third mineralised tissue, *cementum*. The appearance and structure of these three tissues and the dental pulp within the root canal system undergo gradual physiological changes throughout life and are all affected by and react to pathological changes.

Fig. 2.1 An opened model of a single-rooted tooth showing enamel (**a**), dentine (**b**), the root apex (**c** and **e**), an empty root canal system (**d**), and the dental pulp (**f**)

Fig. 2.2 An opened model of a multi-rooted tooth showing enamel (**a**), dentine (**b**), the root apex (**c** and **e**), an empty root canal system (**d**), and the dental pulp (**f**)

Enamel

Enamel is the hardest tissue in our body, with a high mineral content (96% carbonated hydroxyapatite by weight and 85% by volume) when the tooth erupts into the mouth. The rest is organic materials and water [3]. Enamel is a crystallised material, does not contain any cells, and is not considered to be a living tissue. However, it is not an inert material, as the enamel surface is in constant contact with saliva rich in calcium, phosphate, and often fluoride [3]. Depending on our oral hygiene habits, the enamel may also be in contact with dental plaque.

The interaction with saliva and plaque throughout life allows an ongoing exchange of minerals out from and into the enamel surface. This is called the *demineralisation-remineralisation cycle* and occurs as a dynamic equilibrium throughout each day, dependent on the acidity of the local environment [4].

The enamel in a newly-erupted tooth is high in carbonate and low in fluoride, and the level of acidity at which demineralisation occurs in this enamel, is pH 5.5 [5]. The fluctuations in the oral acidity levels and also those generated within dental plaque at the tooth surface, are caused by what we eat and drink [4, 5]. When the oral pH reduces to pH 5.5 and lower, mineral is lost from the surface of the enamel over a longer period, before the remineralisation part of the cycle commences, to repair the enamel [5].

The mature enamel in an older person will have been affected by many years of daily and hourly demineralisation-remineralisation cycles. As a result, the carbonate is progressively replaced with phosphate, and more fluoride is incorporated into the enamel. The level of acidity at which demineralisation occurs in this enamel can then be as low as pH 4.5. The oral acidity is less likely to reach this level, and it will exist for shorter periods of time. Mature enamel is, therefore, less likely to be affected by demineralisation each day. As this process is responsible for the development of tooth decay in enamel, older adults are less likely to experience enamel tooth decay, known as *enamel caries*. In addition, with the increased exposure to fluoride from regular use of fluoride toothpaste throughout life, since its introduction in the 1970s, the enamel will have become increasingly resistant to tooth decay. However, this mature enamel is likely to be thinner due to mechanical tooth wear and more prone to fractures.

Dentine

Dentine is a hard tissue, but not as hard as enamel, with around 70% mineral content by weight. The dentine structure is also different, as it is mainly made of dentine *tubules*, microscopic tubes radiating out from the surface of the pulp chamber to the root surface and the inner surface of the enamel layer. The tubules are patent and taper from the inner to the outer end. Although dentine does not contain any cells, each tubule can contain a process from the odontoblast cell that forms the developing dentine. The odontoblasts remain as a layer on the inner surface of the dentine. The remaining portion of each tubule is filled with

dentinal fluid. Dentine continues to change in a number of ways as people get older. Within each individual tubule, the inner surface becomes more calcified, and the diameter decreases, causing the overall density of the dentine to increase. This also changes the appearance of the root dentine, showing as increased translucency of the root, starting from the root end and progressing towards the crown as the tooth ages. This feature is sometimes used in forensic dentistry to help in age estimation [6]. The sensitivity of dentine, related to much of the experience of dental pain due to tooth decay as well as temperature changes and sweetness, is also affected by the patency of the dentine tubules and root canal sclerosis. The progressive reduction in tubule diameter is largely responsible for an age-related decrease in dentine sensitivity.

The second physiological process is the constant, slow formation of *secondary dentine*, on the surface of the pulp chamber and root canal system, reducing their sizes. This process is called *sclerosis*. Dentine will also respond to pathological processes such as dental caries and loss of the surface enamel by either trauma or tooth wear. This more rapid formation of *tertiary reparative dentine* also occurs within the pulp chamber and root canal system.

Dental Pulp

Secondary dentine formation within the pulp chamber and root canals usually occurs so slowly, that some dental pulp remains present within the tooth throughout life. It consists of various cell types, fibres, blood vessels, and nerve fibres. As we age, not only does the size of the pulp chamber and the root canals reduce, but the dental pulp itself changes. There is a reduction in the number of cells and blood vessels and, therefore, less ability to respond to pathological processes such as caries. The pulp tissue also develops discrete islands of mineralisation, called *odontomes* or *pulp stones,* within the pulp chamber and root canals. The reduction in pulp chamber size as viewed on dental radiographs has also been used to estimate age [7].

Cementum

Cementum is the third mineralised dental tissue. It forms a thin layer over the outside surface of the root dentine, and is similar in composition to bone, and is about 60% mineral content. The cementum layer slowly thickens throughout life, but this rate can increase, especially in response to a chronic dental infection [8].

These age-related physiological changes to enamel, dentine, cementum, and the dental pulp affect how our teeth respond to pathological processes and require modifications to the dental treatment methods used.

Fig. 2.3 Teeth of an older adult, affected by chipping, cracks in the enamel surfaces, increased translucency and an accumulation of staining on the surface

Dental Appearance

The natural colour of enamel is variously described as translucent, white, and whitish blue. This is most noticeable around the edge of incisor teeth, where there is no underlying dentine. A young tooth tends to appear whiter than an older tooth. The increasingly well-mineralised enamel becomes more translucent throughout life, revealing the dentine beneath. The shade of dentine also changes from light, creamy yellow to darker yellow with increasing age. These increasing translucency and colour changes, along with some pathological thinning of the enamel and the development of fine cracks in the brittle enamel surface, account for most of the age-related changes to the appearance of our teeth. In addition, our dietary intake, drinking, smoking, and dental hygiene habits can significantly affect how much stain becomes both incorporated into and adheres onto the tooth surface (shown in Fig. 2.3).

The amount of our tooth displayed when our mouth is either relaxed or engaged in a full smile also changes through life [9]. In general, younger people show more of their upper teeth and less of their lower teeth. In older people, the reverse is true, partly due to the wearing away and loss of the edges of the teeth and partly due to the lower relative position of the lips covering the teeth.

Enamel Caries

The process of enamel caries, leading to the formation of a cavity, is now well understood. All ages experience caries, with peaks at ages 6, 25, and 70 years [10]. As already described, the constant interaction of the mineralised enamel surface with saliva and dental plaque throughout life allows an ongoing exchange of minerals out from and into the surface. If the factors influencing the demineralisation–remineralisation cycle

Fig. 2.4 A model of a diseased multi-rooted tooth showing caries affecting enamel and dentine, encroaching into the dental pulp

interact in such a way that there is a prolonged and more frequent loss of mineral from the surface than mineral repair of the enamel, then a cavity will form within the surface (see Fig. 2.4). The extent and position of the cavity and whether this can be successfully treated will determine how much of the tooth is affected. The superficial enamel cavity will, in time, extend into the dentine and eventually reach the dental pulp.

Root Surface Caries

In our younger years, all dentine is normally covered and protected by the enamel crown or the gum tissue. The gumline recedes gradually through our adult years, revealing and exposing the root surface to the oral environment (see Fig. 2.5). The dentine of the root surface has a lower mineral and higher organic content than

Fig. 2.5 The teeth of an older patient. The gumline has receded significantly, revealing the tooth surfaces, some of which have required restoration due to abrasion with the toothbrush

Fig. 2.6 Dentine caries affecting the exposed roots of two teeth, with various changes to the colour and surface characteristics. These areas are challenging to keep adequately clean every day

enamel. In addition, the root surface has not benefitted from decades of direct and positive interaction with saliva and fluoride in the way that enamel has. Therefore, the exposed root surface dentine is more susceptible to demineralisation than is enamel (Fig. 2.6).

The early root surface carious lesion can be challenging to identify, even on a tooth surface that is easy to see in the mouth. There may be a subtle change to the surface texture, but there is unlikely to be any noticeable colour change. As the carious lesion progresses, the increasing porosities allow penetration of colours from food and drink, causing the area to darken, compared to the surrounding intact dentine (as shown in Fig. 2.6). Eventually, the dentine structure softens, and the cavity can spread both across and deeper into the root surface.

Multifactorial Aetiology for Dental Caries

It is understood that several interacting factors influence the development of dental caries that are discussed below.

Dental Plaque This is the bacterial layer that develops and adheres to the tooth surfaces, both enamel and root dentine. The shape of each tooth, the position of the tooth in the mouth, and the presence of previous restorations influence how dental plaque develops and, more importantly, how easily our daily oral hygiene habits remove it. Our dexterity and appreciation of the need for toothbrushing and a healthy diet gradually improve in childhood. However, with increasing age, these can reverse. Our manual dexterity, eyesight, and appreciation of the need to maintain adequate dental hygiene each day can diminish, especially if we are affected by other age-related conditions, such as arthritis and dementia. The progressive recession of our gumline exposes more of the root surfaces, revealing a greater surface area, and the surfaces are more awkward to reach for cleaning.

Most people only clean their teeth with a toothbrush. The size and design of these are generally unable to reach all the exposed root surfaces, to prevent dental plaque from forming. It is recommended that interdental brushes, interspace brushes and dental floss are used to clean the vulnerable in-between tooth surfaces, but these require dexterity, patience and an understanding of appropriate techniques. As all these can often diminish in older people, the problems associated with inadequate oral hygiene have the potential to increase.

Frequency of Eating and Drinking Some bacterial species present in dental plaque metabolise the carbohydrates present in our food and drinks and produce weak organic acids. These acids are capable of demineralising enamel and dentine. It is now well understood that the frequency of eating and drinking is more important than the quantity of carbohydrates consumed in the process of developing dental caries. It is likely that older people, especially those who rely on others for their care, will have food and drink that is more processed, contain more sugars and eat and drink more frequently than when they were younger. As a result, the risk of dental caries developing is greater, especially when combined with a dry mouth and inadequate oral hygiene.

Lack of Saliva Saliva is the most important agent to protect our teeth from the effects of dietary and dental plaque acids. This is clearly demonstrated when there is a lack of saliva, leading to widespread and often rapid dental caries, especially in the root surfaces [11].

The main features of saliva are its ability to buffer acid and reverse the demineralisation process and supply the minerals required in the remineralisation process.

Saliva flow rate and content can deteriorate as we reach later life, and this can be due to several factors, often combining. These include prolonged low-level dehydration from not drinking enough each day, the side effects of medication, the direct effect of some medical conditions or their treatment and from age-related changes to the saliva glands [12].

Tooth Wear

Alongside dental caries, and traumatic damage, the surface of our teeth will progressively be lost by the process called *tooth wear.* This consists of three distinct causes: *erosion, abrasion,* and *attrition*, which rarely act in isolation but usually cause coincident damage to the tooth surface. The outcome of these processes is shown in Fig. 2.7, where shortened clinical crown height, loss of typical anatomy, reduced occlusal vertical dimension, and loss of buccal enamel are all visible.

Erosion is the loss of the tooth surface by chemical demineralisation, not involving bacterial plaque. This is usually caused by repeated intake of acidic drinks, such as carbonated fizzy drinks, fruit juices, and alcoholic drinks. However, it can also be caused by gastric acid refluxed or regurgitated into the mouth and occasionally by exposure to environmental acids.

Abrasion is the loss of tooth surface by a hard substance being repeatedly rubbed over the tooth surface. This can be due to the pattern of an over-zealous toothbrushing technique or from eating unrefined and naturally rougher foods.

Attrition is the loss of tooth surface by repeated tooth to tooth contact, often caused by an excessive tooth grinding habit.

Over our lifetime, the accumulation of the damaging effects of tooth wear will at least cause loss of the surface characteristics of our teeth and potentially increased tooth sensitivity or unwanted changes to our dental appearance. The effects may also lead to adaptive changes within the tooth, with the formation of secondary and tertiary dentine and also to the masticatory system, adapting to the changing shape of our tooth surfaces which are integral to the biting contacts and functional movements of our mouth.

Fig. 2.7 A dentition significantly affected by erosion, abrasion and attrition

Trauma

Traumatic injuries to the teeth and mouth can occur at any stage of life, although the commonest ages are in young childhood, early teens and early adulthood. It is estimated that up to a third of all adult dentitions have suffered dental trauma [13]. For the older person, decreased mobility, balance issues, and increased frailty may increase the risks of falls resulting in dental trauma and the damage caused to the teeth and facial hard and soft tissues is often significant. The person will find undergoing treatment more challenging and is less able to adapt to the sudden changes to their mouth. Dental trauma itself is not an age-related change to the mouth and teeth but coping with the effects of the event can be more problematic.

Soft Tissues and Age-Related Changes

Periodontal Tissues

These consist of the *gingiva*, the *periodontal ligament*, the *cementum* over the root surface, and the *alveolar bone*. Following tooth eruption, the gingival margin settles to a position around the edge of the enamel, forming a collar around each tooth. As we move through adult life into old age, the gingival margin migrates along the tooth root, exposing the root surface to the oral environment and creating a greater surface area that requires cleaning each day. The rate of migration varies between individuals, with some people appearing to be resistant to this recession and others being particularly susceptible. The periodontal ligament is a thin layer of mainly connective fibres, covering the root and inserting between the cementum and the alveolar bone, securing the tooth into position but also acting as a shock absorber, to limit the damage that daily function would otherwise cause to our relatively brittle teeth. The periodontal ligament is richly innervated, enabling us to have exquisite perception of tooth contact.

The alveolar bone surrounds and supports our teeth and its position relative to the teeth remains stable throughout life, as long as it is not affected by periodontal disease. There are age-related changes to the bone structure, principally a reduction in bone density, mostly related to hormonal levels but also to the functional use of our teeth. The periodontal tissues are also affected by inflammatory periodontal diseases. The extent of this is related to several factors, including genetic predisposition, ability to maintain an adequate standard of daily oral hygiene to prevent inflammation, smoking status and presence of medical conditions such as diabetes and others that causes an immunocompromised status [14].

Older adults therefore demonstrate several factors that increase their susceptibility to periodontal disease, leading to the progression of the disease that was usually of little concern when they were younger. These specifically include more medical conditions, a compromised immune state and an inability to keep the mouth

adequately clean every day. For those people who rely on others to provide daily mouth care, it is highly unlikely that adequate daily oral hygiene will be achieved [15].

Changes to Periodontal Tissues

The end stage of periodontal disease is a situation where there is insufficient healthy periodontal support for the tooth. A tooth so affected will have lost a substantial amount of supporting alveolar bone, become loose and drift from its original position, causing symptoms that are rarely a feature at earlier stages of the periodontal disease process. The tooth will either naturally exfoliate from the mouth or be extracted by a dental professional (see Figs. 2.8 and 2.9).

Loss of a tooth leads to healing and remodelling of the periodontal tissues, with often significant resorption of the alveolar bone, especially if a number of adjacent teeth are lost. This process occurs at any age, however, an older person who has been edentate for many years may have advanced resorption and atrophy of the affected mandible or maxilla. This can lead for notable functional deterioration and also challenging problems to overcome for the dental professional, especially when making dentures.

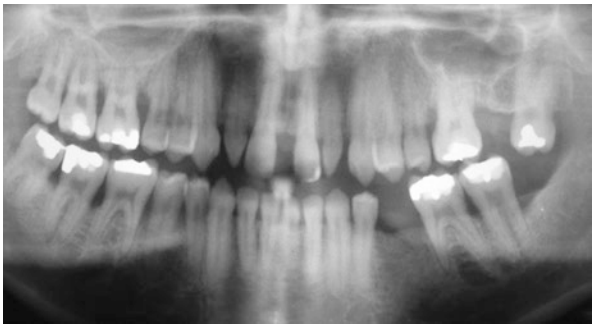

Fig. 2.8 The dentition of a patient at 66 years old, soon after retirement. A small number of teeth have previously been restored with small fillings and there is some evidence of early bone loss due to periodontal disease affecting the posterior teeth

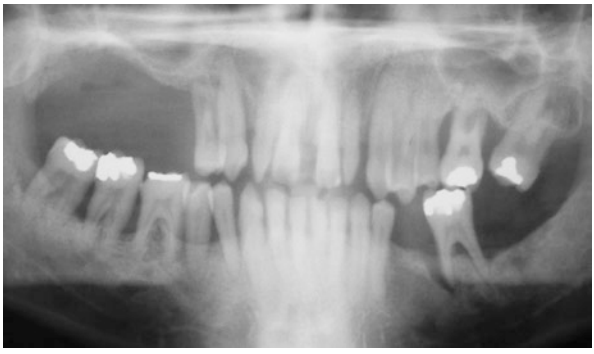

Fig. 2.9 The dentition of the same patient shown in Fig. 2.8, but at 76 years old. The person has developed a number of medical conditions and as a result, their periodontal disease has significantly worsened. Several teeth have been or are about to be lost and there will be insufficient natural teeth to have a functional dentition

Other Oral Anatomy

Skin

The facial skin, including that around our mouths and lips, is affected by age-related hormonal changes, medication-related changes, and an accumulation of sun damage throughout life. The reduction in elasticity, muscle tone, skin hydration, and thinning of the skin cause wrinkles to form and increases the chance of bruising and skin damage from even minor trauma. At the corners of the mouth, a deepening of the skin crease, maceration of the skin by saliva and contamination with skin bacteria and Candida fungal species leads to angular cheilitis, a painful cracking and inflamed skin reaction. Candida infections are presented in greater detail in Chap. 8. This is more common in older people, those that wear dentures and those with a compromised immune system. The clinical presentation of candida infection, in the form of angular cheilitis, is shown in Fig. 2.10.

Oral Mucosa

The oral mucosa is a stratified, squamous epithelium and the thickness and keratinisation of this tissue varies, depending on the position in the mouth. The labial, buccal, soft palate, and floor of mouth mucosa are non-keratinised. The mucosa covering the hard palate and most of the gingival margins is keratinised, to withstand the increased mechanical forces applied to these tissues. In addition to these other types of oral mucosa, the dorsum of the tongue is covered by a keratinised, stratified squamous specialised mucosa, covered with various types of papillae, used for our taste function.

There are very few specific age-related changes, other than some age-related atrophy. Medical conditions and medication-related changes, leading to impaired wound healing and increased discomfort and irritation with spicy and acidic foods, and drinks are more likely to become evident in older people. In addition, the oral mucosa is susceptible to a number of pathological changes, such as muco-cutaneous

Fig. 2.10 Angular cheilitis. The skin at the corner of the mouth is inflamed, painful and cracks when the mouth opens

diseases, correlated to increasing age. The accumulation of risk factors such as tobacco smoking, alcohol drinking and the increasingly understood effect of the Human Papilloma Virus (HPV), increase the risk of malignant changes in the oral mucosa.

Saliva Glands

The three pairs of major saliva glands (*parotid, submandibular,* and *sublingual*) and a multitude of individual minor saliva glands throughout the oral mucosa deliver approximately a litre of saliva into the mouth each day. Around 60% of the saliva is produced by the submandibular glands and around 15% by the minor saliva glands. The rate of flow of saliva alters throughout the day and night, with a number of factors affecting this, such as the rhythmic changes between day and night, the level of hydration and whether the glands are stimulated by food and drink [16].

There are few age-related structural and functional changes within our saliva glands. There is some atrophy of the acinar cells and an increase of fatty and fibrous tissues within the structure. The resting flow rate is usually lower in an older adult although when the person is healthy, the stimulated flow rate is usually similar to when they were younger. However, there are several factors, including prolonged dehydration, medical conditions, side effects of medications, and functional changes to the glands by either pathology or radiotherapy that older adults will experience, impacting on their saliva flow. These will lead to diminished oral comfort, ability to chew and swallow food, take oral medication, speak confidently, wear dentures successfully and an often-dramatic increase in dental caries. *Xerostomia* is the perception of having a dry mouth and is different from hyposalivation although a proportion of older people reporting this do not have a measurable reduction in saliva flow rates.

Masticatory Function

Bering able to open and close our mouth comfortably and to bite and chew a range of food types to a consistency ready for swallowing, is essential for maintaining nutritional intake and to a perhaps lesser extent, the psychological benefits of socialising with others [17]. The presence and condition of natural and prosthetic teeth, the condition of the temporomandibular joints and the muscle mass and muscle function are all important determinants of masticatory function [14, 18].

The temporomandibular joints do not appear to be significantly affected by age-related changes, although conditions such as arthritis can affect these joints. Age-related degeneration of the TMJ can occur as with any other joint. A much smaller proportion of older adults have painful temporomandibular disorders, than middle-aged adults [19]. The age-related loss of muscle mass and muscle function is called *sarcopenia* [20]. This condition that affects all muscles, including muscles of mastication (masseter, temporalis, tongue, and buccinator), reducing the bite strength and chewing stamina required to break down food to be safely swallowed. An older

person may respond to this deterioration in masticatory function by selecting higher carbohydrate foods (such as bakery foods and pasta) that are easier to chew and swallow, than foods high in protein (such as poultry, meat and nuts) and fibre (vegetables and fruits). This can therefore further contribute to the increased risk of enamel and dentine demineralisation and the initiation and progression of dental caries.

Conclusion

Our oral health is closely related to our general health, with the combined physiological and pathological conditions of each, affecting both. We can expect that almost every patient will have experienced dental caries, periodontal disease, tooth wear, and tooth loss as they enter older age. The inevitable age-related changes, along with the accumulation of dental diseases, pathological changes, and adverse incidents will have a significant negative impact on the oral health of most people.

It is the responsibility of the dental team to recognise the impact of ageing on a person's need and desire for and ability to undergo dental treatment, to modify the approach and delivery of age-appropriate management of their conditions.

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Understanding Older People's Experiences of Oral Health Care

3

Margaret Stewart, Rebecca Partridge, and Andrew Geddis-Regan

Learning Outcomes

- To understand person-centredness and the value in focussing on people in a holistic manner.
- To appreciate patients' experiences of dental care and understand how patients may experience care differently from that which care providers may anticipate.
- To gain insight into how understanding patients' experience can support the improvement of person-centred care for individuals as well as supporting the advancement of healthcare services.

Introduction

Older patients bring a lifetime of experience with them each time they access healthcare services. Each person is an individual whose life experiences shape their views of health, illness, and health services. As well as medical, psychological, and social

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influences, these experiences influence patients' needs and expectations of healthcare, including dental care, in various ways. Older people do not appear de novo; they have been shaped by their journey through the course of life, having been exposed to the effects of age, the impact of many events occurring at different times, and effects that are specific to their generation [1]. As for all patient groups, dental care should be person-centred, meaning it should focus on the needs of the whole person, rather than simply the medical or technical aspects of care [2].

Though clinical guidelines and recommendations exist for dental care, patient autonomy is critical, and patients' preferences may not align with what guidelines recommend. On this basis, dentists should support patients to express their views and priorities in the dental setting in order to guide the care they receive. Good communication between patient and members of the dental team is vital to achieve good outcomes, yet to do this, clinicians must establish a connection with patients to understand their beliefs, attitudes, and preferences [3]. Such connections need to be made throughout the dental journey from initial contact, access to the surgery, reception, consultation, and treatment. Patient stories, or stories told by patients' representatives, are a valuable tool and can provide valuable insights to inform improvements in care in a manner that might not occur through discussions in clinical encounters. This chapter sets out four very different patient stories illustrating individuals' perspectives about care and highlights how individualised and person-centred care can be provided.

The Personal Impact of Illness

Though most people experience episodes of acute illness that resolve (sometimes through medical or surgical intervention), chronic illness and multimorbidity (the existence of two or more chronic conditions) becomes increasingly prevalent with increasing age [4]. Chronic conditions can drastically affect individuals and typically impact many aspects of a person's daily life. Most people try to keep illness at the margins of their lives for as long as possible, yet there can be a limit to how long such 'normal' living can be maintained. The progression of chronic disease is not necessarily linear, meaning chronic illness can be experienced as an interruption to people's lives, as an intrusion, and even as an immersion as a disease progresses and becomes all-encompassing [5]. Figure 3.1 illustrates a mobility scooter which supports someone to function despite a chronic illness; using such a device is an example of an attempt to maintain normality yet initial use of such a device may certainly reflect an interruption to 'normal' living. Living with serious illnesses can catapult people into a different reality where their previous life and abilities may be increasingly compromised. Within this altered life, people will typically have good days and bad days concerning their illness. Health professionals need to consider the individual and their experience of any chronic illnesses alongside their dental needs in order to provide holistic healthcare [6].

As well as affecting general health, chronic illnesses can significantly affect oral health. Either the conditions per se or their treatment can directly impact oral health.

The complexity of living with a chronic condition can relegate oral care and regular dental attendance to a lower level of priority and precede a potential proliferation of oral diseases. Pain, infection, or tooth loss are common in older age groups and can be highly impactful, including in later life [7–9]. Rousseau et al. [10] found that tooth loss was relatively insignificant for some people, yet it was devastating and disruptive for others [11]. The individual shown in Fig. 3.2 has a beaming smile, yet tooth loss could lead to alteration in both his self-perception and in how others may perceive him. Such impacts must be understood on a person-by-person basis, as other patients may not share such concerns.

Dental teams need to consider the impact of chronic illness in older people and be aware of the possibility that a person's attitude towards dental care may change over time. The potential for avoiding dentistry may also be a factor in this age group for many reasons such as anxiety, having more significant priorities, or financial concerns. Historically, tooth loss was more acceptable, and people in their later life had fewer dental needs. Increasingly, people are striving to retain teeth, and many recognise that dental health is an important part of keeping well [12]. Tooth retention into old age should have a huge advantage in terms of healthy ageing. However,

Fig. 3.1 A mobility aid may be required as illnesses progress. These aids can help people maintain their independence yet people have to adapt to their illnesses and devices to support them living with illness. (Image Courtesy of Centre for Ageing Better)

Fig. 3.2 This individual with a visible dentition when smiling may find loss of teeth a drastic alteration to his usual state; however other patients may not find tooth loss to be so problematic

poor oral health and tooth loss later on in life can have the opposite effect, being disabling, costly, and adversely affecting the quality of life [13, 14].

Person-Centredness

Person-centred medicine has developed as a concept over the past 50 years [15–18]. Person-centred care is defined as care in which "individuals' values and preferences are elicited and once expressed, guide all aspects of their health care, supporting their realistic health and life goals" [19]. True person-centredness extends beyond medical considerations and considers wider aspects as the person such as who the person is and their interests (examples shown in Fig. 3.3). The emergence of person-centredness reflects the perceived shortcomings of the disease-oriented or illness-oriented models of care [5], which reduce individuals to a set of signs and symptoms and healthcare professionals to a more technical role. Boggatz [20] suggests that a person-centred approach is based on the conviction that people have central concerns according to which they shape their lives; therefore, person-centred care is the required response to an older person's quest for quality of life.

Dentistry lags behind other health professions in progress towards person-centredness and remains deeply anchored in a biomedical vision [21]. In a biomedical approach, there is little interest in understanding patients' lives and preferences and consequently minimal openness to shared decision-making about appropriate care [21]. In a systematic review of the dental literature, Scambler et al. [22] conclude that the concept of person-centred care is neither clearly understood nor empirically and systematically assessed in dental settings, particularly in general dental practice. While most authors suggest that person-centred care is about

Fig. 3.3 People seeking dental care may well have multiple interests and areas of their lives that affect their approach to and desired outcomes from dental treatment. (Credit: Chris Redford)

delivering humane care, involving good communication and shared decision-making, there is little published work that assesses these concepts empirically or relates them to practical outcomes in dental settings. The delivery of person-centred care is an essential aspect of providing quality dentistry. Failure to provide this approach to care compromises the engagement of patients as individuals and potentially diminishes the opportunity to understand how best to support each person in preventing dental disease and improving oral health [23].

Understanding Patients' Experiences

A basic understanding of patients' experience comes from the early part of a clinical consultation. The history-taking process allows a patient to explain the background of their symptoms and what they hope to gain from seeking healthcare. Numerous psychological and sociological factors impact how much information patients may actually share when attending an appointment [24]. Furthermore, the purpose of information sharing is to support a diagnosis, and move towards collaborative decision-making. It is paramount that dentists seek the patient's worldview. A more thorough and in-depth understanding can become especially appropriate when the approach to care provision is associated with increasing surgical, medical, or financial complexity. There is an even greater need to ensure patients are adequately informed to proceed with and consent to any proposed treatment in such instances [25]. The process of shared decision-making is described in depth in Chap. 11; a core element of this is the clinician's responsibility to seek information from the patient and for the patient to share this [26]. While the dentist has expertise in dentistry, the patient is the expert on their health, including their oral health, and their circumstances and preferences [26, 27]. Both areas of knowledge are essential to support care delivery.

Where patients can openly share their experiences, such as in social settings on blogs, social media or interviews, the constraints of the clinical environment are absent, and a patient may express their viewpoints both in more depth and with more openness. The words of a patient to a friend, carer, or relative before or after a consultation are likely to really display their hopes and expectations and, later, reflections on the experience of dental care itself. Whilst history-taking serves a crucial purpose, understanding patients' experiences beyond the dental setting—either individually or collectively—can expose a clinical team to a different perspective or allow a critical analysis of the appropriateness of their consultation style and approach to care delivery.

Despite the growing emphasis on patients' experiences, exposure to patients' viewpoints outside of a clinic may not be encountered in the ordinary course of events. Professional seminars or workshops typically present clinical speakers, and some such events do invite patients to contribute. Such events can illuminate the reality in which patients live. For example, the British Society of Gerodontology invited a person living with dementia to speak at their 2019 Winter Conference. The individual had an open session and was allocated around half an hour to do so. They

were able to share whatever they felt important without any consideration of their dental status. The words presented were generally seen as a highlight of the event and provided a great deal of food for thought. Similarly, HANCC (The Northern Head and Neck Cancer Charity) have invited multiple patients to share their views with the dental profession. The stories shared presented patients' knowledge and lived experience in a detailed manner, in sharp contrast to a snapshot that may result from a simple clinical encounter. Of course, it is not feasible to gain this level of insight into each patient's life yet taking a step back to appreciate the role we play in patients' wider lives can help professionals fulfil their professional duty to their patients.

Examples of Patient's Stories

Here we present four stories from patients or family members describing accessing and experiencing dental care in older age. Each illuminates different challenges that have arisen at a later age and their impact on successful dental care provision. These are presented in the patient's or family member's own words and have only been modified to ensure anonymity. These stories demonstrate what may happen for patients before, during and after dental care. Merely reading through these stories may provide a reader with a new perspective. The stories could, in theory, be analysed by formal methods, and they do bear a resemblance to transcripts that arise from planned research interviews. However, this is not the intended purpose of the stories here. They are presented so the patient voice is embraced to reflect how dental care may fit into people's lives and how receiving dental care across the life course can be both disruptive and highly beneficial.

William's Story
The perspective of a 93-year-old who still lives independently:

"I love being old. I think it's because I never thought I'd make it this far! I was diagnosed with cancer in 1997, and they told me I'd be dead in 6 months, but I sure showed them! I think most people would be angry if they'd prepared to die and then lived, but I've had a great time. I've no family, so I spend my days dancing. I've even been on stage, right up until COVID! It's great to live without worrying about getting ill with age, as I'm already old and I don't feel too ill. I outlived my ex-wife and that makes me smile.

When I think about teeth, I think I've been lucky. My part top denture sits in OK and gives me my big wide grin. I wear it at home even though I live alone. It just makes me feel better to smile. These top front teeth are all-porcelain as I fell down at some point…I must've been 50 or so. It was fine, but about 5 years ago, it all got really sore. I had to go through some horrible procedure to take the bottom of the tooth out and leave the top bit in because it's attached to the other teeth—that was horrible, but I got over it. It's been fine since, but earlier this year, my regular dentist said it needed sorting out and sent me to a specialist. I was convinced the specialist would tell me I needed them all out, but they said I didn't have to if I didn't

want to! I was so relieved! I know they're not great and a bit loose, but I really didn't want some bigger false ones. I can eat whatever I want now, and I can cope with a bit of a niggle from time to time. I really don't want to keep coming and paying for things to get sorted unless it's the only option. How can I keep going to my dance group if I have to waste time at the dentist?"

This story illustrates an individual with a very positive attitude to life, with a clear idea of his priorities. A key point of William's story is how much of a positive impact a denture has on his daily life. It is also important to note that he reports a positive outcome from being given a choice about his care; this demonstrates the need to understand patients' preferences and make shared decisions about what dental care may be most suitable for them.

Holly's Story

The experience of a 90-year-old man who entered a residential care setting after an acute illness, as told by his daughter:

"My Dad was 89 this year. He a history of chronic heart failure, COPD, atrial fibrillation, prostate cancer and macular degeneration. It was one thing after another as the years have gone by, but he stayed positive. Until 2019 he lived with my Mum and was completely independent. He was still driving and spent many hours on his computer. He was phenomenally organised and managed the household finances with precision. He used to be a bank manager, so he was always on the ball with the banking. He had always gone for check-ups and whatever care he was told was needed. He had lost a few teeth but still managed to eat well. He had some gold fillings and crowns and generally did whatever the dentist suggested.

Dad saw the hygienist regularly when he saw the dentist, but over the last 2–3 years, he had become anxious about seeing the hygienist as he felt he was going to choke and struggled to breathe due to his COPD and the water in his mouth. Following discussion with his dentist, and in view of his teeth being in good condition for a man of his age, it was agreed that he could stop these visits and just see the dentist. In April 2019, Dad became acutely unwell and was admitted with urosepsis and an exacerbation of his heart failure, with his heart now only functioning at 25%. After a few days of IV antibiotics, which proved to be ineffective, he was deemed to have a poor prognosis of 6 weeks. Due to his high level of nursing needs, he was moved to a nursing home. He was drowsy, confused, not eating, and doubly incontinent. This was a massive change for such a proud and independent man and very distressing for all of the family.

In spite of all his problems, Dad rallied round. He struggled to eat as he had problems with oral thrush, which altered his taste. His previously good appetite, with a particular love of all things sweet, was reduced to nothing but glasses of milk. Family and care staff all tried to tempt him to eat, but each time he tried something, it didn't taste as it should. He had three treatments for oral thrush, but nothing solved his problem with taste.

The Nursing Home staff referred Dad to the Community Dentist for their opinion and advice. The dentist found his teeth to be in excellent condition for a man of his age. He explained that he hated to miss a dentist appointment and followed a good

dental routine at home (though this was sadly missing whilst he was so poorly in hospital). As the dentist could find no cause of his taste problems, she arranged to see him in 6 months. My mum was visiting each day and helped him to clean his teeth by switching his toothbrush on for him. Though he gets fatigued very quickly, Dad continued to cope well in the same nursing home with good support from the staff for his care needs. He struggled to eat still due to the taste problem and having difficulty in chewing. His physical and mental health has deteriorated and he has lost a lot of weight throughout 2020. Dad died at the end of 2020 after a rapidly becoming more unwell and being admitted to hospital. We weren't aware of any oral or dental issues at this point and it certainly wasn't the priority when Dad was so unwell".

This story again illustrates an individual with a very positive attitude but whose severe illness has potentially compromised his oral health care. It is worth noting that Holly says her father always complied with recommendations from a dentist, demonstrating a potential desire to trust a professional instead of contributing to a shared decision-making process. This story also shows how a person's circumstances change over time, and how they receive dental care may also have to change. Holly's father had previously sought regular dental care in general practice, even when co-morbidities impacted his daily living. Once in a care setting, it was no longer feasible to receive this same dental care. A specialist team became involved when necessary; such a change demonstrates a transition from routine preventative care to more symptom-driven interventions.

Mandy's Story

The perspective of a person living with dementia, in her own words:

"I was diagnosed with Young-onset dementia 6 years ago at the age of 58. That age may not immediately fit with your stereotypical image of someone with dementia. So, contrary to popular belief, dementia isn't age-related. When people think of dementia, they think only of the end stages. However, it has to have a beginning and a middle well before the end stage arrives and some abilities stay intact far longer than others. We have an invisible disability that may be far from obvious when we attend our dental surgery. So it's crucial to ask for our history, but more important to look for the clues as not everyone has or wants a diagnosis of dementia, such is the stigma associated with dementia.

When I lived in Hampshire, soon after diagnosis, I told my dental surgery, and we agreed on a plan on what would work and what wouldn't. They even asked around colleagues to see what others were doing. They were terrific and worked with me. Then I had to move, and I had a very different dental experience—no two-way conversation on what might help, no smiley faces. I had to leave as they simply didn't understand. I have now found another fantastic dentist.

So, what made the difference between good and bad? First of all, I have trouble with the telephone—I never answer the phone now as people are often impatient at the other end and because they can't see me thinking, they interrupt which means I forget what they asked in the first place and get in a muddle. How many NHS Services, including dentists, rely on you contacting them by phone? I can do face

time because I can see the people and they can see me, but not the telephone. I can do text because I can still type and can take my time. I can type as though dementia never entered my life, as that part of my brain thankfully hasn't been affected yet. I can type quicker than I can think and speak the words. So the person you imagine me to be from reading this might not be the person you're expecting if you met me in person.

So with the first two dentists, sadly, I had to get my daughters to ring up for an appointment. With my GP I can book an appointment online. Why not with the dentist? Because I can no longer speak on the phone, they did agree they would send me text reminders. They reminded me the week before, the day before and the morning before as we forget in an instant. I've convinced my current dentist to allow me to email them. It means I don't have to wait for my daughters to be free, and it means I still feel in control of my own life.

The waiting room always had the local radio on, but when I enter, they either turn it off or turn it down, as I can't cope with sensory overload. Being spoken to and having the noise of a radio in the background simply merge together so I can't hear either. Being clear on where I should sit is so important. We need clear, simple instructions. My previous dentist's receptionist would say, "Take a seat in the waiting room upstairs", but without telling me where the door for 'upstairs' was. If a door is closed, I often can't see it. It's important to remember that dementia is not just about memory as so many of our other senses are affected as well. Vision is often one. Our eyes see, but our brain doesn't always interpret the information correctly.

So what can dentists do to help us? Well, I've never been to a dentist yet with good signage. If we can't see where we're supposed to go, we get anxious, and we'll walk into the wrong room. We even get lost. It starts before we even enter the building with a friendly welcome sign on a coloured door we can see with a simple handle. Then reception. The dentist can be a scary place with or without dementia. With dementia, it can be a bigger nightmare. A smiley welcoming face goes a long way to allay fears and calm people down. It's incredible how many people forget the value of a simple smile and welcome. Give us time to talk. Don't be afraid of silence. It often means we're thinking. If you ask another question, we forget the first, so we will just get more confused, more anxious. Don't bombard us with questions, don't rush us. Remember, our brains aren't capable of speed. It takes us forever sometimes just to remember how to walk in a straight line. And please don't say, "remember when you came last time"…because we more than likely won't, and it can make us feel stupid and confused.

Please don't chat with colleagues when you're treating us—the noise of the drill is disturbing enough. To have chatter or music as well as the drills can be simply overwhelming for many. For some, it might be OK. Just ask us. Most of all, be calm, don't rush and give us time. As for cleaning my teeth, well sadly, I imagine some days I clean them more than twice and others may be less, as we simply forget or believe we've done something when we haven't. That's why I visit my dentist every 3 months to get them cleaned and checked.

Finally, we are always saying that if you get it right for people with dementia, you will be helping so many others."

This story illustrates that patients with dementia may have an excellent understanding of their condition. They may be able to advise professionals on their attitudes and what interventions may greatly improve their dental care experience. It also shows how a negative experience led to seeking alternative care. The need to find an alternative dental team could be avoided if such teams aimed to support access for people with cognitive impairment or other conditions that can arise in later life.

Mary's Story

A relative's experience of the absence of dental care in a care facility:

"My first experiences, some 10 years ago, of attempting to access dental care for a relative living in a care facility for people with dementia, were not good. My relative had been living at home with increasing cognitive decline for some years but had been able to cope well with visits to the dentist and necessary treatment, including extraction of a number of teeth. Once his cognitive decline reached the point where he required admission to a care facility, I was anxious that his physical health needs and personal care needs would continue to be met and that this should include regular dental assessment.

The facility manager initially told me that no dental service was available for patients. There had been a visiting dentist in the past, but that individual had stopped coming and had not been replaced. No attempt had been made to identify a new dentist. I was shocked and surprised to be told this, not just that there was no access to dental services, but that the care facility apparently thought that this was not a matter that needed to be addressed. My reaction was emotional rather than intellectual: I felt that surely it was bad enough to lose one's memory and sense of understanding of the world, to be confused and frightened by one's surroundings, to lose one's home and to be placed amongst strangers, some of whom displayed aggressive behaviour—and then not to have access to aspects of health care which the rest of us take for granted.

At this time, I had been an NHS employee for almost 30 years and consequently had a good understanding of how things worked. I made two telephone calls: one to the local Community Dental Service and one to the local branch of the Alzheimer's Society to ask if they had a list of dentists who would attend a patient in a care facility. Both calls had an immediate and positive outcome. The Community Dental Service said they would be happy to attend, they would place my relative on the waiting list for a visit, they would be happy to receive referrals to see other patients at the care facility while they were there, and they would be happy, if asked, to send one of their staff to the care facility to train the care staff in carrying out oral hygiene in patients with dementia. The Alzheimer's Society duly provided a list of dentists in NHS and in private practice. I shared all of this intelligence with the care facility and dental services re-commenced.

The next issue was persuading my relative to co-operate and to open his mouth for the dentist to assess him. This proved to be very difficult, and none of the professionals or care staff concerned was able to think of a way around the problem. My relative at that time had been prescribed a benzodiazepine to calm his restless behaviour, and I suggested that the timing of administration of this drug could be coordinated with the timing of the dentist's visit. However, this proved a step too far in agreeing to arrangements across staffing shifts and handovers, and we had to give up the idea of dental assessment altogether. If a dental emergency had occurred, it would have been treated as a medical emergency.

This problem reminded me of my relative's earlier experience in a linked care facility for patients with dementia where patients were not given their glasses to wear. This was because patients were constantly taking them off and losing them, and it then became a challenge for staff to reconcile the correct spectacles with the correct patient. So the spectacles were collected and placed in a biscuit tin—to be sent in due course those in need! Hence in this instance, in addition to the very significant cognitive and sensory losses experienced by the patients, they were not enabled to see clearly either. These examples illustrate an absence of care for patients as individuals, where convenience for staff was seen as more important than maintaining this sense of self".

This story illustrates a management failure in a care facility where dental care was simply not provided, despite being readily available on request. It demonstrates how advocacy can be required for those who may not be able to proactively seek their own care and how a relative could support service improvement in a residential care setting and establish a link with a professional dental service.

Using Patients' Experience to Support Service Improvement

In England, three key domains contribute to quality healthcare: patient safety, clinical effectiveness, and patient experiences [28]. Services should examine these areas using appropriate measures to drive quality improvement. Historically, there was a focus on outcomes that professionals deemed important; this only allowed determination of quality or improvement to be viewed from a professional perspective, not from those actually using healthcare services [29]. If person-centred care is to be provided, it is essential to use person-centric quality measures.

In oral healthcare, as with wider healthcare service, patients and their family or carers may have significantly different views about what is important to achieve "good" or quality healthcare and what is seen as "satisfactory" in terms of outcomes from care. In addition, regardless of the outcome of care, a person's experiences may have been positive or negative. For example, though a patient may have satisfactory complete dentures, a reasonable clinical outcome, they may have been treated rudely or without compassion in the process of dental extractions and denture constructive. Experience and outcomes of care are different aspects of quality that require separate assessment. There are a range of tools and approaches that can

be used to understand these experiences and support quality assessment in relation to care provision.

Patient-Reported Outcome Measures (PROMs)

Healthcare services can strive to understand the impact of their care on outcomes that matter to patients using patient-reported outcome measures (PROMs) [29]. PROMs are specific standardised tools that measure patients' perceptions of their health, function, and well-being using set questions or rating scales [30]. PROMs are generally completed by patients themselves and can be either disease-specific or more generic [31]. Both approaches use specific questions or rating scales to quantify outcomes that can be re-assessed on either a patient or service level over time.

A range of dental care outcomes can be measured with PROMs. Mittal et al. [32] identified 53 examples of dental PROMs. These fell into four categories: oral function, orofacial pain, orofacial appearance, and psychosocial impact of dental care. Grossman et al. [33] demonstrate specific PROMs for oral surgery, which identify, from the patients' perspective factors such as how long it took patients to achieve their normal activities, or if they needed further surgery or sought further advice post-operatively. In addition, a number of specific measures can be used in Oral Medicine [34].

PROMs have a range of roles in supporting quality improvement, specifically in supporting monitoring of healthcare quality and supporting decision-making. In addition, they can be used as outcome measures for research. The development of PROMs should proactively involve patients and undergo a robust evaluation to ensure they are suitable for their intended purpose [35]. Considering the nature of dental care for older people, existing PROMs may only be partly relevant or relevant in relation to aspects of dental care. More generic dental PROMs may not apply to situations such as when patients are receiving palliative care or when a cognitive impairment affects a person's experience of care. Specific PROMs would need to be developed in such scenarios.

Patient-Reported Experience Measures (PREMs)

When considering patients' experiences, historic measures focused heavily on patient satisfaction. A challenge with this measure is its broad, ill-defined nature and how it can be impacted by a range of inter-dependent factors, such as the experience of care, a person's expectations, and the nature or quality of care actually delivered [30]. Though a good outcome of care is desirable, patients' care experiences are another critical domain of quality. This can also be determined using specific measures, known as PREMs (patient-reported experience measures). PREMs mirror PROMs in using set questions and patients' self-reports, yet the nature of questions within the instruments differs. PREMs aim to identify what actually happened in a clinical visit by explicitly asking about particular processes

or events [30]. Generic examples of PREMs include whether a procedure or investigation was explained, or if a clinician introduced themselves, or if they waited longer than a specific time. PREMs have also been used in dental care, though evidence of their use relates primarily to oral surgery practice [33, 36]. These studies use PREMs that include questions relating to involvement in decision-making, intra-operative pain management, and the opportunity to ask questions.

When they have been appropriately developed and evaluated, these measures should allow specific aspects of experience to be addressed, particularly adverse experiences. The use of PREMs in dentistry beyond oral surgery is not widely documented, and the experiences of older people and their family and carers are not incorporated into any PREMs that can be currently identified, though aspects of generic PREMs will apply. PREMs can be used alongside PROMs to "produce a more rounded picture of patients' views on both the process and the outcome of care", yet a range of challenges may limit these measures guiding service improvement [37]. A cultural change is needed in healthcare settings to ensure that value is placed on person-centred care and to allocate resources to providing care in this way. Staff should also be empowered to support the translation of outcome measures into actual changes in service delivery [38].

Co-Design

The desire to include users' perspectives and experiences has led to a rise in the use of design methods to develop and improve healthcare services [39]. Co-design is an approach which seeks to involve and empower non-designers to work alongside designers in the design process [40]. Often implemented through service design,

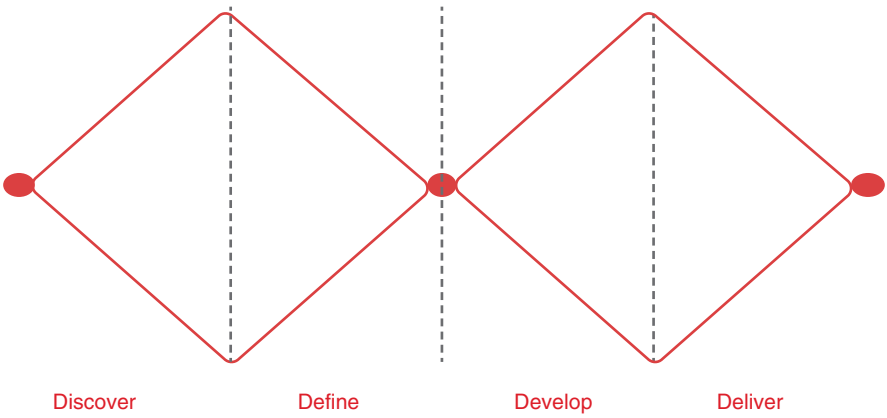

Fig. 3.4 The double diamond model of co-design from the UK Design Council [42]. The 'discover' phase engages with peoples' experience in the beginning of co-design but continues to use this experience over time

co-design is grounded in the belief of a partnership approach to the design of services that includes those experienced in receiving and delivering services [41].

A common approach to co-design, The UK Design Council's Double Diamond Model [42] takes participants through a series of divergent and convergent thinking shown in Fig. 3.4. Participants are involved in all stages of the process, from understanding relevant experiences, through to translating these into potential ideas before then deciding upon which of these ideas to take forward through a process of iterative prototyping. Traditionally delivered through a series of workshops, in response to the COVID-19 pandemic a wider variety of creative approaches has been used to conduct activities [43].

A co-design approach seeks to uncover and understand patient experiences (along with a wide range of other stakeholders) and then uses this understanding to (re) design healthcare services. Visual and creative methods allow structured space for participants to share their experiences (Fig. 3.5). These methods embody a fundamental underpinning of co-design; the reduction of power and hierarchy, where no one person's skills or experience will be preferenced over another's. This provides a supportive activity-based environment which allows those with valuable lived experience to have the confidence to express ideas and surface latent knowledge around their values and feelings. The visual nature of co-design allows participants to externalise ideas, and see that they have been valued, listened to and acted upon [44].

It is essential to adapt any research process to meet individual requirements, ensuring that participants can engage in activities and attend sessions to share their experiences. Co-design activities can also be supported by other research methods, including ethnographic methods (where processes or people are observed) or other qualitative methods (such as interviews or focus groups), the data from which can

Fig. 3.5 Participants taking part in a co-design workshop and sharing their experiences

be visualised and fed into the process. The value of co-design approaches in healthcare is that outcomes are more likely to be context specific and implementable in practice [45]. The sharing of various stakeholder experiences, allows mutual understanding and empathy, resulting in a change in perspective that feeds into the outcome of the process.

Research

Research aims to address a specific question and generate new knowledge. In the design of any studies, the involvement of people with lived experience is crucial; such individuals can support the prioritisation of research questions and the practicalities of study design and conduct to ensure research is acceptable and appropriate in the eyes of those it intends to benefit [46]. Such an approach is deemed so important that national standards exist on how it should be integrated into the design of research [47]. Some researchers have even gone as far as including patient representatives as co-authors in research projects including the authors of this chapter, a dentist and a former carer, who have conducted research together [48].

Research can either be quantitative, such as measuring outcomes numerically (for example, using PROMs or measurements of the number of teeth) or qualitative, using non-numerical data. Qualitative methods can be highly insightful and illuminate aspects of health care not amenable to numeric measurements, such as the impact of social and political factors on healthcare services and patients' experiences [49].

When seeking to understand peoples' experiences, a range of qualitative research methods can be used, as summarised in relevant methodological texts [50–52]. One qualitative approach is ethnography, where the delivery of care is observed by a researcher integrating themselves into a healthcare environment. There are a range of complexities in using such an approach, but it can provide insight that may not be gained from speaking to individual outside of a healthcare environment. The mainstay of qualitative research, however, is the use of interviews. Though this can be highly structured using a set list of questions, it can also be unstructured or partly-structured to allow a participant to speak freely to share their experiences. When interviews are undertaken with multiple individuals, the process can offer invaluable insight into under-explored phenomena. Interviews in a research setting are generally analysed in a formal planned manner to generate new knowledge or theoretical understanding that come from the sum of the qualitative data captured from talking to patients. The understanding can feed to both service improvement and the generation of interventions that can be applied within the clinical setting. Qualitative research can also support co-design as described above, which can be used as a research method as well as

an approach to service improvement. Dentists using qualitative methods and co-design must be mindful of how their own views and experience, particularly their professional status, may impact on their approach to interviewing and analysing interview data [53].

Conclusion

As demonstrated in the stories presented, the needs and preferences of patients can vary drastically. Patients' experiences can vary based on factors ranging from service availability to their or their relatives' attitudes and motivation to receive dental care. Focusing on what is felt to be "ideal" in research and service design fails to account for individual variation. To optimise a service, those using it must be invited to comment and share their experiences related to use of the services and these views have to be listened to carefully. The stories presented highlight the unique insight of those using services or supporting someone else to do so. The lived experiences of such individuals could support a transformation of service in a manner that a clinical team alone may not be able to. Mandy's story described how simple changes vastly improved her dental care experiences, whilst Holly's story provided insight into how a specialist service could provide the necessary support in a complex scenario. In contrast, Mary's story showed a situation with significant apathy toward dental care and the need for a relative to intervene to drive things forward. Relatives can support care improvement alongside patients themselves and dental services and teams must proactively seek these views to understand and improve the quality of care that can be delivered.

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Medical and Psychosocial Considerations in Older Adults

4

Joanna Preston and Iain Wilkinson

Learning Objectives

- Describe frailty and the impact on resilience to illness in older people.
- Recognise the chronic diseases that are more common in older people.
- Be aware of how medical comorbidities impact oral health and dental care.

Introduction

The demographics of the ageing population is changing, and healthcare will need to adjust accordingly. Older people will access more NHS and private health care services compared to younger age groups. The reasons behind this are multifaceted but are linked to the normal ageing process and the risk of developing chronic illnesses over time. Frailty is a related concept, which is discussed in this chapter. The presence of frailty and the related (but separate) concept of multimorbidity also affects a person's response to the additional strain of acute illnesses.

The medical management of older patients has a specific evidence base, particular through the processes that form the Comprehensive Geriatric Assessment (CGA). The CGA is defined as a "multidimensional interdisciplinary diagnostic process focused on determining a frail older person's medical, psychological and functional capability to develop a coordinated and integrated plan for treatment and long-term follow up" [1]. This process addresses the problems that accumulate

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when people have multiple medical conditions. The medical treatments and the conditions themselves often overlap and interweave, adding to the complexity of care. In this chapter, the key aspects of the medical management of older people are summarised and a range of common conditions and their effects on older people are discussed with their relevance to dental care.

Frailty

Frailty is a distinct entity to normal ageing. It is important to distinguish frailty from single organ conditions (such as a stroke) associated with advancing age. Frailty is also distinct from multimorbidity, but these can co-exist (see Fig. 4.1). Single organ disease, multimorbidity, and frailty can each impact a person's well-being and function and potentially cause disability, but for very different reasons. Each may require a different approach to any medical and surgical interventions planned, based on their prognosis and complexity.

Frailty is defined as 'a state of increased vulnerability to stressors due to age-related declines in physiological reserve across neuromuscular, metabolic, and immune systems' [2]. Those living with frailty are more susceptible to adverse health outcomes, including worse health and even death. There are two leading schools of thought around frailty. The first is based on Linda Fried's [3] research suggesting that a person may exhibit signs of a frailty phenotype, which is recognisable by the features in Fig. 4.2. The second, from Kenneth Rockwood, is that

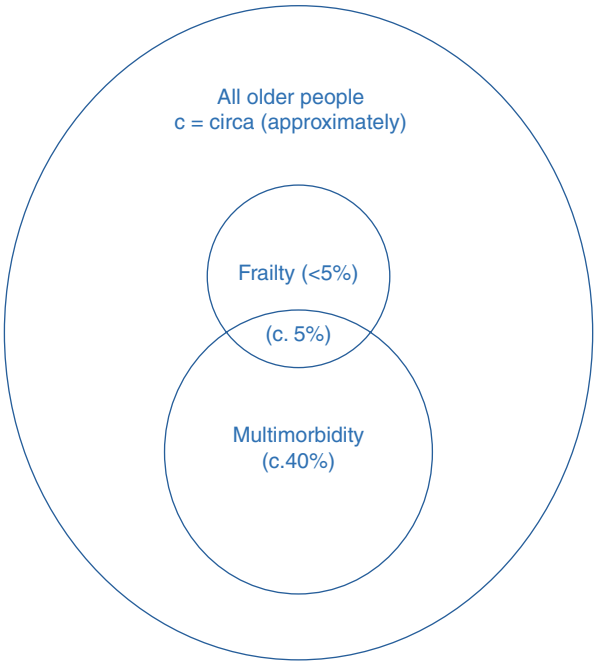

Fig. 4.1 Frailty and multimorbidity

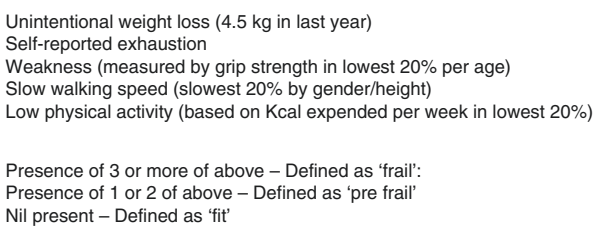

Fig. 4.2 Fried's frailty phenotype

frailty is a consequence of and defined by an accumulation of deficits that are associated with ageing. This is measured by adding the number of deficits a person has to create a Frailty Index [4]. This is useful in research settings but less clinically useful due to the amount of information required to score it.

Frailty Syndromes

In 1960s, the concept of 'Geriatric Giants' was introduced where an individual may present with a specific symptom masking a more complex medical problem. Frailty syndromes have replaced this concept and are clinical patterns that are commonly seen in those who also have frailty and include:

1. Impaired cognition—either delirium or dementia.
2. Instability/falls (which may or may not be because of immobility).
3. Immobility—reduced muscle power.
4. Incontinence.
5. Iatrogenic (now commonly substituted for polypharmacy).

Comprehensive Geriatric Assessment

Comprehensive Geriatric Assessment (CGA) is the well-established evidence-based approach to managing frail older people [5]. CGA provides a structured assessment and management approach to the patient's medical problems and has been shown to increase the proportion of people living independently at home [5]. Given that the process is multifactorial, it requires the care of a multi-professional team to deliver care in this manner. Traditionally this team was located on specialised geriatric medicine hospital wards with individual assessments linked in a multidisciplinary team meeting (MDT). More recently, the approach has been used in other clinical settings, including the community, to care for older people. There are strong similarities between this approach and the approach advocated in the NICE guideline for multimorbidity management [6].

The CGA process is illustrated in Fig. 4.3. There are several domains of assessment (of which some or all will be needed for each patient—shown in orange). The

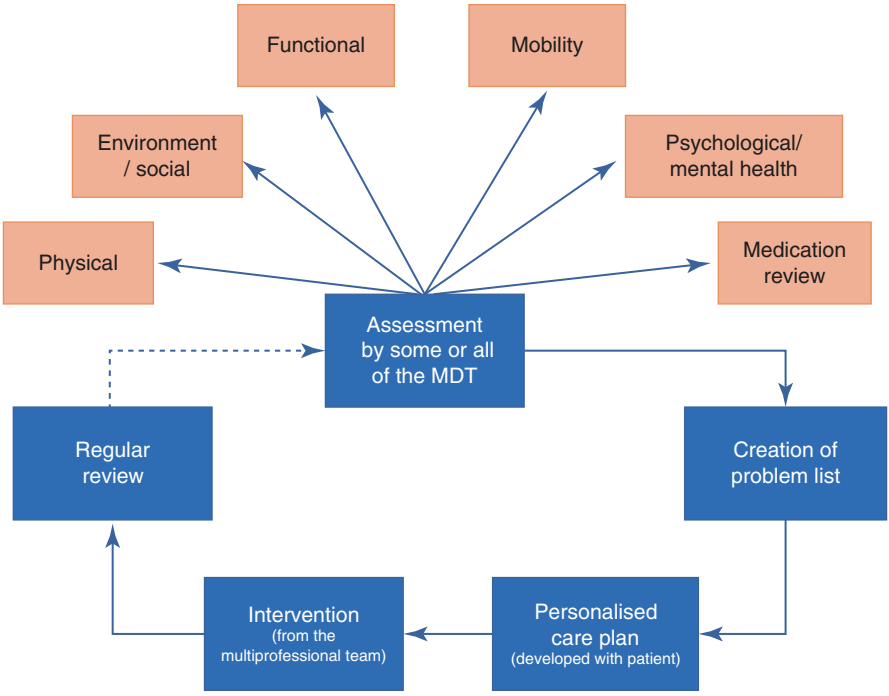

Fig. 4.3 Comprehensive Geriatric Assessment (CGA)

assessments then lead to the CGA process (in blue) to create a problem list that leads to an individualised management plan for the problems identified. The management plan may involve the starting or stopping of medications, onward referrals for specialist input or conservative management. The individualised nature of the management plan is vital as it allows care to be delivered that is personalised to that particular patient in that specific time of their life course. This, therefore, allows for some treatments and treatment plans to be suitable for some patients but not all, so there is no blanket approach to treatment.

A range of health and social care professionals should be involved when completing a CGA. For example, a patient may need to see a physiotherapist, a doctor, an occupational therapist, a dietician, a nurse, a speech and language therapist, and a pharmacist. Dentists can have a role in the wider multi-professional team in completing the CGA. If someone has chronic pain from their teeth, they may not eat as well, which will, in time, affect their physical function. Unfortunately, there are often poorer links between dental professionals compared with other multi-professional team members. A greater awareness of the poor levels of oral health in vulnerable older people amongst non-dental professionals will support the use of appropriate models of care which include dental professionals [7]. Understanding frailty is important for dental professionals as it helps explain the knife-edge on which some older people live. In frailty, the body is struggling to maintain its

homeostasis, and even a small change, such as dental pain or infection, can cause decompensation in their physical or mental health, which in turn can affect a whole range of body systems.

The remainder of this chapter provides a series of short, focused summaries for a range of topics pertinent to older people.

Polypharmacy

Polypharmacy is often described as taking five or more medications. This is based on one cohort study where at the age of 69, 22.8% of individuals were taking more than five medications [8]. However, it should be noted that there is no consensus on the exact numbers of medications defining polypharmacy. Polypharmacy may be appropriate (when all the medicines are needed and the patient wants to and can take them correctly) or inappropriate (when the medications are not required, the patient does not want to take them, or the patient is incapable of following all the dosing requirements). When following the national and local guidelines for individual conditions, a large number of medications can be used; for example, a patient may be started on 5–7 medicines following a myocardial infarction. As patients are diagnosed with more conditions, it is not uncommon for them to be prescribed more drugs, which brings a greater complexity of timings, instructions, and organisation.

The more medications an older patient takes, the more likely there are to be adverse side effects, drug–drug interactions, and problems associated with the changes in pharmacodynamics in older people. Therefore, it is worth thinking about these potential interactions when adding any medications to those taken by an older person, and the pharmacist's role is critical in managing older people.

As more medications are taken, a patient is more likely to encounter oral side effects related to oral health, some of which are discussed in Chap. 8. For example, a patient with epilepsy, hypertension, diabetes, and ischaemic heart disease may be affected in many ways: they may develop xerostomia (diuretics), oral ulcerations (beta-blockers), gingival hyperplasia (phenytoin), or a metallic taste (metformin), for example. The recognition of polypharmacy can lead to a proactive approach to tailoring management to the individual. Medication reviews can be conducted in either primary care by a patient's General Medical Practitioner, pharmacist, or nurse specialist or in secondary care by a geriatrician. Signposting patients to these professionals is a good first step when patients report problems with their medication regime, including impacts on their oral health.

Continence

Older people may experience difficulties in maintaining their continence. Between three and six million people in the UK have some form of urinary incontinence [9]. The most common way to categorise urinary continence is stress, urge, overflow, or functional forms.

In stress incontinence, the sphincter around the urethra is no longer strong enough to overcome additional pressure from the abdomen (such as that which comes about when coughing or sneezing). When this happens, the patient may leak a small amount of urine. Individuals are often very aware of this and may well be very embarrassed.

In urge incontinence, the most common cause is an overactive bladder. Here the neuromuscular system is abnormal. As the bladder fills, signals are sent to the micturition centre too early in the filling process, creating an urgent need to pass urine. The bladder is still relatively empty on passing urine, meaning a person only passes small volumes. This urgency can be highly significant and can lead to urinary incontinence. One treatment is anti-muscarinic medication, but this has the side effect of xerostomia. If a dry mouth is very troubling for the person, there are other newer treatments that their general medical practitioner or oral medicine specialist could consider (see Chap. 8).

Overflow incontinence is more common in men with enlarged prostate glands, and there may be a continual small volume of leaking urine. This is often treated with a urinary catheter inserted into the bladder, which drains the urine into a bag attached to the patient's leg. There is no problem with the urogenital system in functional incontinence, but the person cannot get to the bathroom to pass urine on time. The risk is greater for people with mobility difficulties, such as arthritis or following a stroke. For all older patients, it is essential to understand their needs and work with them to maintain their dignity wherever possible.

The dental team should be aware that patients may need to leave the surgery to pass urine mid-way through lengthy dental procedures and that they may not have much warning for this. To avoid this, patients will often reduce fluid intake before appointments, leading to dehydration and making their mucus membranes appear less moist than usual. Exploring this with patients before longer consultations and procedures may make it easier for older people to describe how incontinence impacts them and how dental teams can support their care. Patients should have access to toilets in dental settings that are suitable in terms of design for older people. Specifically, there may be a need for higher toilet seats, grab bars and handles on doors, and adequate access for mobility aids or wheelchairs. Clear signage to toilets in all areas can help.

Falls

Falls can be a sign of more complex underlying problems that should be addressed to reduce the risk of further falls and associated injuries. Falling is very common, with around 1 in 3 people over 65 falling per year [10]. This rises to 1 in 2 people over the age of 80 [11]. It is helpful to think of falls as being due to either intrinsic or extrinsic related factors. Intrinsic factors are related to the individual, e.g., postural hypotension, and extrinsic factors are related to their environment, e.g., trip hazards in the home. Targeted management or treatment can significantly reduce the rate of falls in older people. Distinguishing between the two can help determine

which kind of intervention and support the person may need. For example, if someone were to fall and injure their face or teeth as part of their presentation, more serious causes and urgent interventions may be required. Injuries sustained to the face from falling often signifies either a loss of brain function through a reduction in cardiac output (e.g., low blood pressure or arrhythmia) or abnormal brain activity, (e.g., seizure or a loss of righting reflexes seen in those with Parkinson's disease) or due to more significant physical frailty. Dental teams may also be the first to see some patients who have fallen and sustained dental trauma. This should lead to questioning about the cause of the fall and prompting the patient to seek assistance from the healthcare team to reduce the risk for further falls.

Due to the interaction between intrinsic and extrinsic factors, falls management is an example of CGA in action. Table 4.1 shows what a CGA for falls might typically include.

Sarcopenia is a change in muscle fibres as we age, reducing explosive muscle power and increasing the risk of falls. It is treated through a combination of nutrition and exercise. There is evidence that vigorous exercise in older people reduces the risk of ongoing frailty than gentle exercise [12]. The combination of balance and strength training has a strong evidence base for reducing future falls and improving confidence in older adults. The role of healthcare professionals is to encourage a focus on a good diet and adequate exercise for all age groups in each interaction.

Dental teams should note that patients may have difficulty getting on and off the dental chair, that space is needed in the dental surgery for wheelchairs and mobility aids, and that patients may need physical assistance moving around the practice (particularly rising from a seated position). Knee-break dental chairs are much more suitable for the ageing population than standard dental chairs. Care should be taken when older patients have been supine for an extended period during dental treatment, and they should be sat up slowly due to the risk of orthostatic hypotension. Some patients may not leave their homes due to an increased risk, or fear of falling, meaning consideration should be given to domiciliary dental care. Chapter 12 discusses adaptations to support patients in the dental surgery who may be at higher risk of falls and the role of domiciliary dental care.

Table 4.1 Falls in Comprehensive Geriatric Assessment (CGA)

Physical symptoms	Pain Arthritis Continence
Sensory impairments	Vision
Mental health	Cognition, e.g., risk awareness
Functional assessment	Activities of daily living Strength Balance
Environment	Trip hazards Adaptations Mobility aids
Social	Support networks Care needs

Bone Health

Osteoporosis is a disease characterised by low bone mass and deterioration of bone tissue that leads to compromised bone strength and an increase in the risk of fractures. The prevalence of osteoporosis increases sharply with age: from approximately 2% at 50 years to more than 25% at 80 years [13]. There is a greater incidence among females than males due to oestrogen withdrawal during menopause which will impact on bone density. There is abnormal bone production in osteoporosis, and the bone becomes "thinned"; thus, there is an increased risk of fractures. Falls from a standing height leading to a fracture are commonly called "fragility fractures" and are pathognomonic for osteoporosis in people over 75 (there are around 500,000 of these per year in the UK) [14]. As the population ages, so will the incidence of osteoporosis and fragility fracture.

Bone density is controlled, in part, by the calcium cycle and from a physiological standpoint, the human skeleton's primary function is as a calcium storage site. The calcium level absorbed from the gut is determined by the hormone vitamin D formed from sunlight falling on 7-dehydrocholesterol in the skin. The resulting hormone is then further activated in the kidney (so normal kidney function is needed), and it acts on the gut to modulate calcium and phosphate absorption. The parathyroid hormone then helps control the calcium level in the serum and the bone. Older adults are at risk for lower vitamin D levels due to decreased synthesis and dietary vitamin D intake, so nutritional supplementation is often recommended [15].

There are good, long-established treatments for osteoporosis, and the most common of these are bisphosphonates. There is a balance between bone resorption (by osteoclasts) and bone formation (by osteoblasts) in normal bone. Bisphosphonates have a very high affinity for bone minerals and reduce bone resorption by the osteoclasts. Due to their impact on bone formation and resorption, bisphosphonates reduce the risk of further vertebral or hip fractures by order of 50%; however, they are associated with side effects. The most common of which is a feeling of reflux, so patients are asked to take the medication on an empty stomach and remain upright for some time following to reduce the acidic effects of the treatment. There is often concern about the risk of osteonecrosis of the jaw, however, this is more common in patients on high dose bisphosphonates to treat a malignancy (the incidence here is between 1 and 12%). For the osteoporosis treatment dose, the incidence is less than 1 case per 100,000. The risk of jaw osteonecrosis increases in people taking corticosteroid medications alongside bisphosphonates and those who have been taking bisphosphates for longer than 5 years [16, 17].

Several newer treatments affect the interactions between osteoblasts and osteoclasts. Denosumab is one such example, and it also has a lower risk for osteonecrosis of the jaw [18] compared to when prescribed as part of oncology treatment, where a higher dose is prescribed.

Dentists may be asked to review the patients' oral health before the initiation of anti-resorptive or anti-angiogenic drugs. In addition to the osteonecrosis risk to the jaw, patients with osteoporosis may have reduced bone density and more significant periodontal disease, especially if they are smokers. Patients with low bone density

may also have experienced a bone fracture that affects their mobility, potentially delaying their attendance. Chapter 7 discusses the dental management of patients taking these medications in further detail.

Nutrition and Weight Loss

Dental teams will be well aware of the importance of good oral health in maintaining good nutrition. Functional teeth or good fitting dentures are necessary for chewing various foods leading to a broader food selection. There are two main considerations for older adults and poor nutrition: sarcopenia, which is addressed earlier in this chapter, and unintentional weight loss.

Unintentional weight loss is recognised as part of the frailty phenotype but would usually only be attributed to frailty as a diagnosis of exclusion by someone able to assess the root causes thoroughly. Although cancer is a primary concern to anyone with this symptom, most of those seen in rapid diagnostics clinics for suspected cancer of an unknown primary have an alternative diagnosis. The end stages of many chronic conditions, including frailty, dementia, COPD and heart failure, will lead to a catabolic state or insufficient nutritional requirements to meet the body's metabolic demands [19]. Living in poverty can also lead to inadequate nutrition and weight loss. Dementia is another common cognitive cause of weight loss in older people. The person may not recall that they have not eaten, prepared, or bought food due to disruption in executive function required for complex planning of tasks.

The older generation may have had poorer childhood nutrition than children experience today. Poor nutrition may have affected teeth formation, including enamel hypoplasia and delayed eruption of teeth that can have lifelong consequences. Inadequate nutrition in later life can also cause delayed healing, or tooth erosion, depending on the nature of the consumed diet. Restriction in food choices due to an impaired dentition may lead to a high sugar diet lacking many essential nutrients and increasing the risk of developing caries. In addition, there has been a recent focus on the role of supplemental micronutrients to reduce oral inflammation (vitamins A to E and omega 3 fatty acids) [20].

Ageing Systems

Musculoskeletal

As we age, the musculoskeletal system ages with us. A "wear and tear" failure can develop in many areas of the body. For example, the development of osteoarthritis can cause pain and stiffness in the large and small joints of the body. The effects of osteoarthritis on joints may be focused on a few areas or be more generalised, affecting an older person's mobility. Getting onto and off dental chairs may prove difficult for people with mobility issues, especially after a

Table 4.2 Causes of reduced mobility

Bones/joints:	Arthritis, reduced range of movement
Muscles:	Sarcopenia and loss of muscle strength
Nerves:	Peripheral neuropathy, proprioceptive loss
Brain:	Ataxia, apraxia, impaired executive function, stroke

prolonged period of inactivity. Large joints (hip and knee) can be replaced with artificial joints, which are very successful in reducing the pain of osteoarthritis but may result in patients not being able to kneel comfortably. Osteoarthritis of the temporomandibular joint (TMJ) is more common in older people and can lead to pain and restriction of jaw movement, impacting dental treatment and oral hygiene [21].

There are many reasons that someone's mobility may be impaired, as listed in Table 4.2. The patterns are helpful to recognise and understand so that adaptations can be made during or after a consultation. Physiotherapy and occupational therapy can provide interventions and adaptations to reduce or treat the associated functional impairment. It may be necessary to refer those with significant physical disabilities to special care dentistry services in the community or hospital with access to specific equipment, including wheelchair recliners and hoists, as discussed in Chap. 12.

Cardiac Conditions

The commonest cardiac conditions encountered in the UK include atrial fibrillation (AF), hypertension, postural hypotension, heart failure, and ischaemic heart disease. Cardiovascular disease is associated with high morbidity and mortality rates. Normal ageing causes the heart and blood vessels to stiffen, leading to these conditions in later years. As general function and mobility decrease, the heart muscles weaken. By and large, changes to medications are not required for dental procedures, Chap. 7 provides details on when this may be appropriate for direct oral anticoagulants (DOACs). For patients taking DOACs, atrial fibrillation is a relatively low-risk indication, where stopping anticoagulation for a short period is unlikely to lead to a stroke. However, if a patient had a recent or recurrent pulmonary embolus or cardiac surgery within the last 6 months, it would be far less appropriate to alter or discontinue medication regimes. Approaching the prescriber can be sensible so advice can be sought about medication changes. Elective dental care should be postponed when there is any uncertainty about medication regimes and the need to adjust these. If higher risk urgent procedures are required, there is the potential to bridge anticoagulation with heparin; however, this should be planned by hospital-based dental teams in collaboration with medical teams.

Generally, the closer to an ischaemic event, whether cardiac or neurovascular, the higher the risk for recurrence. The risk depends on the type of stent used for those with coronary stents, but all are at increased risk for further thromboembolic events. This risk is highest in the first 6–12 months with drug-eluting stents and 6–12 weeks after a bare-metal stent. Dental management of patients on antiplatelet and anticoagulants is discussed in detail in Chap. 7. Chapter 9 discusses the importance of good local anaesthesia for patients with cardiovascular disease to minimise stress and when adjuncts such as conscious sedation may be indicated.

Respiratory Conditions

Dyspnoea (breathlessness) is a common symptom in older adults, with 32% of over 70-year-olds reporting it to some extent [22] and is linked to poorer functional abilities. The forced expiratory volume in 1 s (FEV1) is the volume of air exhaled in the first second during forced exhalation after maximal inspiration and categorises several pulmonary diseases. There can be a small margin between the FEV1 experienced as part of the expected physiological decline associated with ageing and the figures that indicate a disease state. Cardiac and respiratory causes account for approximately 70% of cases of dyspnoea in older adults [23].

In more advanced stages of conditions such as COPD and heart failure, breathing dysregulation is often more pronounced. This can respond well to controlled breathing exercises and specialist prescribing of opioids and anxiolytics to reduce the work of breathing. This dysregulation can increase the risk of aspiration pneumonia due to the loss of coordination of the swallow reflex, which could also affect saliva management during a procedure. Aspiration pneumonia is associated with poorer oral health [24], so good oral hygiene has a preventative role in reducing this risk of pneumonia from inhaled oral contents.

Evidence is still emerging regarding the impact of COVID-19 on the respiratory system. What is known to date is that there is a significantly higher risk of pulmonary embolism in the short-to-medium term for those who require hospital admission. There is also a higher risk of developing fibrosis in the medium to long term and an increased incidence of breathing pattern disorders. These are when breathlessness is not driven by respiratory or cardiac physiological triggers but results in a discoordination in breathing, making it feel out of sync.

The consideration for the dental team is that many patients seeing dental teams will have some degree of breathlessness. This may be worse when they lie flat (particularly in some cardiac disease patients). The usual procedure or positioning may need to be adapted for these patients. Some patients may need to use long-term oxygen (in pulmonary fibrosis, for example); flames should not be used as part of root canal obturation or denture construction. Patients may get quite out of breath moving around the practice or getting on and off the dental chair. They may require

time to catch their breath before procedures start or may not be able to hold open their mouth for a prolonged period if they predominantly mouth breath.

Specific Conditions

Parkinson's Disease

Parkinson's disease (PD) is the second most common neurodegenerative condition after Alzheimer's dementia. In PD, the accumulation of alpha-synuclein protein causes the formation of Lewy-bodies in cerebral neurons. The Lewy-bodies disrupt the production of the neurotransmitter dopamine. Patients have a wide range of potential symptoms, divided into those associated with movement (motor) and those that do not affect movement (non-motor).

During the early stages of PD, patients present with a tremor, stiffness or slowness of movement. The non-motor symptoms (drooling, cognitive changes, hallucinations, and constipation) become more prominent with disease progression. Drooling is a particularly common complaint and can be managed non-pharmacologically with boiled sweets (but with an increased risk of dental disease) that can stimulate swallowing or with topical medications such as anticholinergics or botulinum toxin injections to the salivary glands. The change in salivary flow substantially impacts the oral microbiome [25].

As the disease progresses, PD can affect a patient's cognition and the risk of falls and other complications of the disease increase. In the later stages of the disease, patients may become very sensitive to the replacement of dopamine and exhibit unwanted movements (as opposed to too little movement—which is the norm). These movements are called dyskinesias and result in the patient moving parts of their body in an uncontrolled manner. This may be common at certain times of the day and again should prompt discussions with the patient and carers about how best to approach dental treatment in this situation.

When taking treatment, the regimens of medications become highly personalised, and the timing of medicines becomes critical. For some patients, the difference in timing of taking medication of only 5–10 min can result in them not moving, swallowing, or functioning. Therefore, when planning dental procedures, it is essential to be aware of the timing of a patient's medication and try to schedule treatment around this. A break may need to be planned for lengthy procedures, and patients may need to be instructed to bring their medication to take mid-procedure. Dental treatment may need to be planned around medication times to ensure the patient is not in an "off state" (where movement and swallowing can be challenging). Chairside oral suctioning is very important. Finally, some patients with dyskinesias may find it impossible to sit or lie still at peak times around their medication regime. As discussed in Chap. 9, IV sedation with midazolam for muscle relaxation to reduce movement can help to enable the safe delivery of dental treatment.

Dementia

Alzheimer's disease is the commonest neurodegenerative condition in the UK. The World Health Organisation suggest it accounts for 60–70% of all dementias [26]. It is associated with a decline in cognitive function across various cognitive domains that progresses over time, and many patients will have problems with memory loss. Vascular dementia is less common (around 15% of patients with dementia) and classically follows a stepwise pattern of deterioration. Further information on dementia is presented in Chap. 10.

Some patients, though, will not already have a diagnosis of dementia. Patients who may appear to have an undiagnosed cognitive impairment (for example, forgetting about appointments or appearing disorientated) should be signposted to their GP for a formal assessment. A sudden change in a level of confusion is rare in dementia and is much more likely to be due to delirium. Delirium can be caused by several conditions (from constipation to infection) and should always lead to a more detailed patient assessment by an appropriate healthcare team.

Dementia and frailty states show significant overlap and often co-exist, especially in the later stages of dementia. In the moderate to severe stages of dementia, weight loss is common. As discussed earlier, this can be multifactorial, from either the practicalities of obtaining or preparing food to reduced appetite or catabolic nutritional states. Maintaining a good dentition can significantly optimise a person's intrinsic eating abilities, essential in those who may lack such awareness, such as those with dementia.

Mental Health in Older People

One in four older people live with a mental health disorder, and despite recent attempts to reduce stigma, there is still a risk that mental health problems are not explored as fully as physical illnesses. Fewer older people are referred to NHS services for their mental health problems than younger adults, with over 65's making up 15% of people receiving NHS support for mental health conditions [27]. People living in care homes are especially at a high risk of mental illnesses, with up to 40% having depression [28]. Overall, depression is the most common mental health problem (around 25% of people over 65) in older adults, followed by anxiety [27]. Cognitive-behavioural therapy works well for older people, and not everyone needs medications to help treat their depression. When patients have multimorbidity and mental health conditions are part of the conditions, they have higher mortality and morbidity rates. Healthcare professionals, including the dental team, should be alert to the possibility of mental health problems and ask patients about this as part of their consultation and discuss referral to their general medical practitioner.

The consideration for the dental team is that patients living with mental health conditions may neglect their physical health, including their oral health, and so may present later to dental services or only when there is an acute problem. Poor oral health such as lost dentures, poor appearance of teeth or chronic pain and infection

can contribute to mental health issues, including depression. The number of older people substance-abusing will increase with demographic changes, including heavy drinking, misuse of prescription medication and recreational drugs. Older people may have started substance abuse in their younger age and continued to do so as they got older, or it can be a new pattern in older age. The distinction is important because each requires different assessment, intervention, and treatment regimens [29].

Other Conditions

In addition to the specific conditions outlined above, many illnesses are more common as people get older. The incidence of chronic kidney disease (CKD), usually related to reno-vascular disease caused by diabetes and hypertension increases in older age. CKD stage 3–5 affects 1.9% of people aged 64 and under, 13.5% of people aged 65–74, and 32.7% of people aged 75 and over [30]. The presence of renal disease may affect choices of medications for other conditions and dosing of antibiotics.

Ageing also affects the health of the liver. As we age, we have a greater risk of damage to the liver from medications (including alcohol) and an increase in the risk of this damage leading to liver fibrosis and longer-term effects on liver function. Again, this is important in consideration of medications that undergo hepatic metabolism and the impact on clotting factors and surgical procedures.

Haematological conditions are more common in older people. Anaemia is often related to a non-haematological condition (such as CKD, bleeding from the GI tract or malignancy). Anaemia may make patients lethargic, short of breath on exertion or pale looking (particularly mucous membranes) for which signposting patients to see their GP would be appropriate). Haematological malignancies are discussed alongside other cancers below.

Stroke

Stroke is a condition that occurs in around 100,000 people in the UK per year, and 1.3 million people live with the after-effects of a stroke [31]. In a stroke, there is a sudden onset of focal ischaemic changes in the brain. Ischaemia is most commonly caused by a blood clot occluding an artery (85% of all strokes). Risk factors include atrial fibrillation, where blood clots may form in the heart's upper chambers, hypertension, diabetes, and smoking. An ischaemic area can also result from a rupture in the blood vessel wall leading to haemorrhage (around 15% of all strokes). In both situations, whatever function the affected area of the brain is responsible for will be affected (for example, a stroke affecting the left hemisphere would give rise to a right-sided weakness). Following a stroke, a patient can have a wide range of neurological problems, from complete one-sided paralysis with higher cognitive dysfunction, loss of speech, poor swallowing function, and one-sided visual loss (a total anterior circulation stroke) to a relatively minor weakness. For some people, the sequencing of tasks may be affected.

Speech may be affected in several ways:

Expressive dysphasia—where the forming of language is difficult—the patient may know what they want to say but cannot "get the words out".

Receptive dysphasia—where understanding of language is affected. Patients may vocalise, but understanding what others are saying may be lost.

Dysarthria—where there is difficulty with the physical formation of words, and speech may appear slurred or harder to understand.

The consideration for the dental team is threefold following a stroke: the patients understanding may be affected if they have higher cortical involvement. Secondly, movement and mobility around the surgery onto and off the dental chair may be affected, and finally, speech and swallowing may be impaired. If a person's swallowing is affected, they may have a feeding tube inserted into their stomach; in this situation, they may not take food or drink orally. Adaptions may need to be made to toothbrush handles for people with limited dexterity, as described in Chap. 5. After a stroke, people may be at a higher risk of dental diseases due to poor oral clearance and limited dexterity for oral hygiene, so prevention is critical. When carrying out dental care for a patient with dysphagia, excellent chair side oral suction is essential, keeping them more upright, taking time with treatment, and allowing the person to rest when needed is important.

Visual Impairment

As we age, there is an increase in the number of conditions that affect our eyes (diabetic retinopathy, glaucoma, cataract, and age-related macular degeneration). This means visual loss becomes more common; 1 in 5 people over the age of 75 have a visual impairment, which rises to 1 in 2 people over the age of 90 [32]. 50% of visual loss is treatable [33]. Visual loss can significantly impact the quality of life (one-third of older people living with sight loss also have depression) [34]. Any reported sudden onset of visual loss should be referred for urgent assessment as it may be treatable.

Visual impairments can impact access to dental services and oral health. By law, dental services need to make adjustments to their practices for people with disabilities [35]. For people with visual impairments, this should include appropriately sized signage to and from and in clinics, the size of printed information available for patients, and some patients may need additional assistance in safely moving around the clinic areas.

Hearing Loss

Hearing loss is the fourth leading cause of disability globally, and the prevalence doubles with every 10-year increase in age [36]. 50% of 60-year-olds have some hearing impairment, which rises to 85% in 85-year-olds. Hearing loss is usually benign, but as it becomes more severe, communication can be affected, which may

lead to social isolation and is a risk factor for depression. Age-related hearing loss is usually slowly progressive with an initial loss of high-pitched sounds and difficulty understanding speech.

The dental team should make reasonable adjustments for these patients according to the Equality Act 2010 to improve communication [37]. This can include reducing background and other noises in the dental surgery, facing the patient when speaking to them and speaking clearly and slowly if they lip read. Face masks can be a barrier to communication and using transparent masks or face visors for consultations is important for people with a hearing impairment. Patients with hearing aids may prefer to switch them off during treatment as high-pitch noises can cause interferences. Dental staff should consider writing things down or using apps that can transcribe, some of which allow access to a British Sign Language (BSL) interpreter on a video call. Should patients use BSL, access to interpreters is advised. Since 2016, all NHS services are legally required to follow the Accessible Information Standards, and make services accessible for people with sensory loss, including identifying and recording communication needs [38]. For example, patients might prefer text messages or email reminders rather than telephone calls or require information in leaflets rather than verbal instruction.

Diabetes

Diabetes is a condition where the regulation of blood sugar is affected. Insulin usually is produced by the body to move sugar from the blood into the cells. When the blood sugar level is raised, sugar is excreted into the urine, which pulls water with it, leading to polyuria and polydipsia—the hallmark symptoms of diabetes. There are two main types. In type 1 diabetes, the pancreas does not produce insulin and is often a condition that older people have lived with for many years and would be treated with insulin injections. Type 2 diabetes is the most common form (around 90% of cases) and is where the body becomes less responsive to insulin. This develops over time and is associated with obesity. Treatment can be via insulin injections but is often initially managed with tablets to modulate the response to endogenous insulin. The longer patients live, the longer people live with diabetes and its potential complications. Diabetic related complications, as explored below, may be commonly encountered in older patients.

People with diabetes may have a range of complications—mostly related to its effect on small blood vessels. Renal, retinal, and peripheral small blood vessels can become damaged leading to, chronic kidney disease, visual loss, and peripheral neuropathies. These conditions can contribute to significant disability and adjustments to patients care. For example, written information in larger font size, or providing support with transfer from wheelchairs when the peripheral vascular disease has significant impacts on mobility or has led to amputation. Wound healing can be compromised with diabetes, and infections can progress rapidly in uncontrolled diabetes, requiring aggressive management. Dental wounds and infection risk are no exception. Type 1 diabetic patients or those needing insulin for type 2 diabetes undergoing general anaesthesia for dental procedures may need modifications to

their insulin regime in the pre-operative and peri-operative period, especially as fasting is required before anaesthesia. Medical teams should support the planning of care in such situations.

Cancer

The rising age of the population has led to a greater incidence of cancers as these are more common in older age groups. Cancer Research UK reports that age-specific incidence rates rise steeply from around age 55–59, with the highest rates of cancer diagnoses occurring in the 85–89 age group [39]. Common cancers in older people are shown in Table 4.3. Cancer may be treated by surgery, radiotherapy or chemotherapy. In some instances, the older person and their oncology team may decide not to investigate or treat further.

Head and neck cancer is the eighth most common cancer in the UK, and incidence rates are highest in people aged 70–74 [39]. Dental teams, health care professionals and the public need to be vigilant for signs and symptoms of oral cancer and refer to head and neck cancer services as discussed in Chap. 8. Cancer treatments may affect the oral cavity ranging from mucositis, xerostomia, and candida infections. Bisphosphonates, often used for metastatic secondary bone cancer, is associated with an increased risk of jaw necrosis, and implications for the dental team is discussed in Chap. 7.

Haematological malignancies are common in older patients, such as acute or chronic myeloid leukaemia, chronic lymphocytic leukaemia, or multiple myeloma. As with other malignancies, older patients may not tolerate aggressive chemotherapy treatments, and outcomes are less favourable. There is increasingly a role in the CGA process for these patients. Dental treatment is affected by such conditions. Firstly, patients may require an infusion of bisphosphonate drugs as part of their haem-oncology treatment. For example, patients diagnosed with multiple myeloma should have a dental examination and extraction of teeth of poor prognosis before commencing the bisphosphonate drug due to the increased risk of medicine-related osteonecrosis of the jaw (discussed in detail Chap. 7). Similarly, when chemotherapy is planned, teeth of poor prognosis should ideally be managed before starting to allow teeth with chronic infections or at risk of infection to be managed before a patient becomes neutropenic. When patients with existing haematological malignancies require surgical management; they should be assessed for bleeding,

Table 4.3 Types of cancer in people >75 years (Cancer Research UK 2021)

Male (%)		Female (%)	
Bladder	6	Bowel	14
Bowel	14	Breast	21
Lung	16	Unknown primary	4
Melanoma	4	Lung	16
Prostate	25	Uterine	4
Other	36	Other	40

infection, and osteonecrosis risk. Advice should be sought from their haematology team alongside appropriate blood tests, and the timing of treatment carefully planned.

Immunocompromise

The immune system acts as a defence system against infections and detects and destroys malignant or autoreactive cells. Immunosenescence refers to the changes in the immune system with increasing age. As the immune system ages, it functions less well and the risk of cancer, autoimmune disease, and risk of infections increases. Some infection risk is due to changes in mucous membranes (for example, urinary tract infections in older females partly due to the changes in vulval mucosa) and the way the immune system functions. Macrophages work slower, T-cells respond less well, and less complement protein is produced. As a result, bacterial infections are more common in older people (particularly respiratory, urinary and skin infections). Viral infections, such as flu and COVID-19, also have a more significant effect due to this immunosenescence. Vaccination helps to mitigate against these effects for some viral illnesses. As well as a less agile immune system, many older people may be taking medications that affect the function of their immune system. These medications are broadly in four groups. Firstly, oral corticosteroids for treating a range of inflammatory autoimmune conditions (e.g., prednisolone for asthma or temporal arteritis). Secondly, disease-modifying medications for more severe autoimmune diseases (e.g., methotrexate for rheumatoid arthritis or mycophenolate for systemic lupus erythematosus). Thirdly chemotherapy agents for cancer treatment [e.g. 5-fluorouracil (5-FU) capecitabine for bowel cancer]. Finally, immunomodulatory treatment for cancer treatment (e.g., rituximab to treat non-Hodgkin lymphoma or chronic lymphocytic leukaemia). For the dentist, this is relevant as patients taking such medications are more at risk of dental infections and prolonged healing if invasive procedures are required. Management of immunocompromise for patients undergoing dental surgical procedures is detailed in Chap. 7.

Conclusion

With ageing, there is a greater risk of physical and mental health conditions, often overlapping and interacting. We, therefore, need to be cognizant of the underlying ageing process and understand the effects that this can have on the ability of our bodies to maintain homeostasis and on individual organ function. Looking after older people is more complex than caring for other patients who often have single organ disease. It also requires the ability to assess the whole patient and involve them and their family and care team in decision making in developing truly personalised care plans.

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Prevention of Oral Diseases for the Older Person

5

Rosalyn Davies and Mili Doshi

Learning Objectives

After reading this chapter, readers should be able to:

- understand why older people are at an increased risk of poor oral health and the importance of prevention;
- discuss evidence-based prevention within dental and non-dental settings;
- be aware of national policies and guidance relating to the oral health of older people;
- be able to advise families and carers on practical ways to support older adults with mouth care.

Introduction

Prevention of oral diseases should be lifelong, starting from childhood, and adapt with ageing, factoring in changes in medical health, dietary intake, cognition, and manual dexterity. The impact of poor oral health on the general health and well-being in the older population is significant, so focusing on prevention for this group is important. Caries and periodontal disease, the two most common oral health conditions, are largely preventable through interventions including a low sugar diet, use of a fluoride toothpaste and effective daily oral hygiene. Prevention can slow down the progression of dental diseases that can lead to pain and infection and the need

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for dental intervention later in life when people may be frailer and find treatment more difficult to tolerate [1]. With older age, risk factors for oral diseases increase, including a dry mouth, dietary changes, and reduced manual dexterity.

There has been a considerable transformation in the epidemiology of edentulism over the last century, with people retaining their teeth into later life due to positive oral health changes, including access to fluoride toothpaste and advances in clinical dentistry [2, 3]. The number of people wearing complete dentures has decreased and continues to do so [4]. Today's older population will have increasingly undergone more restorative dental care, including endodontics, crowns, bridges, and implants throughout their lifetime. Heavily restored teeth require a meticulous oral care regime to maintain in a healthy condition, together with regular reviews with dental professionals. Xerostomia, periodontal disease, dental caries (especially root surface), tooth surface loss, advanced tooth loss, denture-related issues, mucosal lesions, and oral cancer are more prevalent with increasing age [5]. The dental team needs to work closely with other health care professionals and care providers to raise awareness of the need for proactive support with mouth care and regular dental attendance, and this is especially important in the early diagnosis stage of any chronic health condition [6].

The first part of this chapter focusses on the main reasons for oral health deterioration in older people and its impact. The second part provides practical advice on supporting older people with their oral care.

Impact of Poor Oral Health on General Health and Well-Being in Older Adults

Understanding of the consequences of poor oral care amplifies the importance of good oral hygiene and dental care [7]. Poor oral health can cause enduring dental pain and infection and can lead to problems with eating and drinking, resulting in nutritional deficiencies and increasing frailty [8]. Poor dental appearance, for example, broken teeth, lost or ill-fitting dentures or halitosis, can result in low self-esteem, particularly in social situations centred around food [9, 10]. Some older people may find it difficult to communicate when they have dental problems; for example, in people with advanced dementia, and oral pain can lead to behavioural changes, including decreased food intake, changes in sleeping habits and increased agitation and restlessness [11].

Oral Health Prevention and the Role of Dental Professionals

Prevention aims to inhibit either the onset or the progress of a disease or to restore function lost due to disease. The framework of primary, secondary, and tertiary prevention according to the stage of disease that Leavell and Clark proposed in 1940s [12] has been widely used to help attain this goal and can be applied to oral health (Table 5.1). Primary prevention includes the provision of information to help

Table 5.1 Prevention framework

Primary (improving overall oral health of the population)	Secondary (disease detection)	Tertiary (restoring function and reducing impact of disease)
Fluoride toothpaste	Oral health screening	Restoration of teeth
Oral hygiene advice	Periodontal screening	Replacing missing teeth
Dietary advice		
Smoking and alcohol advice		

individuals make informed choices about their health-related behaviour and strategies to reduce the risk factors associated with developing disease. Secondary prevention strategies include those that detect disease early and intervene to prevent its progression. Tertiary prevention strategies include those that reduce morbidity by restoring function and reducing disease-related complications.

All members of the dental team have an important role in delivering person-centred oral health preventative messages. Most older adults will continue to be able to carry out effective oral hygiene as they get older independently; however, they should still be advised on age-related changes in the mouth. For example, periodontal disease may mean that gaps between teeth become larger, and there is a greater need for interdental cleaning with interdental brushes rather than using dental floss.

Oral health prevention can be provided verbally and in written form for older people considering sensory impairments and memory issues. There has been an increase in the use of digital technology including smart phone apps as part of health communication, and tele-dentistry (the use of health information technology and telecommunications) has an increasing role in delivering preventative oral care advice in the older population where regular access to dental clinics can be a problem [13].

There is strong evidence that fluoride can reduce the incidence of dental caries, and whilst most of the research to date has been conducted in children and younger adults, there is growing evidence of the benefit of fluoride for prevention in older people. The quarterly application of fluoride varnish in conjunction with daily oral cleaning has been shown to reduce the risk of developing caries in older people in care homes [14]. High fluoride toothpaste (5000 ppm) has been found to be more effective than standard toothpaste in reducing root surface caries and can be considered an alternative option when it is not possible to restore a tooth, for example, poor compliance with dental intervention [15]. There has been increasing interest in silver diamine fluoride (SDF) as a preventative treatment to arrest caries, notably root caries in older people [16]. Treatment with SDF requires minimal instrumentation and application at less frequent intervals than other caries preventive materials. It can be particularly beneficial in older people who face increased challenges accessing dental services or for those with frailty to avoid more invasive dental treatment. In all cases, fluoride should only be prescribed or applied when there is a benefit in doing so, for example, in an older person with a dry mouth and carious lesions. Topical chlorhexidine has been suggested to reduce caries as it is

bactericidal and could inhibit *Streptococcus mutans*; however, the evidence for this is weak so far [17] and it is not recommended for routine use.

Minimally invasive dentistry (MID) is discussed in Chap. 6 and is part of tertiary prevention. The availability of adhesive restorative materials and increased understanding of dental caries means that MID is a good option, especially for frail older people who may find it more challenging to regularly attend dental appointments.

The Delivering Better Oral Health (DBOH) toolkit [18] provides clear evidence-based oral health improvement interventions and updated advice to help dental teams promote oral health to prevent oral disease. It is intended for use by the whole dental team throughout primary dental care and other health and social care workers. DBOH recommends that older people visit a dentist every 3–24 months, depending on the individual's risk status. However, older people, especially those living in care settings, often face increased barriers in accessing dental care as highlighted in the CQC report "Smiling Matters" [19].

Individual Related Risk Factors for Poor Oral Health in the Older Adult

Individual related oral health risk factors include both behaviours and biological determinants; many of these factors are also common to several chronic systemic diseases. Therefore, oral health prevention can simultaneously benefit both oral health and general health. Risk factors include the following.

Socioeconomic Status

In older adults, there are social gradients in the prevalence of dental caries, tooth loss, oral cancer, self-rated oral health quality of life, oral hygiene, and dental service use. Older adults with a lower income and level of education have poorer levels of oral health with higher rates of caries, periodontal disease, increased tooth loss, and more removable compared to fixed prostheses [20].

Frailty and Increasing Need for Support

Frailty is discussed in detail in Chap. 4, it is a separate entity from ageing and is defined as "a dynamic state affecting an individual who experiences losses in one or more domains of human functioning (physical, psychological, and social), which is caused by the influence of a range of variables and increases the risk of adverse outcomes" [21]. As the level of frailty increases, the ability to carry out oral hygiene independently decreases. Motivation and the priority to maintain good oral health can also be impacted. Dental attendance can become more irregular leading to increased attendance only when having symptoms. Although people can move in and out of phases of dependency or frailty, there is an association with increased frailty and having fewer teeth and a dry mouth [22].

Diet and Nutrition

A balanced diet is very important for older people to ensure essential nutrient intake. As part of ageing, muscle mass decreases and metabolic rates declines, and there is an increase in multimorbidity that can lead to decreased appetite and impaired nutrient absorption. Oral health status is closely integrated with eating: dry mouth, loss of teeth, and ill-fitting prosthesis can impact masticatory function and avoidance of hard food, leading to an increased intake of soft cariogenic carbohydrates [23]. Oral nutritional supplements (ONS) are often advised for older people who are unable to meet their dietary requirements through oral diet alone or who have dysphagia. ONS come in various types, including juices, milkshakes, high energy powders, soups, and cereal bars. Many ONS have a high sugar content and can increase the risk of developing dental caries. Furthermore, there is a trend towards more liquid medication, particularly in relation to end-of-life care. It is important to respect the balance and need for calorific intake against the caries risk, and preventative advice should be given, including frequent mouth care and regular exposure to fluoride. It will not always be practical or appropriate to consider alternatives to these sugar-based supplements because of more pressing health concerns, and, in such cases, greater emphasis should be placed on prevention and regular dental reviews.

Tobacco and Alcohol Use

Modifiable risk factors such as tobacco and alcohol intake (particularly when excessive) are the leading cause of cardiovascular disease, diabetes, cancer, cognitive decline, and dementia [24]. Smoking is a major risk factor for periodontal disease. Despite a marked decline in smoking behaviours over the last few decades, around ten million adults in the UK still smoke and 11% (1.1 million) are over the age of 60 [25]. Smokers who quit after the age of 65 benefit from reduced mortality (2–4 extra years of life) and reduced morbidity, so there are clear benefits [26]. The incidence of oropharyngeal cancer increases with any level of alcohol consumption or tobacco use [27]. The *duration* of smoking is more important than the frequency; smoking fewer cigarettes per day over a longer number of years has a higher risk for oral cancer than more cigarettes per day over fewer years. Smokeless (chewing) tobacco often used as a component of betel quid, and betel quid without tobacco (e.g. betel quid and areca nut) are associated with an increased risk of oral cancer [28]. Supporting smokers to quit is a prevention priority in the NHS Long Term Plan [29], and every health and care professional has a role to play, including the dental team. As many of the adverse effects of tobacco use on the oral tissues are reversible, stressing their impact on oral health may provide a useful means of motivating patients to quit. Quitting smoking is the best thing a smoker can do for their health, and the benefits of stopping begin almost immediately. Delivering Better Oral Health [18] provides comprehensive advice on effective interventions to support people to reduce smoking. It describes asking about smoking, providing very brief advice, acting on the patient's motivations, signposting to local services, and

pharmacotherapy. E-cigarettes or vapes have been found to help smokers stop smoking, and although less harmful that cigarettes do still have some risks [18].

Many older adults, both in the UK and internationally, drink at hazardous or harmful levels [30]. For alcohol consumption, *frequency* is more important than duration—higher consumption (more than three drinks per day) over a few years has a higher risk for oral cancer than a lower intake over many years [31]. There is evidence that the dental team can play an important role in identifying older adults with alcohol risk factors and support them to reduce alcohol consumption [18].

Dementia and Cognitive Impairments

Dementia is discussed in detail in Chap. 10. People living with dementia are at an increased risk of developing oral diseases [32], often as a consequence of a decline in memory, self-care, or motor skills [33]. People with more advanced cognitive decline have been found to have the highest increase in plaque levels, underpinning their higher risk of oral diseases [34].

Physical Impairment

People living with a physical disability experience poorer oral health due to barriers accessing dental services and maintaining effective oral hygiene. With an ageing population, many people grow older with physical disabilities they were born with or acquired when they were younger, such as muscular dystrophy, multiple sclerosis, or spinal cord injury. The incidence of physical disabilities, including Parkinson's, Huntington's disease and stroke, increase with age. A physical impairment that affects the hands and arms, such as arthritis and paralysis, will inevitability affect an individual's manual dexterity for effective oral care, which will in turn negatively impact their oral health status. Patients who have had a stroke are likely to have a long-term physical impairment, with more than a third of stroke patients reporting difficulty with tooth brushing [35]. Furthermore, the physical weakness, lack of coordination, and the cognitive problems that can accompany a stroke may prevent a person from maintaining good levels of oral hygiene independently [36]. Figure 5.1 shows an implant-retained denture that belonged to an individual in a rehabilitation care home who after having a stroke did not have the manual dexterity to remove and clean it independently. The nursing team did not feel confident and adequately trained to remove the implant-retained denture.

Dry Mouth

A dry mouth as a result of xerostomia or hyposalivation is more prevalent in older people and can profoundly affect quality of life and oral health. Xerostomia is the subjective feeling of oral dryness, while hyposalivation is an objective symptom of decreased salivary flow rate [37]. These symptoms may impair speaking, chewing, tasting, and swallowing and may affect the quality of life [38, 39]. Individuals who

Fig. 5.1 Food debris on implant retained denture

complain about xerostomia with a low or altered salivary flow may be at a higher risk of dental caries, periodontal disease, dental erosion, mucosal ulceration, oral candidiasis, dysgeusia, and dysphagia [40]. An older person may experience pain and soreness, and a dry mouth can impact denture retention and stability. The most common cause of hyposalivation is prescription and non-prescription medications. Sreebny and Schwartz reported that 80% of the most commonly prescribed medications cause xerostomia, with more than 400 medications [41] associated with salivary gland dysfunction as an adverse side effect. Older people are much more likely to take multiple medications and are at increased risk of dry mouth. Other causes of dry mouth include dehydration, oxygen therapy, systemic diseases such as diabetes, Sjogren's disease, and the side effect of head and neck radiotherapy.

Dysphagia

The prevalence of dysphagia (swallowing difficulties) in the general population is 16–23%, increasing to 27% in those over 76 years of age and is higher in the presence of neurological diseases, such as dementia, Parkinson's disease or stroke [42]. People with dysphagia may be on modified diets, oral nutritional supplements or be non-orally fed via an enteral route. Some people may be completely unable to swallow or may have trouble safely swallowing liquids, foods, or saliva. The reduced oral clearance negatively impacts oral health, increasing the risk of caries, periodontal disease, *Candida* infections, and potentially aspiration pneumonia [43].

Oral Health Inclusion in Policy and Legislation

The impact of poor oral health on an individual's general health and quality of life is often poorly recognised outside the dental profession. Oral health policies are frequently produced separately from overall health policies. This results in oral health and mouth care being considered in isolation from the rest of general health

and personal care, which gives it a low priority [44]. Oral health should be prioritised as an essential determinant of health care and given the same importance as other determinants of health, including nutrition, hydration, tissue viability, and falls. The importance of oral health needs to be a greater priority within the multidisciplinary team that care for older people, including medical teams, nursing teams, allied health care professionals, and importantly within social care [45, 46]. One positive example of oral health inclusion within guidance in England is the Enhanced Health in Care Homes (EHCH) Framework [47]. EHCH is part of the Ageing Well branch of the long-term plan to ensure that people living in care homes receive the same level of healthcare and support as those living in their own homes. The implementation framework advises on best practices in all aspects of care, including an oral health assessment within 7 days of admission.

Oral Health for Dependent Adults in Care Homes, Hospitals, and Their Own Homes

Most older people in industrialised countries will continue to live in their own homes and continue to care for themselves. However, many older adults with chronic illnesses, frailty or increased levels of dependency will reside long term in residential care or short term in hospitals, hospices or rehabilitation units, all requiring varying levels of support in all aspects of life. In all these settings, oral care had been found to be suboptimal, leading to poorer oral health for vulnerable older adults.

Oral Health in Care Homes

The number of older people living in care homes is increasing. The number needing community or residential care in the UK will rise to 1.2 million by 2040—almost double the 2015 rate [48]. There are different types of care settings based on an individual's need that may change with time when people require different levels of support (Table 5.2).

When people move into a care home, a person's diet and oral care regime changes and a combination of poor oral hygiene, frequent sugar intake and dry mouth can lead to the dentition deteriorating rapidly (Figs. 5.2 and 5.3). Dry mouth, periodontal disease, caries, and dental infections are more common in older people in care homes [49] and can be debilitating for those already living with frailty. Barriers to good mouth care support for care home residents include care resistant behaviour (opposing the action of the care giver), time pressures, inadequate mouth care products, and lack of knowledge or training for staff [50]. As discussed earlier in the chapter, a minimal emphasis on oral health training can lead to mouth care being given a low priority. The Care Certificate curriculum released [51] in 2015 in England for healthcare assistants and carers who work in hospitals and social care omits mouth care from the agreed standards. This undoubtedly contributes to the

Table 5.2 Types of residential settings

Type of residential home	Type of care
Residential homes	Provide support for personal care, such as washing, dressing, taking medication, and going to the toilet. They may also offer social activities such as day trips or outings
Nursing homes	Provide personal care as well as assistance from qualified nurses Sometimes called care homes with nursing
Care homes with dementia care	Designed to make people with dementia feel comfortable and safe
Dual-registered care homes	Care for residents who need both personal care and nursing care This means that someone who initially just needs personal care but later needs nursing care won't have to change homes
Palliative care	Palliative care provides specialist care for those suffering from an incurable, terminal illness and aims to control pain and relieve symptoms
Respite care	Short-term care and holiday care, short breaks, and day-care facilities for those who are usually looked after by a family member or a professional home carer

Fig. 5.2 Deteriorating oral health for a resident in a care home

Fig. 5.3 Inadequate oral care leading to plaque build-up for a care home resident 5 weeks after admission

perception that oral care is a low priority rather than an essential part of holistic patient care.

The NICE guideline NG48 [52], published in July 2016, recognised the importance of good oral care for care home residents and recommends that care homes develop policies on oral health, including supporting residents to access dental services, undertake individual oral health-related needs assessments, develop mouth care plans, and provide appropriate levels of staff training. Care home managers and staff have a duty of care to ensure that good mouthcare is carried out effectively every day. Care home staff must be suitably trained and skilled to provide support with mouth care. Training should take place at induction and be refreshed throughout their working career. Other multi-disciplinary health and care professionals have a part to play and can support care home staff. They include nursing teams, speech and language therapists, dietitians, occupational therapists, and pharmacists, and therefore should not be excluded from receiving mouth care training.

Care homes residents can find it challenging to access dental care, in particular domiciliary dental care and urgent dental care, and this was highlighted in the 2019 CQC "Smiling Matters report" [19]. The lack of dental interaction can mean individual based prevention is not regularly reinforced and dental diseases are not identified until quite advanced requiring more invasive management like extractions rather than restorations.

There are a number of well-advanced oral health initiatives in the United Kingdom working to improve the oral health of older people living in care homes. These include Caring for Smiles in Scotland [53], Gwen am Byth in Wales [54], and the ROCS project in Sheffield [55].

Oral Health in Hospitals

A growing body of evidence has shown that following hospital admission oral health deteriorates, with an increase in dental plaque, gingival inflammation, and subsequent deterioration in oral mucosal health [56]. Poor oral health can affect nutritional uptake and patient recovery leading to a longer admission and increased frailty. This, in turn, can mean older people are less independent after they are discharged from the hospital. Of particular relevance within the hospital setting is the association between poor oral health and the development of hospital-acquired pneumonia [57, 58], which has a very high mortality rate and can extend a hospital admission by on average 8 days. An absence of oral health protocols and policies included within hospital governance indicates that oral health is given a low priority in nursing compared to other aspects of care [59]. A study carried out in 33 Trusts in England with 1576 nursing staff found that 42% of nursing staff had not had training in oral health. The most commonly reported barriers to providing mouth care was lack of patient cooperation (70%) and time pressures (45%) [60]. A lack of suitable equipment including toothbrushes and toothpaste is a frequently cited

barrier for providing mouth care [61]. Increasing patient complexities and staffing shortages may lead to nurses struggling to have the capacity to support patients with all aspects of their personal care, including mouth care.

Mouth Care Matters [62] and the All Wales National Oral Health Improvement Programme for Patients in Hospital [63] have been introduced into secondary care settings throughout England and Wales to improve oral health standards. Both these programmes provide useful risk assessment and care planning tools. However, it must be stressed that no tool can obviate the need for good nursing care.

Oral Health at Home

The number of older people with complex needs living in their own home with the support of home care services or families is growing. Many older people prefer to stay in their own homes rather than move into a residential setting. Home care can involve paid and non-paid carers, often family members. There is very little evidence on the oral health of people living in their own homes compared to other settings, and more research is needed.

There are many examples of oral health quality improvement programmes for healthcare workers in care environments focusing on improving patient experience and up-skilling staff through training, including small group teaching, simulation, and practical hands-on training [64]. However, there is limited evidence of the long-term effectiveness and sustainability of these initiatives. With the ever-increasing financial pressures placed upon health and social care, any intervention ideally needs to improve health outcomes and provide value. There is the potential for oral health improvement programmes to have a cost-benefit when factoring in improved nutritional uptake and the lower risk of oral related infections, but more evidence is needed in this field [65]. Health care professionals, including dental care professionals are often best placed to lead on oral health promotion work and develop and deliver training for non-dental staff in residential settings, hospitals, and carers supporting people in their own home.

Practical Recommendations for Supporting Older Adults with Mouth Care

Effective daily mouth care to remove dental plaque, food debris, saliva secretions and keeping the oral tissues moist is essential to maintain oral health. The following section discusses practical advice that dental teams should provide to carers or family members who support older adults with oral care. A range of mouth care products are available, and advice should always be tailored to the individual.

Toothbrushes

In older people who have limited mouth opening, a small-headed toothbrush can access more areas of the mouth compared to a larger headed brush. Electric toothbrushes can be useful for older people with limited dexterity due to the larger handle, which may be easier to grip, but they are heavier, and they may not always be tolerated in people with cognitive impairments who may find the noise or vibration distressing. There are many ways to adapt oral care equipment for people with limited grip-ability, inflexibility in their joints, or restricted and uncoordinated movements. The simplest way to improve grip is by enlarging the handle of the toothbrush. Dentists can make customised handles by placing silicone putty around the handle of a brush and asking the person to grip the putty as it sets (Fig. 5.4). Other adaptations include using a tennis ball, some types of foam or an ergonomic grip. There are many commercially produced aids to adapt toothbrushes that can be purchased from major chemists.

A three-headed toothbrush (Fig. 5.5) can be used for people whose co-operation with tooth brushing is limited. These toothbrushes simplify the tooth brushing technique by brushing multiple surfaces of a tooth simultaneously and, therefore, can be completed in less time. Three-headed toothbrushes should be used with toothpaste

Fig. 5.4 Putty adaptation for toothbrush handle

Fig. 5.5 Three-headed toothbrush

and placed over the teeth. A forward–backwards motion is used to remove plaque from the teeth.

Suction toothbrushes are useful for people with severe dysphagia who are at risk of aspiration or who produce excessive oral secretions. The brush head can attach to suction tubing for people who have regular oral suctioning.

Toothpaste

It is important that a fluoridated toothpaste is used twice daily (once before bed and one other time during the day) to help protect teeth against dental caries. For adults, toothpaste should contain at least 1350 ppm fluoride (1.1% sodium fluoride). A pea-sized amount should be used, and it is important after brushing to "spit not rinse" to ensure that a film of toothpaste is left in contact with the teeth, allowing it to be absorbed. Often carers are unaware that individuals should be advised not to rinse, and not to eat and drink for at least 30 min after tooth brushing. High fluoride toothpaste with 2800 ppm or 5000 ppm fluoride may be prescribed for individuals who are at a high risk of dental decay. Sodium lauryl sulphate (SLS) is is a foaming agent added to many kinds of toothpaste. For people with dysphagia who are at risk of aspirating, a non-foaming SLS free toothpaste should be advised. SLS can have a drying effect on the oral tissues and should be avoided in individuals who already have a dry mouth.

Interdental Cleaning

Older adults may have increased spacing in-between teeth due to generalised bone loss and where teeth have been extracted. Larger interproximal spaces can result in food debris stagnation resulting in caries, and localised periodontal disease, so interdental cleaning is beneficial. Interdental brushes and single tufted brushes can clean in-between teeth, under bridges, and around implants. For people with limited dexterity, interdental brushes with a long handle are easier to use.

Mouth Rests and Finger Guards

There are a range of mouth rests and finger guards that can be used to gently keep the mouth open when providing mouth care. These can prevent individuals from accidentally biting down on fingers of carers, or for people who get fatigued keeping their mouth open during mouth care. Mouth rests include bite blocks made of rigid foam (Fig. 5.6). A finger guard is a solid plastic or rubber device that is placed between the patient's teeth, which will help with access for tooth brushing, and will also help to protect the fingers of the person assisting brushing.

Carers or staff need to be shown how to use these products safely, and they should be avoided in people who have a very strong bite reflex, for example, in some people with an aquired brain injury.

Tongue Cleaners

The dorsum of the tongue has a large surface area that can harbour microorganisms, including bacteria and is a major habitat for *Candida*. Micro-organisms combine with the surface epithelium and food and debris to form a tongue coating and may

Fig. 5.6 "Mouth Rest" for a person who finds it hard to keep mouth open for long periods

be linked to aspiration pneumonia [66]. Older people are more likely to have a dry mouth, fissured tongue, and maybe non-orally fed, leading to an increased coating on the tongue. Regular tongue cleaning has been found to reduce the amount of bacteria in the tongue coating and should be promoted as the same importance as tooth brushing in an oral care regime [67]. A toothbrush can be used to brush the tongue or a specific tongue cleanser; the tongue should be cleaned from the back to the tip to clear debris from the mouth.

Foam Ended Products

Foam ended products have been used for decades in hospitals and care settings for mouth care. In 2012 the Medicines and Healthcare Regulations Agency (MHRA) [68] published a medical device alert on the safety of oral swabs with a foam head and the risk of choking following several incidents, including a fatality in Wales where a foam head became detached. Research shows that oral foam swabs are ineffective at removing dental plaque and should not be used as an alternative to tooth brushing [69]. A soft toothbrush or a MouthEze (Mc3) (Fig. 5.7) cleanser are safe alternatives to foam ended products and can be used to apply dry mouth gels. They can also be used to clean the soft tissues of the mouth and remove food debris and tenacious dried oral debris. They are gentle enough to use on people with sore mouths and yet strong enough to reduce the choking hazard with a hard plastic handle.

Fig. 5.7 MouthEze Mc3 Cleanser

Denture Care Products

Food debris and plaque can quickly accumulate on dentures and needs to be removed daily. In the case of partial dentures, plaque left on dentures can lead to an increased risk of decay in the remaining teeth. Dentures can be cleaned with fragrance-free liquid soap and a toothbrush (different to the one used to clean the mouth) or a denture brush. Some people may wish to use denture cleansing products. It is essential that regardless of the setting, all individuals have a named container to keep dentures safe when not in the mouth.

For infection control, mouth care products should be stored separately from other personal care products such as razors and hair combs (Fig. 5.8). Ideally, they should be left to air dry and not kept in toiletry bags where bacteria can proliferate.

Oral Health Assessments

An initial oral assessment should form part of an overall health and care assessment when someone receives domiciliary daily care in their own home, moves to a residential setting or is admitted to a hospital or hospice.

The purpose of the oral health assessment is to identify:

- The level of support the individual needs with their mouth care.
- Whether they have their usual mouth care products.
- Oral health risk factors.
- If they have any existing dental or mouth care problems.
- When they last visited a dentist and the plans for further visits.

Fig. 5.8 Storing mouth care products in a wipeable container

Every effort should be made to involve the individual in planning their mouth care regime with support from family or friends who best know the person.

Supporting Older Adults with Mouth Care

People may require different levels of assistance with their mouth care; it could be as simple as prompting and reminding them to brush their teeth to needing full support with all their mouth care. It is important to assist individuals with their mouth care in a way that maintains their independence and feeling of self-worth. People in the earlier stages of cognitive decline may find it useful to set timers on clocks, digital devices or voice-operated devices to remind them to brush their teeth twice a day, and for dental appointments.

Personal protective equipment (PPE) should be worn by all health and care staff when providing or supporting a person with mouth care. Staff should follow local up to date guidance and PPE may include a plastic apron, disposable gloves, face mask, and protective glasses or a full-face visor.

Positioning

Older vulnerable people must be in a safe position for mouth care, some will be able to stand in a bathroom in front of a mirror, but for others with mobility issues, they should be sitting. If they are in a bed try and make sure, they are as upright as possible to reduce the risk of aspiration.

Mouth care can be carried out with the "carer" standing behind, in front or to the side of the person. When standing behind, the teeth should be brushed with the dominant hand and the freehand can support the head. This can be a handy technique for a person with Parkinson's or other movement disorders. Carrying out mouthcare in front of a mirror will mean the person can see their carer and it may feel less threatening. If standing in front of a person, eye contact at the same level should be maintained.

Dry Mouth Care

A dry mouth can mean that food does not clear from the oral cavity and stagnates around teeth and dentures. In people with severe dysphagia who are non-orally fed or on medication to reduce salivary flow, such as hyoscine patches or glycopyrronium, dry sticky secretions may coat the mouth especially on the palate and dorsum of the tongue.

Management of dry mouth for older adults will vary. For adults who are able to eat and drink it may be as straightforward as advising them to sip water throughout the day, and at night when often dry mouth is experienced more due to reduced salivary flow. However, older people may be reluctant to drink more fluids due to

urinary incontinence and difficulties in easily accessing the toilet. Some people may benefit from applying dry mouth moisturising products that come in the form of gels or sprays, or suck on lozenges that stimulate saliva production. If using gels, these can be applied as necessary, and every 2 hours for severe dry mouths. When using sprays these should be sprayed into the cheeks and under the tongue. Gels need to be massaged into the soft tissues with either a finger, toothbrush or MouthEze (Mc3) cleanser so that they do not add an additional sticky layer of debris in the mouth.

Mouth Care at End of Life

As discussed in Chap. 11, oral health symptoms are common in older people at the end of life with an increase in caries, periodontal disease, dry mouth, difficulties wearing dentures, and mucositis. Mouth care for people approaching the final stages of the end of life should seek to make the person as comfortable as possible in the least invasive way. Mouth moisturising gels or hydrating the mouth with a soft toothbrush dipped in water or with a fine water spray can help with dry mouth symptoms. "Taste for pleasure"—dipping a toothbrush in the person's favourite drink and then placing it in the mouth can be really comforting. Teeth should be brushed twice a day with a very soft toothbrush when the mouth is sore. Assessing the mouth regularly for signs of thrush and keeping the mouth moist and lips lubricated is very important. Topical pain relief, for example, 0.15% benzydamine hydrochloride spray or mouth wash can help with oral pain. As people approach the last few days of life regular removal of oral/dried secretions with gentle suctioning or a toothbrush or MouthEze (Mc3) cleanser may be required in additional to regular lip care with a moisturising lip balm.

Care-Resistant Behaviours

"Care-resistant behaviour" describes opposition to the actions of health and care staff and is common in people with cognitive impairments such as dementia [33]. A person may not understand when a carer attempts to brush their teeth and resisting is their way of protecting themselves. Dental professionals can advise families and carers on techniques to try and manage resistant behaviours.

Behavioural techniques, and gentle clinical holding, such as offering the person a hand to hold or supporting their head if they have tremors or movement disorders, are sometimes required to provide care [70]. Clinical holding is a form of restrictive physical intervention, so appropriate training is required to ensure the least restrictive approach is used, to preserve the person's safety and to comply with relevant legislation. These interventions should form part of the person's care plan and be documented in all care settings. Strategies to help provide mouth care for people who are resistant include:

- Having a quiet background environment.
- Carrying out mouth care at the same time every day to develop a routine.
- Having a calm and empathic manner.
- Encouraging the individual to participate, as much as possible, for example, giving them a toothbrush in their hand for familiarity.
- Involving carers/family who are more familiar and have a rapport with the individual.
- Using short sentences and suggesting simple tasks like "open mouth", "brush teeth".
- Using distractions, such as playing music or singing, visual aids on mobile phones or tablet computers, or counting from one to five and providing rest periods.
- Undertaking mouth care in front of a mirror to help with understanding that mouth care is being provided and feel less threatening.
- Putting some toothpaste on the lips before commencing mouth care since may assist the person to understand they are going to have their teeth cleaned.
- If the person appears confused or resists care it is important to advise to stop and try again later and document this.

Denture Care

There will continue to be a significant number of older people who wear partial, complete, or implant-supported dentures. Dentures should ideally be rinsed under water after each meal and cleaned twice a day to prevent the build-up of plaque, food debris, and calculus. Dentures, particularly acrylic dentures, can harbour microorganisms such as *Candida* which can lead to denture stomatitis (*Candida* infection under a denture). Evidence-based recommendations for denture cleaning are as follows [71].

- Mechanical cleaning involves brushing the denture with a denture brush or toothbrush and a non-abrasive denture cleaner such as non-scented liquid soap. Toothpaste should be avoided as it can damage the acrylic base and lead to increased bacterial colonisation. Dentures should be cleaned over a bowl or towel to minimise the risk of accidental damage if dropped.
- Chemical cleaning involves soaking the denture daily with a chemical cleanser after mechanical cleaning to provide extra breakdown and removal of bacterial plaque. It is important to follow the manufactures instructions and not leave dentures sitting in chemical solutions for more than the recommended time. There is a lack of consensus about storing dentures wet or dry, but it is important to keep denture cleaning tablets and solutions away from older people with visual or cognitive impairment as there is evidence of accidental ingestion of denture cleansing products [72].

- Denture wearers should not keep their dentures in their mouth overnight as dentures have been found to increase the risk of aspiration pneumonia [73].
- All removable denture wearers should see a dentist regularly.

Some older people may use a denture adhesive to improve the retention, stability, and comfort of a denture to help eat and speak with more confidence. Denture adhesives should ideally not be used for dentures that do not fit well, and people should seek dental advice. If the reason for poor retention is a dry mouth, dry mouth moisturising gels under the denture may be beneficial. Denture adhesives must be cleaned from the fit surface of a denture and the oral mucosa daily. Dependent older people may require help with this.

Unfortunately, denture loss is a common problem for older people and often happens during hospital admission [74]. The loss of a denture can have a detrimental effect on a person's well-being, impacting on nutrition, communication, and dignity. If lost in hospital, patients will usually need to wait until they are discharged before they can access dental services to start the process of having a denture remade [75]. Many individuals will never be able to have their dentures replaced, including those living with advanced frailty or a severe cognitive impairment who cannot cooperate with the process of having an impression taken. Others may not be able to adapt to wearing a new denture. Dental teams should consider denture labelling when fabricating new dentures; this can also be done chairside with denture marking kits. Having a "spare set" of dentures made via the established copy denture technique is worth considering for people at risk of denture loss, for example, people with advanced dementia or frailty. Denture scanning and 3D printing will start to play an important part in managing lost and broken dentures.

Summary

Good oral health is linked to general health and well-being in older adults. As people age, their oral health risk factors will change, and preventative advice will need to be adapted for the individual. Prevention can be delivered by all dental care professionals and should form part of dental treatment planning. Clinical prevention should include the importance of dietary sugar, regular mouth care, and topical fluoride. Older people with multimorbidity, especially those living in care homes or requiring care in their own homes will face increased barriers in maintaining oral health and accessing routine and urgent dental care. To help address this, health policies for older adults needs to include oral health, including regular oral health care training for carers and appropriate commissioning of dental services.

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Restorative Management of the Older Patient

6

Francesca Mullan and Abisola Asuni

Learning Outcomes

- Understand the presentation of restorative oral disease and complexities that may manifest themselves in the older patient.
- Understand the principles involved in minimally invasive restorative management and rehabilitation.
- Review restorative techniques including endodontic care, periodontal care and fixed, implant-supported and removable prosthodontic rehabilitation and consider how these may be provided for the older population.

Introduction

Restorative rehabilitation for older patients is often more complex due their presenting position within the restorative cycle. The restorative cycle describes the lifespan of a tooth where every invasive restorative intervention will lead to further reduction or destruction of tooth structure, eventually resulting in tooth loss [1]. Older patients are often much further along the restorative cycle than younger patients. This is not solely linked to age related physiological changes in the oral cavity, but can be linked to oral pathology or even different trends in dentistry when the patients were younger, including less exposure to fluoride toothpaste. Preventative and minimally invasive techniques are currently favoured, however, when our current older patients

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were younger, large amalgam restorations and conventional fixed prosthodontics were more common interventions than they are today. Other compounding factors that can result in increased complexity of the restorative management of the older patient are cumulative disease, systemic comorbidities, and loss of independence. However, older people value oral health and these challenges need to be overcome to continue to provide a high standard of dental care [2].

Gingival and Periodontal Diseases

Periodontal and gingival diseases are a collection of conditions that affect the supporting structures around teeth. Periodontitis and gingivitis are essentially the effects of the host response to biofilm-induced inflammation. In gingivitis the inflammatory response is limited to the gingiva, whereas in periodontal disease there is progression of the disease to involve clinical attachment loss and/or loss of alveolar support. Therefore, gingivitis is a prerequisite and primary risk factor for periodontal disease. The World Health Organisation suggest that almost 10% of the world population have a level of periodontal disease which is severe enough that it may result in tooth loss [3]. Natural age changes occur within the periodontium, meaning limited attachment loss and buccal gingival recession are considered physiological ageing [4]. Periodontal disease is cumulative, any previous disease or recurrent disease will be evident in the bone levels therefore prevalence and severity of periodontal disease increase with age [5]. However, age is considered an associated factor for periodontal disease and not a risk factor in itself. The progression of periodontal disease is a breakdown in the balance between host response and biofilm challenge. The main risk factors identified in older people are previous periodontal diseases, biofilm and smoking [6]. It can also be argued that if a person has retained their teeth into older age, then their innate susceptibility to periodontal disease is low. However, periodontal disease is experienced in older patients often with complications including pain and ultimately tooth loss. The change in disease status may be linked to changes in ability to attend appointments, ability to minimise biofilm, motivation, salivary function or indeed changes in medical status such as the development of Type 2 Diabetes. Saliva is an important mechanism in cleansing the oral cavity of bacteria; risk factors for reduced salivary flow increase with age including multiple medications commonly prescribed to older people for systemic conditions [7]. Nutritional factors such as severe vitamin C deficiency have been suggested to increase susceptibility to periodontal disease, and there is evidence to suggest that nutritional deficiencies are more common in older adults living in institutions further increasing their risk of periodontal disease [8, 9].

Classification of Periodontal Diseases

A new classification of periodontal and peri-implant diseases and conditions was published in 2018 from the work undertaken at a world workshop in 2017, an

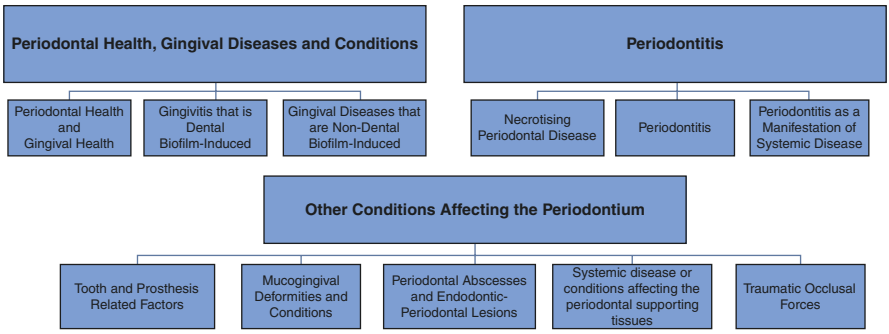

Fig. 6.1 Adapted from a new classification scheme for periodontal and peri-implant diseases and conditions—introduction and key changes from the 1999 classification [10]

Table 6.1 Key periodontal indices for periodontal diagnosis

Key periodontal indices
Plaque scores
Bleeding on probing scores
Periodontal probing pocket charts
Tooth mobility assessment
Multirooted tooth furcation involvement assessment
Presence of suppuration from periodontal pockets
Attachment loss

overview is provided in Fig. 6.1 [10]. In the previous 1999 classification, periodontitis was separated into chronic or aggressive, a key outcome from the 2017 World Workshop was agreement there was insufficient evidence to suggest a distinct pathophysiology to differentiate between what was previously 'chronic' and 'aggressive' periodontitis.

Diagnosis and Treatment Planning of Periodontitis

To reach a periodontal diagnosis, key clinical examinations are essential to assimilate the information. Key periodontal indices would be expected to be undertaken to support diagnosis, planning, and monitoring of a patient with periodontitis, given in Table 6.1.

Another significant outcome from the 2017 workshop was the structured format for periodontitis diagnosis to include consideration of sites, severity, rate of progression, disease risk factors, and activity [10]. Radiographs are helpful to determine the bone support present around the teeth. Horizontal bone loss and vertical bony defects can be visualised from intraoral periapical, vertical, or horizontal bitewings or an overall survey using extra oral dental panoramic views as shown in Fig. 6.2.

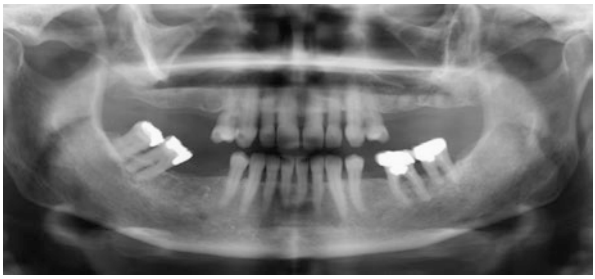

Fig. 6.2 Orthopantomogram demonstrating generalised horizontal bone loss, vertical defects (distal upper right first premolar, mesial lower left first molar, mesial lower right first premolar), and furcation involvement (lower left first and second molar)

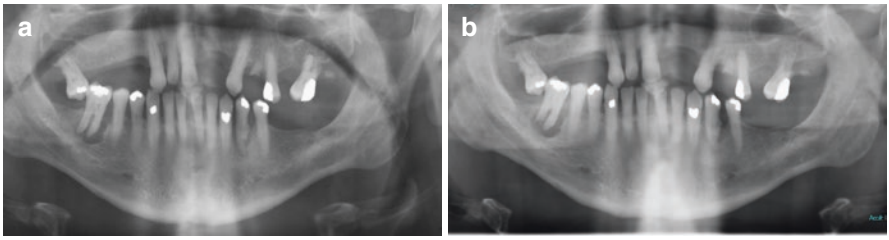

Fig. 6.3 Sequential orthopantomograms taken 18 months apart. Progression of bone loss is visible in the distal of the upper right canine, mesial upper left canine, distal upper left second premolar, and distal lower left first premolar. (**a**) was the initial radiograph (**b**) the follow up 18 months later

However, it is important to remember that radiographs should show all the bone loss that has occurred. A one-off radiograph represents a snapshot in time and will not give indication of when the active disease occurred or rate of progression. Sequential radiographs may provide a longitudinal history of changes to supporting bone levels and give context to the rate of progression in unstable periodontitis as shown in Fig. 6.3.

Cause Related and Nonsurgical Periodontal Management

The key risks for the establishment and progression of periodontitis are modified by a complex interplay of microbiological, genetic, immunological, and environmental factors. Whilst this is true, spending significant quality time on the basics with patients reducing biofilm (plaque) levels, supporting smoking cessation, and improving diabetes control (if diagnosed) remain the cornerstone of initial therapy. Along with these behaviour modifications an opportunity to professionally remove plaque and plaque retentive factors such as calculus associated with the clinical crown of teeth or reshaping of poorly adapted restoration margins should be undertaken. This phase of treatment also gives an opportunity to evaluate the engagement of the patient and their commitment to a lifetime of

periodontal therapy and maintenance. If engagement and improvement in plaque colntrol cannot be reached, a decision on whether to continue the intervention or agree on palliative care, leading to eventual tooth loss, needs to be made. In the engaged and highly motivated patient who is achieving low levels of plaque progression, professional mechanical plaque removal (PMPR) in the subgingival space on the root surfaces within periodontal pockets is appropriate. In the context of the older patient it is important that expectations are realistic. Changes to cognitive and physical abilities that can happen when we age may impact upon one of the cornerstones to the management of periodontitis. This is the ability of patients to achieve the highest level of biofilm control on a daily basis and is usually achieved with a multitude of oral hygiene aids sometimes combined with adjunctive topical antimicrobials. For example, if there is a reduction in the ability to grip and direct a toothbrush or interdental brush through arthritis, it becomes almost impossible for a patient to achieve what is needed to stabilise periodontal inflammation. In some instances, the older person may be reliant on carers providing the oral hygiene, which is a recognised challenge [11]. Oral care and prevention is discussed in detail in Chap. 5. The new periodontal guidance refers to the non-engaging patient. However, there is a significant difference between a non-engaging patient and one who is achieving their best effort in challenging circumstances.

PMPR is a newly established term that has been introduced to define all of the mechanical interventions (scale and polish, root surface instrumentation, root surface debridement, root planning, and so on) undertaken by dentists and dental care professionals [6]. These interventions remove biofilm retentive factors and disrupt biofilm on the tooth and root surfaces. PMPR is considered to be applied in two broad areas of the periodontium either supra-gingival or sub-gingival. Instruments designed to do this can be considered to be either manual or 'hand' instruments or powered instruments being sub-sonic, sonic, or ultrasonic.

This intervention must not lose sight to the maintenance of the behaviour changes already in place that need to remain. PMPR can be delivered using manual and powered instruments. The patient is then reviewed after 3 months with repeating of periodontal indices and comparison to those recorded at the diagnosis stage. Any changes in pocket depths, bleeding scores, suppuration, and mobility can be determined and responding, or non-responding sites, identified for further treatment. If sites have responded and the periodontitis appears to be stabilising, a period of close supervision and a supportive stage will begin. This will include regular monitoring with periodontal indices, encouragement, and reinforcement of the changes in behaviour already achieved and targeted PMPR as required.

At all stages of periodontal management for a patient there is the opportunity to engage with specialist periodontal services for advice or where sites are non-responsive and progressing in an engaged patient. Adjunctive antiseptic mouth rinses such as short-term use of chlorhexidine mouth rinse or slow releasing antiseptic agents in localised site may provide some benefit in either the intervention or supportive phase of treatment. However, systemic antimicrobials are not recommended [12–15].

Surgical Periodontal Management

Surgical management of periodontitis is separated into open flap debridement, resection, and regeneration [16]. Surgical management primarily serves to improve access to the inflamed sub gingival tissues and pocket spaces to allow improved biofilm disruption or to remove and/or modify the inflamed periodontal tissues supporting the teeth. There are only a few studies that compare treatment response to periodontal disease and age and show no association between treatment of non-surgical or surgical treatment of periodontal disease and age [17–19]. Certainly, there is no evidence to support previous attitudes of simpler options only which would be in conflict with the Equality Act 2010 [20]. The decision on whether to proceed with surgical treatment will be on a case-by-case basis dependent on clinical indications and patient choice.

Endodontics

With people retaining more teeth as they age, especially in industrialised countries, there is an increased prevalence of teeth requiring root canal treatment and untreated apical disease in the older patient compared to the general adult population [21]. There is, therefore, a growing need for more complex restorative treatment in older people, where endodontic treatment provides not only a means of maintaining oral health but may also improve quality of life and well-being. Root canal treatment provides a means of retaining strategic teeth, avoiding prosthetic replacements, maintaining bone levels, anterior aesthetics, or a shortened dental arch. Older people generally have comorbidities, and polypharmacy is common. Therefore, recognising the potential risks associated with these common conditions is an important component of treatment planning. Endodontic treatment provides a means to avoid extractions where this is contraindicated, such as those with an increased risk of medication-related osteonecrosis of the jaws (MRONJ) or osteoradionecrosis.

Patients may have a disinterest in keeping natural dentition for fear of treatment, cost or reduced value in oral health, more readily accepting extractions as part of the ageing process. There may be long-standing negative beliefs about delivery and prognosis of non-surgical root canal treatment due to an unpleasant association with pervious dental treatment including root canal treatment or the perceived complexity of care [22]. On the other hand, older people may be less likely to adapt successfully to complete dentures or partial dentures with free end saddles and may not be readily accepting or even suitable for implant treatment.

As long as the infection can be appropriately managed, it is widely accepted that age in itself is not a factor in predicting endodontic success [23, 24]. Quality of life for older patients can be significantly improved and associated with the psychological and functional importance of maintaining the dentition [25].

Endodontic Diagnosis

The same principles and diagnostic approaches to endodontic pathology apply regardless of age, and is based on a good clinical history, examination, and special tests. The patient may present with acute symptoms or may present with periodic episodes of pain. It is not uncommon for the older patient to present with a painless discharge or an incidental radiographic finding.

It is important to remember that increased amount of reactionary or reparative dentine or an increased pulpal fibrosis as part of an ageing pulp may reduce pulpal response to stimuli. This in itself is not justification to perform endodontic treatment in the absence of other signs or symptoms of pathology.

A heavily restored dentition may also present challenges regarding examination and sensibility testing. Care should be taken regarding caries, defective margins of direct or indirect restorations, and the possibilities of other pathologies such as cracks and the periodontal status of the tooth. Therefore, removal of existing restorations or extra-coronal restorations may be required to fully evaluate the restorability of the tooth, before embarking on treatment.

Considerations in Endodontic Treatment

Although treatment considerations and treatment planning in this group of patients are similar to those of a younger patient, treatment can present challenges. There may be technical difficulties in treating on old tooth with physiological and pathological response to years of dental treatment or tooth wear, which has led to deposition of dentine causing the pulp chambers and canals to become 'calcified' or 'sclerosed' as shown in Fig. 6.4.

Fig. 6.4 Example of calcification in the pulp chambers, also known as a pulp stone. (Image courtesy of Dr. Iad Gharib)

There may be operational difficulties with the patient's ability to lay supine in a dental chair or inability to tolerate a lengthy course of treatment. Although there are few contraindications to root canal treatment, consideration should be made in patients who may be medically compromised. Some conditions are more common in older patients such as cardiovascular disease, osteoporosis, diabetes, and joint prosthesis. In addition, the need for anticoagulation for various conditions increases with age. This does not tend to be a concern for non-surgical endodontic treatment, and the general advice is not to change or alter medical regimes, even for surgical treatment. More consideration will need to be given for surgical treatments, but this will be no different to advice for extraction procedures, and often do not contraindicate surgical treatment. Chap. 7 summarises risk-assessment for surgical procedures.

Other considerations as part of examination and treatment decisions will include the patient's frailty and medical status (discussed in Chap. 4) and ability to cope with treatment under local anaesthesia alone (discussed in Chap. 9). Patients due to have radiotherapy treatment for head and neck cancer who require a pre-operative oral and dental assessment with the aim to remove teeth with doubtful prognosis or those at risk of future dental disease especially in areas of increased risk of osteoradionecrosis (ORN) [26]. Radiotherapy is not an absolute contraindication; however, foci of infection should always be removed before or shortly after the onset of radiotherapy treatment and endodontics completed post-radiotherapy to avoid delay in receiving oncology treatment [27]. Careful consideration should be made for pre-existing root treated teeth of a dubious prognosis. If there is a specialist service available, advice can be sought, which is especially important in the context of a multi-disciplinary service for head and neck cancer.

Conversely, systemic conditions may play a role in decision making to retain a tooth. Patients taking anti-restorative medication such as IV bisphosphonates as part of cancer treatment may present a higher risk of developing MRONJ. Retaining a tooth through endodontic treatment, even as an overdenture abutment, presents a means to preventing extraction and development of MRONJ or osteoradionecrosis in those who have experienced radiation to the head and neck area.

There has been a shift in management strategies for the treatment of the early pulpitic tooth from pulpectomy to the resurgence of vital pulp therapies (VPT), especially considering the development of newer biocompatible materials such as mineral trioxide aggregate and biodentine. There is limited evidence regarding the success rate of this type of treatment in the 'aged tooth', especially with age-related changes associated with the dentine pulp complex and reduced cellularity. This may theoretically reduce the success of this form of treatment in the older patient. Nonetheless VPT may present a first line attempt or a pragmatic alternative to root canal treatment in treating older patients, especially if it may avoid an extraction.

In situations where patients may have poor compliance due to physical and cognitive difficulties such as dementia, significantly medically compromised and

limited mouth opening, it may not be possible to provide endodontic treatment. Other contraindications include over-eruption, misaligned or non-functioning teeth. Predictable treatment demands good access and in consideration of all the factors, a pragmatic approach should be adopted [28].

With good decision making, adequate planning and a systematic approach, there is no reason why good quality endodontic therapy should not have a good prognosis in a healthy older patient.

Considerations for Successful Endodontic Treatment

The age-related changes to the pulpo-dentinal complex is covered in Chap. 3. Endodontic treatment of the 'aged tooth' should not necessarily be treated any differently to a systematic approach to endodontics in other age groups. Table 6.2 summarises some considerations when embarking on endodontic treatment in the older patient.

Table 6.2 Clinical considerations for successful endodontics in older people

Challenges in preparation of the patient	Potential solutions
Physical or mobility limitations that may impact on treatment	• Consider shorter clinical time or split appointments • Support—use pillows/rolled towels/medical gel head prop • Mouth opening—use rubber bite blocks or mouth props
Challenges in preparation of the tooth	**Potential solutions**
Tooth wear/ heavily restored- may lose landmarks Calcified pulp chamber Sclerosed canals	• Good quality pre-operative radiograph (estimate depth of patent pulp space and orientation of anatomical long axis). The bur may be placed against the radiograph to estimate the clinical predicted depth • Magnification (loupes/microscope), transillumination, front-silvered mirror, and irrigation • Burs—short/medium length tapered diamond bur and safe-ended endodontic access burs, e.g. Endo Z bur (reduce risk of iatrogenic damage while locating landmarks) • Once at the estimated pulp chamber depth, consider less aggressive drilling and switch to a slow speed method such as: • Long neck round burs (pin-head bur/gooseneck bur) or ultrasonic tips to locate sclerosed canals. Also consider another radiograph with or without temporary markers such as gutta percha to inform orientation and direction. Careful consideration of bur position in the 3D space compared to a 2D radiograph • Constantly check orientation and identify any colour change, differences in texture and translucency of mineral deposits against the darker surface of the pulp chamber floor

(continued)

Table 6.2 (continued)

Challenges in root canal location and preparation	Potential solutions
Early entry into canal spaces	• Prepare a glide path using a small file, e.g. size 10 or pathfinder files. Use great care with a watch winding and 'picking' motions—don't try and rush straight to the apex, this will likely lead to a fractured file. Although the introduction of NiTi rotary instrumentation has made endodontics easier and faster, even when using a single file system, it is important to scout the canals and create a glide path with hand files in the first instance (and prevent iatrogenic damage or file fracture) • Remember that in the majority of sclerosed canals, the sclerosis is usually located in the coronal section of the canal • Always use copious irrigation/lubrication and recapitulate by passing a small file (size 10) just passed the apex to dislodge and remove debris in between instrumentation • If an apical calcification is felt (dead stop), consider a small gentle curve at the tip of the file to navigate curved canals. Again, care not to force the file if it 'catches' which may lead to a fractured file

Surgical Endodontic Treatment

Once a full history, examination and a correct diagnosis are made, surgical endodontics may provide a viable treatment opportunity to maintain a tooth. Surgical options include incision and drainage, root end resection, apical curettage, hemisection or root amputation, perforation or root resorption repair and regenerative procedures. While considerations and indications for endodontic surgery are similar to any other patient, a surgical approach can be needed in older people who have heavily restored dentitions, for example, a tooth that supports a multi-unit bridge as seen in Fig. 6.5. Within the UK setting, surgical endodontics are usually carried out in a specialist setting and therefore referral can be considered if the care required is beyond the skill set of the practitioner. The clinical steps for all of the endodontic surgical techniques are beyond the scope of this book. For further details, consider other texts, and The Royal College of Surgeons of England have produced guidelines that can also be referred to [29].

Outcomes of Endodontic Treatment

The goal of endodontic treatment is to eliminate intracanal bacteria, prevent re-infection, and promote peri-apical healing, regardless of the age of the patient. The prognosis of non-surgical endodontics in older patient is as favourable as other age groups [22]. Old age and systemic disease do not influence the prognosis of root canal treatment [30]. It is well recognised that orthograde re-treatment is seen to be

Fig. 6.5 (**a**) Pre-operative view of an anterior six unit bridge involving UR3, UR1, and UL3. UR1 has a large symptomatic periapical lesion; (**b**) periapical radiograph showing UR1 abutment to six-unit bridge with a pinned core and previous apical surgery; (**c**) post-operative view 1 week after surgical root amputation and crowned abutment sealed with restorative material

better than surgical endodontics in the first instance [31], and inherently less traumatic than extraction of a tooth.

Surgical endodontics can be considered, however, given its invasive nature should be carefully considered especially in the medically compromised patient. Although healing can take longer, healing is still considered predictable with no greater adverse outcomes in the older patient compared to other groups. Surgical outcomes are more dependent on other predictable factors such as oral hygiene and post-operative care compared to age [32, 33]. A more common complication of surgical interventions in older patients is ecchymosis (bruising) where there is widespread migration of haemorrhage. Despite appearing unsightly, patients should be informed as part of the consent process and reassured that it should resolve within approximately 2 weeks.

With regard to patient factors, frailty can be considered a more important independent factor for postoperative complications [34], and will more likely tip the

balance when considering providing treatment, especially surgical treatment to a patient. Therefore, on balance of risk and benefit of endodontic treatment, patient factors such as frailty, physical and cognitive impairments should be considered on their overall burden to the patient. In considering these factors, it may be sensible to monitor asymptomatic chronic periapical lesions if the intervention carries a high risk, as long as the patient or those involved in their care are aware of this, and involved with the overall plan.

Tooth Wear

Tooth wear is the irreversible loss of dental hard tissues from mechanisms other than caries and trauma. The three main aetiological mechanisms for tooth wear are abrasion, attrition, and erosion. It is quite usual for two or more of these mechanisms to work in combination causing a synergistic effect. Erosion is the chemical dissolution of dental hard tissues and is the greatest cause of the tooth wear we witness today. In Europe, there has been a shift to adopting the term erosive tooth wear (ETW) to highlight its significance. Abrasion is wear from interaction with a foreign object such as a toothbrush, although oral soft tissues have also been identified as potential sources of abrasion following an acid attack. Attrition is wear caused by tooth-to-tooth contact. The progressive nature of tooth wear results in increased prevalence and severity with age. Historically, tooth wear was considered a natural ageing phenomenon with anthropological studies identifying attritive wear patterns that were associated with abrasive diets. From this aetiology, the severity of tooth wear decreased as diets became softer. However, the prevalence of tooth wear has significantly increased in recent years, which has been linked to increased older people retaining their teeth for longer and increased consumption of acidic dietary products. Whilst tooth wear can occur in any age group most referrals to specialist care are for older patients, also with these older patients the more advanced and severe tooth wear presents. Tooth wear is pathological when the tooth will not survive the rate of wear, there is a loss of function, there is serious aesthetic concern or there are associated symptoms. Severe tooth wear can be associated with dentine hypersensitivity (DH) especially when combined with gingival recession as shown in Fig. 6.6. There has been a general increase in the prevalence of DH and, despite

Fig. 6.6 Example of severe multifactorial tooth wear combined with gingival recession

the formulation of tertiary dentine with age, the prevalence of DH in older populations is high. This suggests that although the numbers of tubules may reduce with age, patency from the surface to the pulp is still maintained [35].

Age related changes to saliva production can increase risk of ETW for the older patient. Saliva offers protection from erosive wear from the salivary pellicle, physiological clearance, and neutralisation. Studies have suggested that the salivary pellicle is less protective in people with ETW and even in specific sites erosive wear in the same individual [36–38]. ETW is the result of a prolonged and/or repeated oral acidic environment and can be mitigated by physiological clearance of the oral cavity [39]. Reduced salivary flow results in less acid clearance [40]. There is a consensus between studies identifying lower unstimulated salivary flow rates in people with ETW compared to those without. As part of the natural ageing process both stimulated and unstimulated salivary flow rates decrease [7]. Polypharmacy has a significant effect in the reduction of both stimulated and unstimulated salivary flow rates. This can mean that a person who was not at high risk for tooth wear in their younger years may become so later on.

Minimally Invasive Techniques

Identifying and monitoring tooth wear is essential for any age group. There are numerous indices which have been developed. The first clinical Tooth Wear Index was developed by Eccles in 1979 [41]. This differentiated between different causes of tooth wear and became a basis for the development of future indices. Smith and Knight developed one of the most well-known indices in 1984, The Tooth Wear Index (TWI) [42]. It remains the most commonly used index for research, but is not easily adapted into a general practice setting (Table 6.3).

Table 6.3 The Tooth Wear Index (TWI) developed by Smith and Knight [42]

Score	Surface	Criteria
0	B/L/O/I	No loss of enamel surface characteristics
	C	No loss of contour
1	B/L/O/I	Loss of enamel surface characteristics
	C	Minimal loss of contour
2	B/L/O	Loss of enamel exposing dentine for less than one-third of surface
	I	Loss of enamel just exposing dentine
	C	Defect less than 1 mm deep
3	B/L/O	Loss of enamel exposing dentine for more than one-third of surface
	I	Loss of enamel and substantial loss of dentine
	C	Defect less than 1–2 mm deep
4	B/L/O	Complete enamel loss–pulp exposure–secondary dentine exposure
	I	Pulp exposure or exposure of secondary dentine
	C	Defect more than 2 mm deep–pulp exposure–secondary dentine exposure

Table 6.4 The basic erosive wear examination (BEWE) [43]

Score	Criteria
0	No erosive tooth wear
1	Initial loss of surface texture
2	Distinct defect, hard tissue loss <50% of surface area
3	Hard tissue loss >50% of surface area

The basic erosive wear examination (BEWE) was developed to be used as a screening tool [43]. It has similarities to the basic periodontal examination (BPE) by dividing the mouth into sextants and recording highest score in that region. Unlike predecessors this simplified index makes it much more convenient for general practice settings. Whilst originally it was intended for identifying erosive wear it is now advocated for recording wear of all aetiology (Table 6.4).

Whilst BEWE can help to identify those at risk and in need of intervention, it is not intended for monitoring progression. All visual indices can be criticised for low reliability especially lack of agreement between differing clinicians. Clinical photographs and study models are advised for baseline records and monitoring of progression of tooth wear. The use of silicone impression materials will provide a more accurate study model record; although alginate materials are more commonly used in practice and are sufficient. The use of intraoral scanners to replace traditional impressions is a recent and encouraging area of research, which may allow for a combination of both qualitative and quantitative monitoring. However, the scanners require the patient to remain still during the scanning which may be more challenging for an older patient with comorbidities such as Parkinson's disease.

As with all dental disease, treatment should be preventative led, failure to stabilise the disease increases failure incidence of restorative rehabilitation. Establishing the aetiology of the tooth wear is important. Majority of the causes of extrinsic erosion is from dietary acids, although some occupational risk factors or medications may also contribute. Research has identified higher incidence in erosive tooth wear in factory workers from battery, galvanising and plating factories, competitive swimmers, and wine tasters [44]. Regular ingestion of acidic medication or saliva reducing medication is also believed to be a risk factor, for erosive tooth wear. This has significance when linked to the synergistic saliva reduction which occurs with polypharmacy [45]. It is important to obtain an accurate medical, social and diet history to identify the sources of the erosion, and collaborate with the patient in a cohesive fashion to plan the behavioural change. Consumption of more than four dietary acids a day is linked with increased prevalence of tooth wear, particularly when consumed outside of mealtimes or over prolonged periods. Using a diary to list all dietary intake of food can be helpful in identifying risk factors, especially when the diary is discussed with patients to identify any habits which may also increase tooth wear risk [46]. Spending clinical time with a patient on implementation-planning for behavioural change in relation to tooth wear is more effective than providing generic advice [47]. However, whilst these interventions will hold

importance and relevance in independent older adults, they may be more challenging for those older adults suffering cognitive decline or less independence in planning mealtimes. In these situations, it may be possible to have the conversations with the care team to understand how and when foods and drinks are planned.

Along with identifying dietary habits that increase an individual's risk, advice should be given to follow acidic exposure with a neutralising agent [48]. Naturally calcium rich products such as milk and fluoride containing product have remineralising properties following an acid exposure [49–51]. Fluoride can provide protection and remineralisation. Fluoride can substitute for hydroxyl ions in the hydroxyapatite crystallites which have become dissociated during the erosion process, forming a partially fluoridated hydroxyapatite $Ca1O(PO_4)6(OHxFy)$ [52]. Whilst initial therapeutic effects of fluoride application are quickly overcome in in-vitro erosion cycling models, they are beneficial in a clinical context as they precipitate on the tooth surface to provide a protective layer. There is some suggestion that stannous fluoride has a superior therapeutic effect compared to sodium fluoride. Recaldent products contain casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) which offer therapeutic effect by acting as a pellicle able to release calcium and phosphate to enable remineralisation when the environment becomes acidic. The effectiveness is increased in the formulations which also contain fluoride [53]. Tooth paste and mouth rinses which contain components for dentinal tubule occlusion have been shown to be effective for the management of DH [54]. These products contain active ingredients such as bioactive glass with calcium sodium phosphosilicate which occlude the dentinal tubules and diminish patency to the pulp. It is recommended that this preventative approach should be utilised when treating DH in older patients rather than bonding agents such as seal and protect, as the adhesives lose their efficacy over time. Thereby, treating the pain whilst reducing the need for repeated clinical intervention to continually replace failed adhesive restorations.

Failing Dentition

Careful planning is essential for successful treatment outcomes for wear cases including full examination, radiographs, pulp sensibility testing, study models, and diagnostic wax ups. Facebow registration is a necessity if there is a need to alter the occlusion. When considering treatment options it is important to optimise the conditions to improve treatment outcomes. One of the primary considerations in treatment planning is space. Despite the teeth becoming worn and shorter there is not usually space to build the teeth up. This may be due to forward posturing of the mandible or dentoalveolar compensation. If the general dentition is to be rehabilitated the issue of space may be managed in the planning stages by increasing vertical dimension for all of the occlusal contacts. If rehabilitation is only required in the anterior region, then Dahl techniques are often effective. In ETW caused by intrinsic erosion the palatal surfaces of the anterior segment can be built up to allow the posterior teeth to over erupt. Space can also be created by distalising the mandible

Fig. 6.7 Example of severe multifactorial tooth wear in a partially dentate patient with anterior alveolar compensation

and planning the restorations in retruded contact position. This technique is particularly helpful when posturing has created and edge to edge occlusion and attrition is the primary aetiology of the tooth wear. However, this may need to be planned in combination with removable prostheses in the partially dentate patient as shown in Fig. 6.7. Crown lengthening and orthodontic options to open the occlusion posteriorly are mentioned in the literature but would not be recommended as routine treatment options.

The first line restorative rehabilitation option for the interventive management of tooth wear is direct composite. Freehand application has the advantage of being placed within a single visit, without the need for taking impressions. However, its success is solely dependent on operator skill to achieve both aesthetically pleasing and occlusally stable restorations. Freehand application should be limited to minimal coverage or localised build up. Silicone matrices made from a diagnostic wax up can be very helpful to give a level of control for advanced cases. These can be traditional putty matrices or the clear silicones such as Memosil. The advantage of the transparent matrices is the transparency allows the operator to ensure there are no voids in the material and easier to allow a better depth of cure, but their lack of rigidity makes them more difficult to use than traditional putty. An alternative is laboratory vacuum matrices which are both rigid and clear. The resin is place in the matrix and the then the matrix containing the resin is placed over the teeth and cured. These matrices are designed with relief hole to allow excess material to express. Whilst this may seem the ideal solution, care needs to be taken for the interproximal regions. If there is a substantial amount of excess, the final polishing will be more difficult, there is risk of sensitivity during the curing process due to heat build-up and air entrapment is common which causes voids.

Direct composite is the most common treatment modality with success rates ranging from 50 to 99.3% but follow up from the included studies ranged from 1 to 10 years [55]. The success of direct composites is linked with planning, operator

skill, and optimising the conditions through surface treatments and bonding. The presence of enamel, even a limited amount is essential for bonding. Bevelling the enamel enhances bonding by removal of any aprismatic enamel which is more difficult to penetrate, exposes of the ends of the prisms in prismatic enamel improving resin penetration and improves marginal shade match by increasing the increment depth of the composite. It is important to remember with composite build-ups that you will be bonding the composite material to two substrates, enamel and dentine. Self-etch primers are not recommended for tooth wear cases as the dentine in these wear cases is often sclerotic and difficult to penetrate. Surface techniques for dentine aim to remove the salivary pellicle, which is resistant to etching, and increasing the surface area for bonding. Sandblasting is the superior method according to the literature, but high speed or slow speed burs can also be effective, with less clinical drawbacks. Following surface treatment a separate etch and rinse for both enamel and dentine and placement of a hybrid direct composite is recommended material for worn teeth.

One of the more complex aspects of the rehabilitation of tooth wear in older patients is that they are often seeking further intervention following the failure of previous treatment. In these cases fixed conventional prosthodontics may be more appropriate than they would necessarily be for a younger patient or first line treatment options. When considering the materials to use there may need to be a balance between aesthetics, function and preservation of remaining tooth structure. Cast alloys require less tooth preparation and are kinder to the opposing surfaces than ceramic. Ensuring that there is retention and resistance form in the crown preparations can shift the balance of success in your favour where there is inadequate enamel for chemical bonding. In the partially dentate patient consideration and meticulously planning may be required to combine fixed and removable prosthodontics.

Sometimes, there may be inadequate remaining tooth structure to restore and an overdenture can restore function and aesthetics. Overdentures with overlays are not a treatment modality that is commonly used today but can be successful in special circumstances as shown in Fig. 6.8.

Fig. 6.8 Example of a posterior overlay prosthesis. (Image courtesy of Mr. Hassan Aldabbus)

Restorative Management of Caries

Coronal and root caries are very common amongst older people, with caries replacing periodontal disease as the most common cause of adult tooth loss in the over 65 year olds [56].

Although root caries can be observed in young adults, its prevalence and incidence increase with age. Age related changes in the oral environment (gingival recession, reduced salivary flow), age related comorbidities (arthritis, dementia), and behavioural changes in diet can alter a person's caries risk as they become older. There is increasing epidemiological evidence linking frailty, and reduced independence with poorer oral health [57]. Root caries (Fig. 6.9) develops in a similar way to coronal caries whereby a fermentable carbohydrate penetrates a cariogenic biofilm and is converted to acids by bacteria. The conversion process initiates demineralisation of the root surfaces by removing calcium and phosphate ions from surface apatite crystals. However, when this occurs on coronal enamel this process takes place below a pH of 5.5. Dentine demineralisation can be induced at a pH if 6 which means that the surface is at risk for longer and collagen degradation concurrently occurs. Cementum is highly organic and dissolves very easily so most clinically exposed root surfaces will have exposed, as a result, demineralisation is approximately twice as rapid on root surfaces [58, 59]. Research has suggested that approximately around half independent living older adults had root caries experience, but for those who are living in long-term care facilities prevalence is increased and there are high levels of untreated root caries [60].

Minimally Invasive Techniques

As both coronal and root caries are prevalent in the older population risk assessment and preventative fluoride regimes are therefore extremely important when treating older patients. Poor plaque control, xerostomia, presence of coronal caries, and exposed root surfaces are risk factors for root caries identified in the literature [61]. Similar to tooth wear, a structured diet diary can be helpful in identifying dietary risk factors for caries. The same limitations also apply when considering

Fig. 6.9 Example of generalised recession, root and coronal caries

older adults suffering cognitive decline or less independence in planning mealtimes. In these situations, it may be possible to have the conversations with the care team to understand how and when foods and drinks are planned. Preventive interventions of high fluoride toothpaste and fluoride varnish applications have been well integrated into UK guidelines for some time [62]. Recently there has been evidence to suggest that silver diamine fluoride (SDF) and chlorohexidine varnish applications may also provide therapeutic effect [63]. Atraumatic restorative techniques (ART) either partially removing carious lesions or sealing caries can be helpful in the treatment of the older person who is unable to attend the dental surgery or less able to tolerate traditional restorative intervention [64]. However, operative interventions are not recommended in the management of root caries due to the poor prognosis of restorations [65].

Prosthodontics

Fixed Prosthodontics

Trends have changed in restorative interventions with improved knowledge and quality of dental materials steering a move towards minimal intervention [66]. Whilst at one time it was deemed necessary to have 28 tooth contacts, 14 in each arch, there is now professional acceptance of the shortened dental arch. Adhesive (or resin-retained) bridges can be used with minimal or no tooth preparation as a non-invasive approach to restore small spaces. These are only suitable when an abutment tooth is minimally or unrestored to facilitate effective enamel bonding. Simple cantilever designs are preferred in almost all situations. Such bridges can be used to facilitate a shorted dental arch and avoid the need for removable prosthodontics in certain scenarios.

There has also been a change in replacing missing teeth with partial dentures to choosing fixed prosthesis. Whilst today advances in composite technology and techniques can provide highly aesthetic outcomes, in the 1980s and 1990s conventional crowns and veneers were the treatment modality of choice to improve aesthetics in the anterior region. Conventional crown and bridgework (as shown in Fig. 6.10) have predictable lifespans up to 10 years, after 20 years failure rates exponentially increase, as does the likelihood of catastrophic failure and subsequent tooth loss. The lifespan of first time conventional fixed prosthodontics is not influenced by a

Fig. 6.10 Anterior crowns which were over 30 years old. The defective crown margins contributed to development periodontitis and subgingival caries

patient's age. The challenge with fixed prosthodontics and older people is the complexity of the dental treatment that they have had in the past and the ability to adapt to change [67–69]. Caries and periapical pathology are the most common causes of failure in fixed prostheses.

Removable Prosthodontics

Unrestored edentulous regions can lead to complications when attempting restorative interventions at a later date, including overeruption of unopposed teeth and tipping of adjacent teeth.

Removable partial dentures can be a useful method to replace missing teeth and are also effective for those whose remaining teeth that have a poor long-term prognosis, to act as a transition into complete dentures. However, without careful planning and preventative regimes, removable partial dentures have the potential to increase plaque retention and subsequently increase caries and periodontitis risk. To help reduce plaque retention, partial dentures should be designed with 3 mm clearance between the connectors and gingival margins [67]. Where the periodontium is stable, cobalt chrome partial dentures are generally preferred as they can be designed to minimise plaque retention, are thinner, more retentive and generally better tolerated by patients compared to acrylic partial dentures, which rely on full extensions and mucosal coverage for retention and stability. The exception for this can be when clasps are required in the anterior region, compromising the aesthetics. Flexible dentures (as shown in Fig. 6.11) are relatively new to prosthodontics and are made from thermoplastic materials such as nylon. They can provide superior aesthetics, as in place of metal clasps on the abutment teeth they rely on nylon extensions which engage with mucosal undercuts. They are thinner than conventional acrylic and as well as being flexible they are stronger and more resistant to fracture. They also can be easier for an older person to insert and remove. However, they are more plaque retentive, can damage the mucosa and are prone to roughness and discolouration [70].

Fig. 6.11 Example of a flexible denture. (Image courtesy of Dr. Hawa Fathi)

Whilst more older people are retaining their teeth, previous estimates would suggest an edentulous population of 2.7 million in England and Wales [71]. The longer the period a person is edentulous can affect the ability to provide successful complete dentures. Some argue that when people lose their teeth later in life, it is more difficult for them to develop the neuromuscular skills needed for the successful wearing of dentures making denture wearing on atrophic ridges difficult. However, as the edentulous ridge continues to resorb over time, lower atrophic ridges are common later on from initial tooth loss and challenging to provide a prosthesis with adequate retention.

In long-term denture wearers hyperplastic soft tissue can replace alveolar bone. This is particularly common and creates the so-called flabby ridge. In these cases the dentures become dislodged during eating as the occlusal forces on the prosthesis displace the fibrous tissue. Whilst prosthetic surgery to augment the ridge and implant retained prosthesis can be considered, there are non-invasive conventional prosthodontic interventions which can be effective, such as mucodisplacive and mucostatic impression techniques. The intention of the mucostatic approach is to compress the fibrous tissue that will replicate the ridge contour during function and therefore prevent the loss of peripheral seal and dislodgement during eating. The mucostatic impression technique achieves support from the other firm areas of the arch to maximise retention. A common technique is the combination mucodisplasive mucostatic 'window technique'. The fibrous region is marked out on the primary cast. A close-fitting special tray is made with a window cut out in the fibrous area shown in Fig. 6.12. The major impression is carried out in two parts with standard border moulding and impression of the firm edentulous ridge in heavy bodied silicone (or zinc oxide eugenol) followed by impression of the fibrous region with light bodied silicone (traditionally plaster).

Stability of complete dentures is not solely related to the edentulous ridge itself, but is influenced by the surrounding neuromuscular. The neutral zone is the potential denture space where the forces of the tongue, cheeks, and lips are neutralised providing a stable area for the prosthesis. Finding the neutral zone can be difficult, as it may not be where the natural teeth were and may change, becoming more buccally positioned over time. There are different techniques that can be used but one method would be to carry out all the usual impression and registrations stages and request an

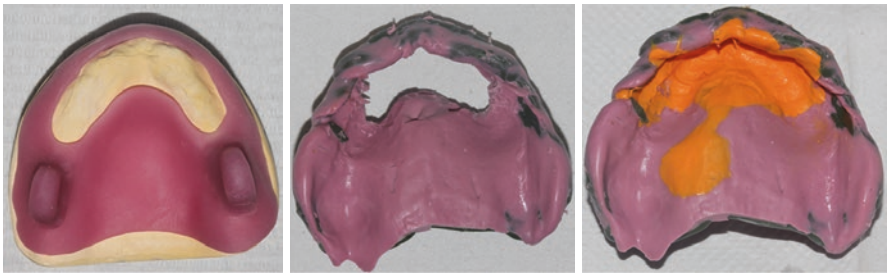

Fig. 6.12 Example of window technique impression. (Image courtesy of Mr. Hassan Aldabbus)

upper try in and lower neutral zone impression tray. The tray should be fabricated with occlusal stops. It is important to check the vertical dimension and freeway space against the upper try in. A suitable material should be sufficiently viscous to allow it to be supported on the tray, and additions or modifications to be made such as impression compound tissue conditioners, medium bodied silicone, wax, zinc oxide eugenol, chairside relining material or acrylic. The neutral zone impression is for tooth position rather than the fitting surface. After the material is applied to the occlusal surface of the tray and the tray is inserted you must instruct the patient in functional movements which can include phonetics, swallowing, sipping water, licking, smiling, pursing the lips, sucking, masticating, and mouth exercises [72].

Edentulism has been linked with nutritional and vitamin deficiencies amongst older people, with conventional complete denture wearers being more susceptible to malnutrition than those with implant retained prostheses [8, 73]. Despite the evidence to suggest that two implant retained lower prosthesis should be first line treatment for the edentulous lower arch, this is not the convention [74].

Implants

Age alone does not influence the success rate, survival or function of implants in older patients. Several studies demonstrate high implant survival rates, and improved quality of patient's lives. After 10 years, a success rate of over 91% for dental implants was found in the older population and comparable to the general population [75]. While this is encouraging, longer healing times can be associated with older people especially in the presence of comorbidities such as osteoarthritis, diabetes, irradiated bone and other soft tissue pathology such as vesiculobullous conditions. Needless to say, the usual local and systemic factors that impact on wound healing such as oral hygiene, health status of the oral cavity, i.e. periodontal and caries status, and smoking will still have the same effect on implant success rates in older people.

Removable prosthesis present challenges to masticatory function and reduced biting forces, which increases with fewer natural remaining teeth, and it significantly reduced in the complete denture wearers. Patient satisfaction and adaptability to wearing a prosthesis is rarely related to the quality of denture construction [76], and therefore, there is enormous scope for addressing most needs with the spectrum of possible implant numbers and design to address partial or complete edentulism. Despite this, implant treatment can still be challenging for the frail patient when considering possible physical and cognitive impairments in addition to the time needed for treatment and surgical and financial burden of implant treatment. In addition to this, there may be cultural expectations and psychological apprehension from both the dental clinician and patient with regards to this form of treatment. Despite this, if surgery is possible, dental implants offer distinct advantages to all patients including an increase in quality of life and patient reported success.

Osseointegration and Implant Fixtures

Implant supported restorations replace tissues that have been lost. They can be classified into fixed (cemented or screw retained crowns and conventional bridges, or hybrid metal substructure and acrylic screw retained bridges) or removable precision attachment partial or complete dentures. Innovation in implant technology is constantly evolving. A more recent implant system being introduced is something between a fixed and removable solution with a fixed locator attachment system that eliminates the need for screws or cements, but is only removable by the clinician (e.g., LOCATOR F-Tx® Fixed Attachment System).

Whichever option is chosen, the final outcome is central to the treatment planning process, with future planning in place to manage potential problems as they occur. The older or frail individual may increasingly find adaptation to new prosthesis more difficult and implants can be considered in edentulous areas before frailty limits the feasibility of surgery. The final outcome and prognosis of implants should be considered while managing the patient's expectations from the outset, so the treatment can achieve the most predicable outcome. It should be noted that osseointegrated implants are suspectable to conditions resembling periodontal disease. Implants should be offered to those at low risk of such conditions and who can, —independently or with the support of carers—maintain an appropriate degree of oral hygiene to support the success of such treatments.

Indications

Osseointegrated implants provide retention and support for dental prosthesis which may take the form of a single tooth, group of teeth or the entire dentition. The advantages of implant treatment include an increased quality of life associated with a desirable aesthetic result and functional occlusion. It is improper to deny an older patient implant treatment solely on the basis of age, especially in consideration of their biological rather than chronological age, if they are generally in good health. It is however essential to consider the special characteristics of this age group, especially medical risk factors, functional impairment and the possible future functioning decline and frailty. These considerations heavily influence treatment planning. The typical indication for implant treatment including:

- Avoidance of removable dental prostheses in partially edentulous patients.
- Preservation of existing partial dentures after loss of strategic abutment teeth.
- Stabilisation of partial prostheses with supporting short distal implants.
- Stabilisation of mandibular complete dentures with implants.

Table 6.5 General precautions and contraindications for implants placement in the older patient

Local	Poor oral hygiene
	Space available for final restoration, e.g. severely over-erupted opposing dentition or reduced occlusal vertical dimension
	Insufficient bone quality and or quantity, e.g. highly atrophic anterior mandible or posterior maxilla (can be associated with highly pneumatised sinus)
Medical	ASA IV or higher or medical conditions that carry significant risks to life
	Bleeding disorders
	Uncontrolled diabetes mellitus can impair wound healing and the process of osseointegration
	Bone disorders, for example, osteopenia and osteoporosis
	Anti-resorptive medication, for example, bisphosphonates, receptor activator of nuclear factor kappa-B ligand (RANKL) inhibitors, and antiangiogenic agents has a risk of osteonecrosis
	Radiation treatment to the head and neck region (although some may still receive implants with very careful planning, and consideration or radiation dose)
	Patients ≥80 years old may have a slight tendency for a higher risk of early implant loss
Patient factors	Smoking
	Bruxism
	Frailty; those who maybe unable to tolerate treatment or travel for multiple visits
	Physical impairment that may impact on mouth opening or ability to maintain oral hygiene
	Consider cognitive decline: Anticipated longer-term deterioration in ability to provide oral hygiene or maintain implant treatment must be considered. This does not contraindicate implant placement in people with cognitive impairment in all instances
	Highly dependent on help for the activities of daily living may be unsuitable for implant therapy and the level of maintenance required

Contraindications

Implant surgery is an elective oral surgery procedure and therefore any contraindications to surgery will be a contraindication to receiving dental implant treatment. There are few absolute contraindications to implant surgery. However, along with the well-recognised risk factors for peri-implant disease and implant failure, relative contraindications and consideration for implants in the older patient are given in Table 6.5.

Selection and Decision Making

All patients requiring dental implant treatment require a thorough history and examination. It is important to ascertain patient motivation and their understanding of what is involved and what outcome to expect. Additional factors should be considered in the older patient including the individual's resilience, physical and mental

health, medical history with special attention to drug prescriptions. Social environment, biological age, and patient expectations can vary widely in this age group, and must be explored with every patient.

It is important to understand any previous problems encountered, such as poor denture retention, mucosal intolerance or a strong gag reflex which sometimes can be rectified through conventional means. For example, implants are sometimes recommended to a hypersensitive gag reflex patient, only to find that good working impressions are not always achievable to restore the implants. More appropriate management of some of these patients may include desensitising exercises to better enable wearing a removable prosthesis, and may avoid surgical intervention in the first instance.

What is clinically achievable needs to be made clear and balance this with the patient's expectation. The number of appointments, length, and stages of treatment should be explained. This includes that they may need to be without their interim prosthesis to encourage undisrupted healing, especially if there is evidence of less bone density or increased cortical porosity.

Cost of treatment is a big factor and must be considered. The initial cost of any implant option, especially prostheses on multiple implants is significant. In England, Implant treatment can be provided by the NHS, but under strict criteria. Generally, alternative treatment option should have been tried before dental implants are considered. The Royal College of Surgeons of England have produced guidelines in line with NHS priorities for selecting the appropriate patients to receive this form of treatment [77].

- Patients with developmental conditions resulting in deformed and/or missing teeth.
- Patients who have lost teeth due to trauma.
- Patients who have undergone ablative surgery for head and neck cancer.
- Patients with extra-oral defects.
- Patients who are edentulous in one or both jaws.
- Patients with severe denture intolerance.
- Patients with aggressive periodontitis.
- Patients requiring implant-borne orthodontic anchorage.

Therefore, implant provision in a specialist private setting may be required and appropriate in many cases.

As with any implant treatment plan, the primary aim is a successful treatment outcome with high predictability and low complication rate with long-term stability of the osseointegrated implant. In an older patient, especially if more frail, this should be achieved with minimal treatment stress and post-operative morbidity, a reduced number of surgical interventions and therefore a minimally invasive approach, reducing the treatment time and hopefully healing time involved [78]. This can be more readily achieved with short or narrow-diameter implants, mini-implants (Fig. 6.13) and/or flapless surgeries.

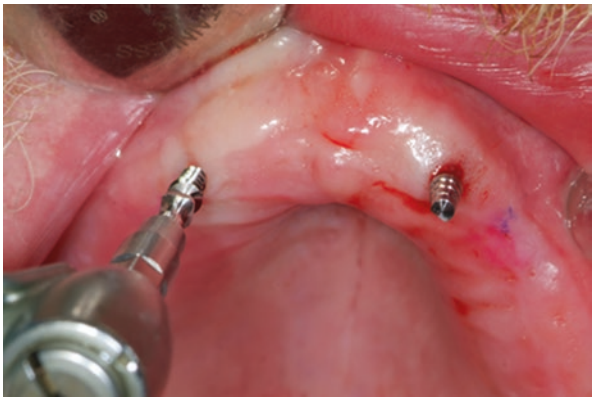

Fig. 6.13 Maxillary mini-implants placement using a flapless technique. (Image courtesy of Mr. Francis S Nohl)

Treatment Options with Dental Implants

Dental restorations for older patients should be designed so that they are easy to clean, stable and as much as possible, can be simplified as needed in the future.

Overdentures (Bar, Locators, and Magnets)

Fixed prostheses for edentulous patients may not be achievable for all patients for various reasons. There are several advantages for the implant retained overdenture which include an ability to replace a larger volume of lost tissue including soft tissue, which can also provide lip support. Implant treatment nearly doubles maximum bite forces compared with those achieved with conventional complete dentures and have been have shown to have better quality of life outcomes [79]. Overdentures may also provide a stable and retentive prosthesis with a reduced cost when compared to fixed options. The most feasible and cost-effective option for the vast majority of edentulous patients is the two implant supported mandibular overdenture which is now considered the minimal standard of care by the McGill and York Consensus Statements as shown in Fig. 6.14 [74, 79].

Mini Implants

The dependent older patient can also benefit from implant treatment with minimal surgical trauma. For those unable to tolerate extensive surgical treatment or have difficulty in treatment positioning, mini implant treatment with or without raising a flap can be placed with reduced effort for both the patient and clinician, and provide support and stability to removable prostheses as shown in Fig. 6.15. Mini implants fell out of favour but has seen a resurgence in response to the benefits discussed.

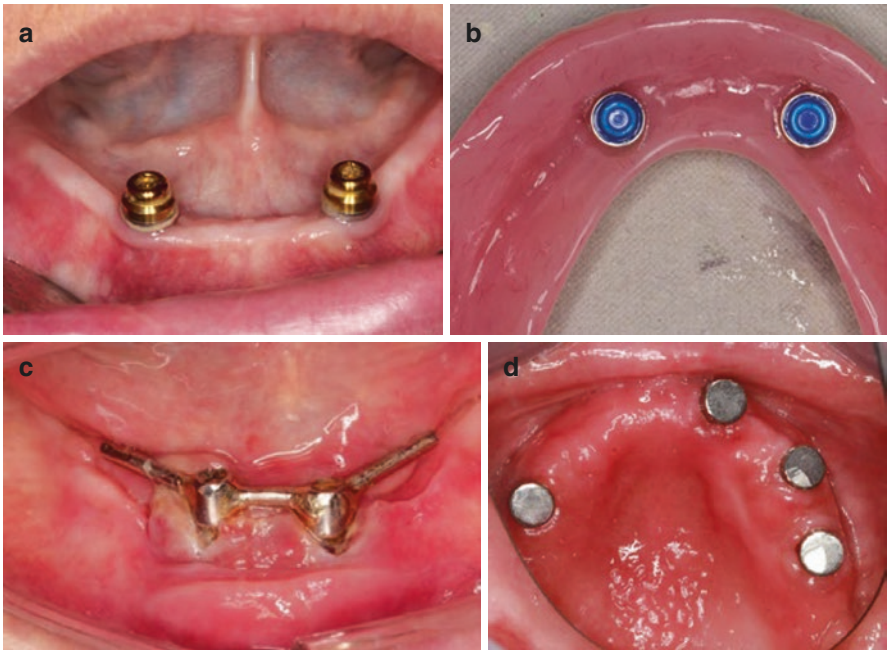

Fig. 6.14 (**a**) Two mandibular implants for overdenture retention, (**b**) corresponding implant retained overdenture, (**c**) mandibular implants with gold bar (note the soft tissue reaction to poor oral hygiene), (**d**) maxillary implants with magnets for retention. (Images courtesy of Mr. Francis S. Nohl)

Implant Complications

There are a wide range of complications that can occur during any stage of implant treatment, from the first appointment and pre-operative treatment planning up to many years after the initial implant placement. Some risk factors include quality and quantity of bone, medical complication, history of smoking, history of advanced periodontal disease, and technical complications that can lead to mechanical implant damage. Where possible, contingency or future planning is an important aspect of implant treatment planning. This is especially important in more complicated implant rehabilitation, where planning may include the eventual loss of additional teeth with a long term guarded prognosis. Implant placement may consider the possibility to transition to a removable option if the patient can no longer manage invasive dental care, or treatment of implant complications, which may lead to burying or losing an implant altogether.

An increasingly reported biological complication of implant treatment involves an inflammatory reaction of the peri-implant tissue and is divided into peri-mucositis and peri-implantitis. Peri-mucositis involves a reversible inflammation of the soft tissue surrounding the implant, while peri-implantitis involves inflammation of the soft tissue with associated surrounding implant bone loss.

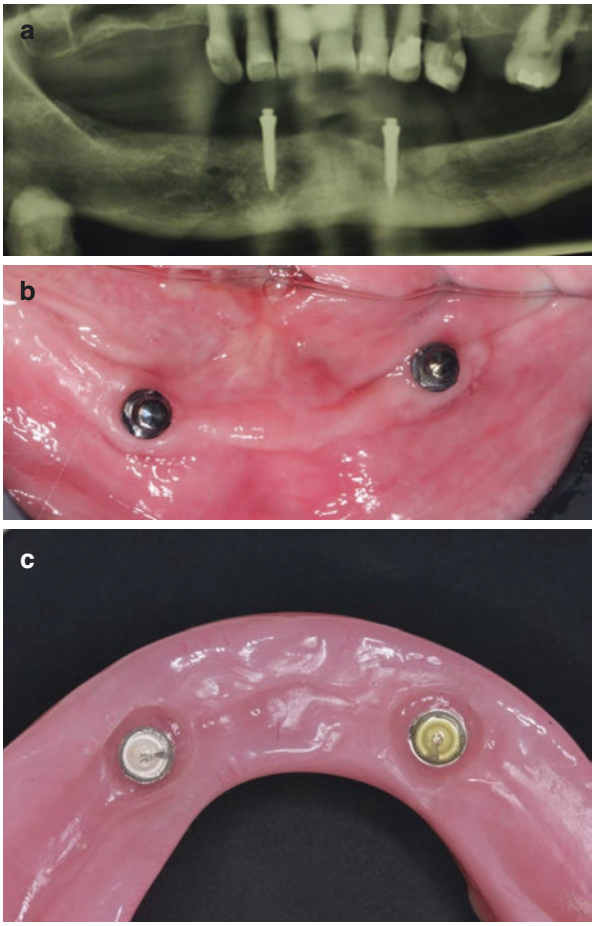

Fig. 6.15 (**a**) Radiographic view of mandibular mini-implants, (**b**) corresponding intra-oral view of mandibular mini-implants, (**c**) corresponding mini-implant retained overdenture images courtesy of Mr. Francis Nohl.

There is weak evidence that implant biological complications may be more prevalent in older people. However, some conditions such as dementia, osteoarthritis, and Parkinson's disease amongst many other reasons, could impair adequate oral hygiene around implants. Insufficient plaque control is known to elevate the risk of peri-mucositis and peri-implantitis, so it may be reasonable to assume that an increased difficulty to maintain oral hygiene with increasing age, may be linked to an increased risk for peri-implant disease [80].

The growing demand for specific oral health care needs associated with implant treatment in older people should be anticipated. Patients who are or become dependent on others for daily oral health care will benefit from educational support to family and carers to maintain adequate levels of oral hygiene. Those with regular aftercare follow up to reinforce oral hygiene compliance and maintenance, will often have favourable long-term outcomes.

Summary

The restorative management of the older patient can become complex due to comorbidities, previous dental experiences or changes in social status. The least invasive approach should always be considered first, just as it would when treatment planning for younger patients. However, there is no need to avoid restorative treatment in older patients and even the more complex procedures may be appropriate. It is important to fully take into account the individual's unique circumstances and how these may affect treatment outcome when planning restorative care with the older patient. Time should be taken to explain the risks and benefits of treatment using a patient centred approach.

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Oral Surgical Procedures and Considerations for Older People

7

Naomi Rahman and Shrina Nathwani

Learning Outcomes

- Be aware of surgical-related complications that are more likely to occur in older people.
- Know the importance of common medical conditions and the impact on surgical interventions.
- Understand how to manage patients with an increased risk of bleeding and jaw necrosis.
- Be aware of the indication for pre-prosthetic surgical procedures.

Introduction

Older people are increasingly retaining their teeth into older age and are more likely to require oral surgical procedures [1, 2]. The 'ageing dentition' with multiple heavily restored teeth may require a more conservative approach to management, and a greater number of considerations may need to be considered when planning treatment [3]. Medications such as bisphosphonates can precipitate osteonecrosis of the jaw, whilst head and neck radiotherapy can significantly impact oral health and dental treatment.

Heavily restored teeth are more likely to need surgical intervention, especially in cases where they have been root treated, making them more brittle and more prone to fracture during extraction. Surgical care will need to consider the management of medical comorbidities, patient mobility, frailty, increased risk of complications, complex social circumstances, mental health conditions, mental capacity

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implications and communication impairments. Patients' preferences must be taken into account when these factors are considered. This chapter explores some of the challenges encountered when surgical procedures need to be undertaken in the older patient and where the benefit is felt to exceed the risk.

Challenges with Dentoalveolar Procedures in Older People

Dental extractions in older people can present numerous challenges due to anatomical changes that are more prevalent in older age. Bone density increases with age, there is reduced elasticity of bone, and there can be an increase in hypercementosis (Fig. 7.1). Internal or external resorption can also increase the indication for surgical removal of teeth, whilst generalised bone loss and advanced periodontal disease can lead to additional risk factors when undertaking dental extractions. For example, severely resorbed ridges can make iatrogenic damage to anatomical structures such as the mental nerve more likely. Older patients have a higher risk of mandibular fracture during or following surgical procedures such as cyst enucleation. Less invasive approaches such as decompression or marsupialisation should be considered to encourage a reduction in the overall size of the cyst before enucleation, minimising the potential risk of jaw fracture. When extracting lone-standing upper molar teeth, there is a greater risk of either tuberosity fracture or oral antral communication (Fig. 7.2) [4].

Antral changes can occur in older patients, and the sinus floor can pneumatise between individual roots or edentulous spaces, creating elevations in the antral surface often referred to as 'hillocks' [5] (Fig. 7.2). Risk factors that could increase the

Fig. 7.1 Hypercementosis/cementoblastoma in a 68-year-old female

Fig. 7.2 Hillocks of the antral floor in close proximity to the UL6 retained roots

likelihood of displacing a root into the sinus are the presence of a large sinus, difficult access (visual and mechanical), use of excessive force, incorrect use of instruments, difficult surgical extractions necessitating division of the roots and the presence of little or no bone between root apices and sinus floor. It is important to consider the more common factors that are more likely in older people when planning surgical interventions and gaining informed consent.

In addition to anatomical changes in older patients, clinicians should also consider age-related physiological changes and the need to make practical adaptations for older patients undergoing surgical procedures. Some patients may have postural changes such as kyphosis with a chin on chest posture that can impact access to the mouth when undertaking a surgical procedure. In addition, patients with temporomandibular disorder (TMD) or limited mouth opening may find it challenging to keep their mouths open for a prolonged time, making access for procedures and administering inferior dental (ID) blocks more challenging. These patients are at increased risk of jaw dislocation and may also experience trismus postoperatively. It may be worth considering alternative techniques such as buccal articaine infiltration or akinosi (closed mouth mandibular block) to achieve effective anaesthesia. Using an appropriately sized mouth prop can help gain more access to the surgical site whilst also providing the patient with a 'jaw rest.' Postoperative advice of a soft diet, jaw massages, analgesics and ice packs should be advised in patients who experience jaw ache during a procedure. Paediatric forceps can be helpful in patients requiring extractions with limited mouth opening. Adaptations may need to be made by the operating team caring for older people. For example, if someone cannot safely transfer to a dental chair, the team may consider treating them in their wheelchair, especially when there are no hoist or wheelchair recliner facilities.

Fig. 7.3 An OPG showing a resorbed or carious unerupted horizontally impacted left mandibular third molar (LL8)

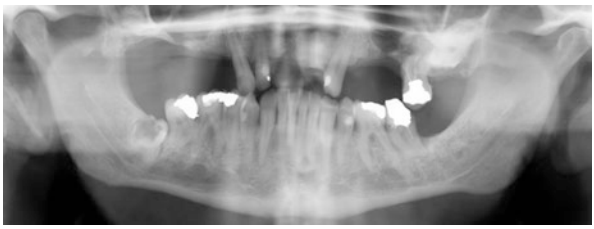

Fig. 7.4 An OPG showing an asymptomatic right mandibular third molar tooth (LR8) with internal resorption, hypercementosis and unclear root morphology, requiring extraction

Risk Assessment for Undertaking Dentoalveolar Procedures

In older people, there are likely to be more relevant factors that form part of the risk assessment for surgical intervention. A comprehensive patient assessment is crucial for older patients as for any other patient group. In addition to consideration of dental factors such as those detailed above, a medical history involving all systems, prescribed and non-prescribed medications, a social history and a history of previous dental procedures and related complications must be explored. Consideration of these factors and the patients' preferences can help determine if the risks of treatment are justifiable or whether these outweigh potential benefits to intervention. Figure 7.3 shows an OPG of an 88-year-old patient with a resorbed or carious unerupted horizontally impacted left mandibular third molar (LL8). The patient in this example was asymptomatic and keen to retain teeth where possible. The risks of intervention in this example are considerable and benefits few, demonstrating how surgical procedures are not always the solution to identified dental problems. In contrast, Fig. 7.4 shows a lower right wisdom tooth requiring removal due to substantial longstanding symptoms, which is associated with a justifiable procedural risk due to the symptom history.

Impact of Specific Medical Conditions and Medications

The incidence of medical comorbidities and polypharmacy increases with age, and it is beyond the scope of this book to discuss them all in detail. This section will focus on more common conditions that have implications for dental surgical procedures.

Cardiac Disease

Ischaemic heart disease, heart failure and related comorbidities are being encountered more frequently in UK dental practice because of their prevalence in the ageing population [6]. Hypertension (blood pressure exceeding 140/90 mmHg) is a common condition, yet this is only identified and treated in a proportion of patients [7]. Patients who have raised uncontrolled or undiagnosed hypertension should ideally have any elective dental treatment delayed until it is controlled to reduce the risk of a further rise in blood pressure related to dental treatment.

Myocardial infarction is a leading cause of death. Patients at risk of myocardial infarction (MI) are those with unstable angina or who have had an MI in the last 6 months; such patients should be cared for with due caution and elective procedures delayed [8]. Referral to secondary care services should be considered for more urgent procedures in this timeframe or where there are concerns about persistent unstable cardiac conditions that may affect dental care. With a background of a recent MI or uncontrolled hypertension, it is advisable to postpone elective treatment and liaise with the general medical practitioner (GMP) for further investigation, such as 24-hour blood pressure monitoring. Adequate pain control is crucial to reduce distress during treatment. Adrenaline-containing local anaesthesia is not contraindicated, and this can provide suitable anaesthesia to reduce the stress of dental treatment.

Infective Endocarditis

Specific cardiac conditions such as congenital malformations or valve replacements can increase a patient's risk of developing infective endocarditis following invasive dental treatment [9]. Infective endocarditis (IE) is a multi-system disease associated with high morbidity and mortality rates that result from infection, usually bacterial colonisation, of the endocardial surface of the heart. IE can cause symptoms including pyrexia, chills, night sweats and shortness of breath. There has been debate about whether antibiotic prophylaxis for at-risk patients is appropriate. The European Society of Cardiologists (ESC) concluded that the weight of evidence and opinion was in favour of the efficacy and usefulness of antibiotic prophylaxis in preventing IE in those at high risk [9]. They recommended that 'antibiotic prophylaxis should be given before invasive dental procedures to all patients at high risk of IE'. In contrast, the National Institute for Health and Care Excellence (NICE) does not routinely recommend the 'routine' use of antibiotic prophylaxis [10].

The Scottish Dental Clinical Effectiveness Programme (SDCEP) provided 'Implementation Advice' in 2018 to support clinicians in the UK in caring for those at risk of IE [11]. This publication clarifies those at higher risk of IE who require special consideration, and procedures that may cause a greater risk of

Table 7.1 Cardiac diseases or statuses predisposing patients to a risk of infective endocarditis. Content taken from NICE [10] and SDCEP [11]

Patients at a higher risk of developing infective endocarditis
Patients with a history of infective endocarditis
Prosthetic valves or where a prosthetic material has been used for valve repair
Structural congenital heart disease: Especially any type of cyanotic congenital disease or congenital cardiac disease that has been repaired with prosthetic material (highest risk of 6 months, or permanently if ongoing valvular regurgitation and turbulent blood flow remain)
Patients at risk of developing infective endocarditis
Hypertrophic cardiomyopathy
Acquired valve disease with stenosis or regurgitation
Patients with any other form of native valve disease (including the most commonly identified conditions: Bicuspid aortic valve, mitral valve prolapse and calcific aortic stenosis)
Patients with unrepaired congenital anomalies of the heart valves

Table 7.2 Invasive procedures (content modified from SDCEP) [11]

Procedures that can be considered 'invasive' causing a higher risk of bacteraemia
• Dental extractions, surgical or non-surgical and any procedures where alveolar bone is disturbed
• Incision/draining of dental or orofacial abscesses
• Implant placement or uncovering of implant sub-structures
• Other oral surgery procedures such as periodontal or endodontic surgery
• Endodontic treatment where subgingival instrumentation may occur
• Manipulation of subgingival tissues by matrix bands, subgingival restorations, subgingival rubber dam placement
• Disturbance to periodontal tissues through subgingival scaling, root surface instrumentation or comprehensive periodontal indices in diseased tissues
• Placement of stainless steel/preformed metal crowns

bacteraemia. This document proposes that those at higher risk (as per Table 7.1) requiring invasive dental complex procedures (as per Table 7.2) may benefit from antimicrobial prophylaxis. Current recommendations [11] for antibiotic prophylaxis for adults in the UK are to use 3 g Amoxicillin orally 1 h preoperatively or 600 mg clindamycin orally for penicillin-allergic patients undergoing invasive procedures (as per Table 7.2). This document advises clinicians to liaise with cardiology teams for advice on whether prophylaxis is warranted and that a discussion with patients about their options and related risks is appropriate.

Respiratory Disease

Asthma, chronic obstructive pulmonary disease (COPD) and respiratory tract infections are common in older people. Asthma is a chronic inflammatory condition of the lung airways characterised by reversible airflow limitation, hyper-responsiveness of the airways to a range of stimuli and bronchial inflammation. By contrast, COPD is characterised by poorly reversible airflow limitation that is progressive and associated with persistent lung inflammation. COPD is usually associated with long

term exposure to harmful substances such as cigarette smoke, and the term encompasses both chronic bronchitis and emphysema.

Elective oral surgery procedures should be deferred in patients with acute exacerbations of respiratory diseases. Patients with asthma should be asked to bring their inhalers when attending for treatment and use them before treatment. Aspirin and non-steroidal anti-inflammatory drugs (NSAIDs) may induce an asthma attack and should be avoided. Conscious sedation may benefit patients whose asthma is exacerbated by dental anxiety. General anaesthesia and intravenous sedation are best avoided in patients with COPD where possible due to the increased risk of morbidity and mortality when the respiratory system is compromised. Patients with severe respiratory conditions may struggle being reclined for long periods and may find frequent breaks during treatment helpful. Some may have continuous oxygen administration through nasal cannulae: this should be continued during treatment but can interfere with access to the upper anterior teeth.

Kidney Disease

Renal function typically declines with age, and specific conditions such as diabetes and hypertension can cause chronic kidney disease (CKD). CKD can result in susceptibility to infections, enhanced activity of drugs excreted by the kidneys and increased postoperative bleeding due to thrombocytopenia. CKD requires increasingly careful dental management from stages 3 to 5, with stage 5 being a complete failure of the kidneys needing either a transplant or some form of dialysis. Patients at stage 4 may be preparing for these interventions as well. The following preoperative haematological investigations may be required in CKD stages three or above:

1. Full blood count (FBC)
2. Urea and electrolytes (U&Es)
3. Estimated glomerular filtration rate (eGFR).

These specific tests are needed to check platelet levels, white cell count and assess the degree of renal impairment and its impacts, such as bleeding and local anaesthetic maximum dose. Local haemostatic measures should be used to manage bleeding tendencies. Patients on dialysis should be treated on a day in between dialysis sessions. This is to ensure beneficial effects of their dialysis are maximised, and the effects of heparin (an anti-coagulant used in the dialysis process) have worn off. The evidence for prophylactic antibiotics in renal failure is limited, yet these may be indicated for surgical procedures in some instances. Clinicians need to be cautious with prescribing drugs with renal excretion [12]. Amoxicillin, erythromycin, metronidazole, paracetamol and codeine are relatively safe, and dosage alterations are only required if renal failure is severe. Aspirin and NSAIDs are nephrotoxic and should be avoided in patients with CKD.

Intravenous sedation with midazolam may be used; cannulation should be avoided on the forearm with the arteriovenous shunt used for dialysis. Sedatives

may have a more profound effect, and therefore slow titration of benzodiazepines is essential. Patients with a renal transplant will be taking immunosuppressant therapy, increasing the risks of prolonged healing after surgical intervention. For patients needing complex procedures, conscious sedation or general anaesthesia, it can be sensible to consult with a renal physician to discuss how dental care may be most appropriately delivered.

Liver Disease

Liver disease can include alcohol-induced cirrhosis, viral hepatitis, auto-immune, drug-induced hepatitis or primary biliary cirrhosis. Patients with liver disease have impaired drug metabolism and a decrease in clotting factors needed for haemostasis leading to increased bleeding tendencies. They may also have a relative reduction in platelet levels. If any dentoalveolar surgical procedures are planned, the following preoperative haematological investigations are required: [13].

1. Full blood count
2. Liver function tests
3. Clotting screen or INR and activated partial thromboplastin time (APTT).

Liver function tests are used to determine the extent of hepatic functional decline. An elevated prothrombin time (PT) is a key marker of reduced hepatic function and is detected by a clotting screen or INR investigations. A small increase in prothrombin time (PT) test (e.g., PT = 13–15) indicates significant liver damage, and PT is used to inform INR, as one aspect of the model for end-stage liver disease (MELD) [14]. Vitamin K (at doses of 10 mg IM) corrects hypoprothrombinaemia from malnutrition and biliary obstruction, but not intrinsic liver disease. Fresh frozen plasma will decrease the prothrombin time, and platelet transfusion addresses both quantitative and qualitative problems. If any of the tests suggested above are not within normal range, a haematologist or specialist consultant that manages the patient should be contacted as blood products may need to be arranged prior to the procedure. Local haemostatic measures should also be employed where there is a risk of bleeding from dental procedures.

Erythromycin and tetracyclines are hepatotoxic and should be avoided in patients with liver disease. Clindamycin, metronidazole and paracetamol may be used in reduced doses, and penicillin is safe at normal doses. Aspirin and NSAIDs should be avoided due to the risk of haemorrhage in patients with portal hypertension and oesophageal varices. Patients with chronic liver disease may have increased susceptibility to infections. Metabolism of benzodiazepines is also impaired, and therefore, IV sedation should be undertaken with careful titration.

Management of Immune Compromise

Immunocompromised patients are more susceptible to poor wound healing and postoperative infections. Immunocompromise can be caused by diseases or by medication or therapeutics. Common immunosuppressive conditions include diabetes mellitus, HIV, alcoholism, cirrhosis, splenectomy or haematological malignancies. Optimised medication of conditions such as diabetes can reduce the extent to which immunosuppression can impact dental treatment.

Chemotherapeutic agents used to treat haematological or other malignancies can cause substantial immunosuppression by preventing the production of red and white blood cells and platelets. Consequently, infection and bleeding are highly likely during and after chemotherapy. Patients with these diseases may require blood tests (i.e., full blood count, clotting screen and, if appropriate, liver function tests and urea and electrolytes) prior to dentoalveolar surgery. These patients may require liaising with specialists who may recommend any of the following; antibiotic cover, blood transfusions, platelet cover or use of 5% tranexamic acid topically (soaked gauze pack or mouthwash) or taken orally [15]. The impact of chemotherapy extends beyond immunosuppression, including bleeding and a range of oral manifestations, which are summarised in relevant guidance and texts.

As summarised in Table 7.3, a wide range of medications can cause immune suppression and are prescribed for this specific purpose. Corticosteroids are the most commonly used immunosuppressive medications, yet their side effect profile can be highly significant [16]. These drugs are taken for a range of reasons but are the mainstay of management for Addison's disease (primary adrenal insufficiency), where the body does not produce cortisol in response to stress. Acute adrenal crisis is a medical emergency and potentially life-threatening. Patients may develop

Table 7.3 A summary of key immunosuppressive drugs

Drug	Main adverse effects
Azathioprine	Myelosuppression hepatotoxicity, leukopenia thrombocytopenia
Ciclosporin	Neurotoxicity, hypertension, tremulousness, hypertrichosis, gingival swelling, hepatotoxicity, and nephrotoxicity with hyperkalaemia and/or renal tubular acidosis. No bone marrow effect, infections, lymphoproliferative disorders, malignancies, teratogenicity
Corticosteroids	Hypertension, peptic ulceration, psychosis, mood changes, thinning of the skin, bruising, delayed wound healing, impaired glucose tolerance, alteration of the hypothalamic-pituitary-adrenal system
Daclizumab	Hypersensitivity reactions
Dapsone	Mainly haematological
Mycophenolate mofetil	Nausea, vomiting No liver or kidney damage More gastrointestinal, haematological effects and infections than azathioprine
Tacrolimus	Hyperglycaemia, neurotoxicity and nephrotoxicity

Stop/stabilise the procedure.
Lie patient down and raise legs
Monitor blood pressure and pulse
Give 200mg hydrocortisone IM/IV if available
If the patient is unresponsive, follow basic life support (ABC) and call 999 or equivalent if working in secondary care.

Fig. 7.5 Management of adrenal crisis

hypothermia, hyponatraemia, eosinophilia, severe hypotension, hypoglycaemia, confusion and circulatory collapse that may ultimately lead to death [17]. The management of this presentation, regardless of aetiology, is summarised in Fig. 7.5.

Patients with Addison's disease are often well informed and aware of their pre- and postoperative steroid requirements. Whilst relevant guidelines inform what protocols should be used [18, 19] liaising with a patient's endocrinologist as part of their initial assessment for further advice on the necessity of steroid supplementation is recommended.

Higher doses of corticosteroids taken for a prolonged period, often with the aim of immunosuppression, can reduce tolerance to stresses and cause adrenal cortical atrophy, reducing the body's ability to produce endogenous steroids under stress [19, 20]. On this basis, there is a risk that complex surgical treatments, especially in anxious patients, could precipitate a steroid crisis mirroring an adrenal crisis. There are different protocols in place based on a limited degree of evidence. In some units, the patient is asked to double the dose of steroids preoperatively, others will give IV hydrocortisone preoperatively between 25 and 100 mg. The approach used should be based on a risk assessment of each patient's medical status, history of adrenal crises, dental anxiety and the nature of the treatment they require.

Management of Patients at Higher Risk of Postoperative Bleeding

Many older patients requiring dental intervention may be taking medication that affects how their blood clots. As discussed, conditions acquired over the life course, such as hepatic or renal disease, can affect coagulation in addition to the impact of medications. The management of congenital conditions such as haemophilia is not within the scope of this book and described elsewhere [21, 22], and these conditions affect dental care throughout a patient's lifetime. Acquired conditions and medication-related bleeding tendencies are those most likely to affect older people, so they are discussed herein.

When assessing the suitability of dental care for patients at risk of bleeding: the nature of the planned procedure and the history of acquired or medication-related bleeding conditions must be understood. More invasive procedures such as biopsies, surgical extractions or implant placement are at higher risk than general restorative care [23] as per Table 7.4. (*Note: Procedures in* Table 7.2 *that are 'invasive' are invasive in terms of bacteraemia risk;* Table 7.4 *details procedures at higher risk of bleeding.*)

Table 7.4 Bleeding risk of specific dental procedures (taken from SDCEP [23])

	Procedures likely to cause bleeding	
Procedures unlikely to cause bleeding	Low-risk procedures	Higher risk procedures
• Local anaesthesia with an infiltration or ID block technique* using an aspirating technique • Direct or indirect restorations • Dental examination, radiographs and a BPE • Impressions for fixed or removable prosthodontics and orthodontic appliance, and the fitting of such devices • Non-surgical endodontics • Supragingival scaling	• Routine extraction of three teeth or less • Incision and drainage of swellings • Detailed periodontal exam with bleeding on probing assessment	• Surgical extractions or complex extractions in close proximity • Multiple adjacent extractions of more than three teeth • Implant placement • Incisional or excision biopsies • Gingival, periodontal or endodontic surgery • Procedures where the raising of a flap is required, such as crown-lengthening

*An ID block in a warfarinised patient with an unstable INR should be avoided if possible, or an INR taken

Where a patient has one risk factor for bleeding, there may be additional related risk factors that amplify bleeding tendencies, such as the use of non-steroid anti-inflammatory drugs or high levels of alcohol consumption. Undertaking a bleeding history provides a useful indicator of bleeding complications during dental treatment. This includes bleeding requiring hospital treatment, prolonged bleeding from other wounds, spontaneous bleeding and bruising related to dental care. A cautious risk assessment is needed where there is an unexplained history of bleeding, an unclear history or a combination of invasive procedures needed for a patient at risk of bleeding. Information about specific conditions below informs how delivery of higher risk procedures should be approached or risk-assessed. Key principles apply regardless of the cause of bleeding:

- postponing treatment if the cause of bleeding is temporary, such as short-term heparin use following orthopaedic surgery.
- appropriate medical and dental history informs a risk assessment.
- early in the day and earlier in the week allows appropriate management of unanticipated complications.
- the extent of the initial treatment area where multiple procedures are required.
- measures such as oxidised cellulose and suturing are appropriate for all conditions where there is concern about bleeding.
- avoid postoperative NSAID usage and provide clear postoperative instructions.
- a longer postoperative monitoring period before the patient leaves the clinic and ensure the patient has contact details (working and non-working hours) should there be any bleeding concerns.
- secondary care referral is indicated for atypical or rare conditions, where a clinician is uncertain about management, where a patient has a history of unexplained postoperative bleeding or where haematological products may be indicated.

Table 7.5 Platelet levels and considerations for dental care

Platelet count	Clinical effect	Dental considerations	
100–150 × 10^9/l	No consequences	Proceed as normal	For all patients: • Avoid aspirin/NSAIDs • Use local haemostatic measures such as oxidised cellulose and sutures • Consider if other causes of bleeding are present that may warrant further investigation or management • Use tranexamic acid if appropriate or necessary
50–, <100 × 10^9/l	Mild bleeding tendency	Consult a haematologist if in a primary care setting or if there are additional bleeding concerns, avoid ID blocks	
20–<50 × 10^9/l	Significant bleeding tendency, especially after injury/surgery	Consult a haematologist for all management, defer elective dental procedures	
<20 x 10^9/l	Severe spontaneous bleeding tendency including from the mouth/gums, life-threatening	Consult a haematologist	

Thrombocytopenia

Many medical conditions can cause thrombocytopenia (low platelets) which are commonly seen in older people. Conditions can either affect platelet production (idiopathic thrombocytopenic purpura, aplastic anaemia, leukaemia) or increase platelet destruction (auto-immune conditions, splenomegaly). Where there is any history of thrombocytopenia or postoperative bleeding, a full blood count should be requested to check platelet levels before surgery to inform a risk assessment and the setting in which a patient should receive their care.

Patients can present in the dental setting with purpura, petechiae, bullae, haematoma or bleeding from the mouth or gingiva. Fear of oral hygiene can lead to ineffective oral hygiene and subsequent gingival inflammation. Treatment for thrombocytopenia can include immunoglobulin or corticosteroids (7–10 days before the procedure) and platelet replacement (on the day of surgery). In cases where older patients with a platelet count of less than 50 x 10^9/l require dental surgery, they should be referred to a specialist in a hospital setting where bleeding can be managed appropriately (with blood products where required) following liaising with the haematologist as per Table 7.5.

Antiplatelet Drugs

Multiple antiplatelet drugs can be used in isolation or combination. Aspirin irreversibly inhibits cyclooxygenase (COX 1 and 2) enzymes, preventing the production of prostaglandins and thromboxane (A2), responsible for mediation of pain and inflammation as well as platelet aggregation. Other antiplatelet drugs such as clopidogrel, prasugrel and ticagrelor act by inhibiting adenosine diphosphate receptors, preventing platelet aggregation and adhesion. Dual antiplatelet therapy is advised in non-ST elevation acute coronary syndrome and following percutaneous coronary

intervention (for example, stenting) to reduce the occurrence of a thrombotic event, especially in those with stents.

Current recommendations for patients on both single or dual antiplatelet therapies are not to discontinue medications prior to dental procedures due to the risk of thrombotic events, which outweighs the risk of bleeding post-dental intervention [23]. Dental clinicians should consider the use of local haemostatic measures. Appointments should ideally be made early in the day and week to manage bleeding complications should they occur.

Warfarin and Direct Oral Anticoagulants

Warfarin is a vitamin K antagonist and inhibits vitamin K dependent synthesis of clotting factors (II, VII, IX, X), affecting the formation of a fibrin clot. These factors are synthesised in the liver in precursor form and activated by carboxylation of specific glutamic acid residues, requiring vitamin K in its reduced form as a cofactor.

Warfarin is primarily used for:

- Stroke prevention in patients with atrial fibrillation (AF)
- Thromboembolic disease not limited to deep vein thrombosis (DVT) and pulmonary embolism (PE)
- Any heart valve surgery but especially prosthetic mechanical replacement heart valves

Warfarin interacts with a wide number of drugs and requires dose alterations and INR monitoring. Newer direct oral anticoagulants (DOACs) such as Dabigatran, Rivaroxaban, Apixaban and Edoxaban are used for similar conditions to warfarin and are often preferable [24]. These drugs inhibit specific clotting factors (factor Xa for rivaroxaban or apixaban or factor IIa by Dabigatran) and do not require monitoring, have a rapid onset and offset, are used at a fixed dose and have few interactions with other drugs. However, DOACs have a shorter half-life. Therefore, a missed dose can increase the risk of a thromboembolic event, suggesting the importance of patient counselling to ensure patients understand the importance of adherence.

Management of patients on warfarin includes: [23, 25]

- Risk assessment of the procedure(s) required, and how likely they are to cause bleeding as per Table 7.4.
- For procedures unlikely to cause bleeding (such as direct restorations), proceed as normal without the need for preoperative investigations.
- For more invasive and surgical procedures, continue warfarin therapy (as discontinuation carries a risk of thrombosis) but check the International Normalised Ratio (INR) within 24 hours of dental procedure (or within 48–72 hours if the INR is persistently stable).
- If INR <4 (and within target INR), proceed with dental treatment without cessation of anticoagulation, using local measures.

- If INR is ≥4, delay routine treatment until INR is <4 and consider secondary care referral for urgent treatment.

Management of patients on DOACs includes: [23, 26]

1. Risk assessment of the procedure(s) required for how likely they are to cause bleeding as per Table 7.4.
2. For procedures unlikely to cause bleeding (such as direct restorations), proceed as normal without the need for preoperative investigations.
3. For procedures likely to cause bleeding with a lower risk of complications, proceed with dental treatment without cessation of anticoagulation, using local measures (resorbable haemostatic agents and sutures).
4. For procedures that are likely to cause bleeding with a higher risk of complications, proceed with dental treatment using local measures (resorbable haemostatic agents and sutures) but either miss a dose of the DOAC if taken in the morning or postpone the DOAC dose until 4 hours after the procedure.

Low Molecular Weight Heparins (LMWH)

Low molecular weight heparins (LMWHs) (such as Dalteparin/Fragmin and Enoxaparin/Clexane) are administered via subcutaneous injection. LMWHs are used post-surgically (after orthopaedic surgery) to manage deep vein thrombosis (DVT) or for those with cancer and those who may be immobile, for example, after having a stroke. They can be administered once or twice daily at low (prophylactic) or treatment (therapeutic) doses. They have a short onset of action and a short half-life. It is suggested that patients on these medications have a similar bleeding risk to those on continued oral anticoagulation with an INR of 2–3.

For patients taking a low (prophylactic) dose of LMWH, treat without interrupting their anticoagulant medication. For patients on higher (therapeutic) doses, practitioners should liaise with their prescribing clinician/specialist to assess the impact of these drugs on bleeding during or after a dental procedure. These patients may require referral to an appropriate care provider [23]. Local haemostatic measures should be used to achieve haemostasis.

Management of Patients at Risk of Osteoradionecrosis (ORN)

Overview

Osteoradionecrosis is bone necrosis that occurs in previously irradiated tissues without tumour persistence or recurrence. The risk of oral cancer increases with increasing age, meaning older people are more likely to have received radiation to the head and neck region to manage such conditions [27]. Radiotherapy can cause xerostomia, mucositis, lethargy, localised skin erythema, hair loss or taste

alteration, fungal infections and trismus [15]. This can substantially impact patients' care in the short term, where elective dental care is best avoided [15].

In the longer term, ORN can arise when the bone becomes devitalised and exposed through overlying skin or mucosa for more than 3–6 months. The incidence rate is 5–15%, occurring more commonly in the mandible than the maxilla and where radiation doses exceed 55Gy (although it can occur in irradiated fields of 30 Gy plus) [28]. Most cases are induced by secondary trauma (tooth extractions or trauma from dentures), but ORN can occur spontaneously in 10–35% of cases. On this basis, it is desirable to manage any dental diseases before radiation is administered. A multi-disciplinary team approach to head and neck cancer care is recommended for care planning prior to radiotherapy.

Radiotherapy causes a reduction in vascular supply known as 'endarteritis obliterans'. This renders the bone vulnerable to infection resulting in hypovascular and hypoxic conditions that jeopardise cellular activity, collagen formation and wound healing. Current understanding is guided primarily by the work of Delanian and Lefaix [29], who proposed the radiation-induced fibroatrophic (RIF) process. This is where free radical production leads to activation and/or deregulation of fibroblastic activity and decreased osteoblastic activity. Osteoclasts that resorb bone also suffer irradiation effects earlier than vascular alterations leading to suppression of bone turnover. There is also increased loss of attachment in the periodontium.

Risk Factors for ORN and ORN Prevention

The risk factors related to ORN are summarised in Table 7.6, informed by Owosho et al. [30]

Following radiotherapy, the risk of osteoradionecrosis is three times more likely in dentate patients in comparison to edentulous patients. This risk is more likely 6 months post-radiotherapy, and if more than five extractions are undertaken [31], so prevention of the need to undertake surgical procedures should be intensive and a part of the patient's holistic management. The history of radiation and other risk factors guides how treatment may be delivered. If extractions are indicated in tissue

Table 7.6 Risk factors for development of osteoradionecrosis

• Higher radiotherapy dose (>60 Gy)
• Dose fraction was large, with a high number of fractions
• Local trauma (e.g., tooth extraction, uncontrolled periodontal disease or an ill-fitting prosthesis)
• Immunodeficiency
• Malnourishment
• Poor oral hygiene
• Alcohol use
• Proximity of tumour to bone
• Primary site of the tumour (posterior mandible bone is compact and dense and therefore more commonly affected by osteoradionecrosis)
• State of dentition (active odontogenic and periodontal disease)

that has been in the field of a radiation dose above 60 Gy, preoperative and postoperative antibiotics are recommended for patients at risk of ORN [15]. If extractions are required in tissues that received no radiation or radiation below 60 Gy, antibiotics are not routinely required. There is no strong evidence for the use of chlorhexidine mouthwash or adrenaline free local anaesthesia to prevent ORN. Healing should be monitored for 2 months after extractions, and patients should be advised not to wear dentures during this healing period. Hyperbaric oxygen therapy (HBO) for prophylaxis of ORN has been advocated in irradiated patients undergoing dental extractions but is currently only recommended in research trials [32]. PENT-E or PENTOCLO (pentoxifylline, Vitamin E without or with clodronate) has also been a suggested therapy, given as a 4–6 weeks pre-extraction course to minimise the risk of osteoradionecrosis. Limited evidence is available to support the use of HBO or PENT-E, PENTOCLO in the prevention of osteoradionecrosis for post-radiotherapy extractions [29, 33, 34]. Such mediations and the necessary information regarding radiotherapy doses and sites may not be readily available for those in primary care services, so referral to specialist services to manage those at risk of ORN is not unreasonable.

Management of ORN

Management of osteoradionecrosis can be very challenging. Observation in the early stages can be adopted. However, there is a risk of progression and early simple surgical intervention in the form of sequestrectomy can be undertaken. In this procedure, necrotic bone is removed or drilled until bony bleeding appears, and local mucosal flaps are used to cover the bone defects. Conservative management (saline irrigation, analgesics, antibiotics) is more likely to cure in less severely affected cases. More extensive surgery is indicated where the jaw is more severely affected. Extensive lesions require aggressive resection and reconstruction. Pathological fractures are unlikely to heal and require excision of either side of the fracture and bone grafting. Surgical management of ORN should be undertaken in a specialist-led oral surgery unit or maxillo facial departments and is inappropriate for management in primary care.

Medication-Related Osteonecrosis of the Jaws (MRONJ)

Overview

MRONJ is defined as an area of exposed bone or bone that can be probed through an intra- or extra-oral fistula in the maxillofacial region that has persisted for more than 8 weeks, due to a history of current/previous treatment with anti-resorptive/anti-angiogenic medications, with no history of radiotherapy to the jaws and no obvious metastatic disease [35, 36]. This presentation was first observed in relation to bisphosphonates, yet a range of additional medications have been found to induce

Table 7.7 Drugs commonly associated with medication-related osteonecrosis of the jaw

Bisphosphonates	Alendronic acid Zoledronic acid Pamidronate Risedronate Clodronate Ibandronic acid
Tyrosine kinase inhibitors	Sunitinib Cabozantinib Imatinib Sorafenib Regorafenib Axitinib Pazopanib Dasatinib
Immunosuppressants	Methotrexate Corticosteroids Thalidomide Rituximab Adalimumab Ipilimumab Infliximab Romosozumab
Selective oestrogen modulator receptor	Raloxifene
Monoclonal antibodies	Denosumab Bevacizumab
Mammalian target of ramamycin	Sirolimus Temsirolimus Everolimus
Radiopharmaceuticals	Radium 223
Fusion proteins	Aflibercept

a similar clinical presentation. Drugs associated with MRONJ are summarised in Table 7.7. The risk of developing MRONJ varies based on the reason for taking medication and the type of medication being taken. Reported prevalence ranges from 0.001% to 0.01% in patients taking these medications for osteoporosis; this is only marginally higher than the incident in the wider population [37]. The incidence of MRONJ is similar for those taking bisphosphonate medications and denusomab [38], yet the incidence of MRONJ is much higher in patients with an oncological indication for their use, ranging from 1% to 15% [37]. The risk of spontaneous MRONJ for those on denosumab or zoledronate is approximately 1%, with the risk increasing with trauma such as from dental extractions or ill-fitting dentures [39]. Therefore, surgical, dental treatment can directly cause MRONJ to develop, meaning an understanding of the condition and its management is essential for those involved in the care of older people.

Each of the medications that can cause MRONJ functions differently, as discussed below, meaning the pathophysiology of MRONJ can vary depending on the causative agent. The pathophysiology of MRONJ is not definitely understood [40], and a range of mechanisms have been proposed to explain how MRONJ develops.

The alteration of typical bone homeostasis both due to medications and the conditions they aim to treat can impact the ability of bone to heal, reducing bone turnover and potentially impacting angiogenesis. There may be an association with oral microbes, yet this is unclear. Underlying medical conditions and the use of systemic steroids suggest there may be an immunological component to the condition's pathophysiology.

Bisphosphonates (BPs)

Bisphosphonates are used to manage many conditions where the bone is impacted, such as osteoporosis, bone disorders (Paget's disease, osteogenesis imperfect, fibrous dysplasia), prophylaxis to counteract osteoporotic effects of glucocorticoids or to prevent bone-related complications in primary hyperparathyroidism [41]. Bisphosphonates also have a role in preventing the metastatic spread of primary cancers (such as those of the breast, prostate or lung) and managing multiple myeloma. Many of these conditions are increasingly prevalent in the older population meaning older people may be at greater risk of developing MRONJ than younger patients. Bisphosphonates work by inhibition of osteoclast action, as well as impacting osteoblast function, osteocyte, macrophages, keratinocytes and angiogenesis. Bisphosphonates are not typically taken for more than 5 years, but if taken for over 5 years or with steroids, the risk of MRONJ is increased [39, 42].

Anti-resorptive Agents

Denosumab is the most commonly used anti-resorptive drug and works as a monoclonal IgG2 antibody against RANKL (receptor activator of nuclear factor kappa-B ligand), affecting osteoclast production. RANKL protein acts as the primary signal for bone removal by driving osteoclasts' proliferation and function, leading to reduced osteoclastic activity and reduced bone resorption, supporting an increase in bone density. Its use is indicated in osteoporosis patients and prevention of skeletal fracture in patients with bone metastases. Denosumab is given subcutaneously every 6 months (osteoporosis) or every 4 weeks (bone metastases). Denosumab does not bind to the bones, and the effects on osteoclast activity end 9 months after treatment [43].

Anti-angiogenic Drugs

Tyrosine kinase inhibitors are anti-angiogenic drugs that interfere with the formation of new blood vessels in the angiogenesis signalling cascade (via inhibition of vascular endothelial growth factor). As tumours induce their own vascular supply through angiogenic growth factors VEGF, these drugs suppress tumour growth. As one example, sunitinib is administered orally and licensed for use in advanced

metastatic renal cell carcinoma, metastatic malignant gastrointestinal tumours and metastatic pancreatic neuroendocrine tumours.

Diagnosing MRONJ

MRONJ can have a variable clinical presentation. Typical clinical findings can include exposed necrotic bone, loose teeth (not explained by periodontal disease), periapical fistula potentially with purulent discharge, swelling, oro-antral communication, pathological fractures, erythema of the overlying mucosa and paraesthesia.

Patients with suspected MRONJ may present with dull and aching bone pain not explained by an odontogenic cause (due to secondary infection and inflammation as dead bone is de-innervated) that may radiate to the TMJ, sinus pain associated with inflammation and thickening of the maxillary sinus wall and altered neurosensory function. When patients present with symptoms indicative of MRONJ, two-dimensional (or three-dimensional) imaging can aid diagnosis. Radiographic findings can include alveolar bone loss or resorption (in the absence of other diseases such as periodontal disease), changes to the trabecular pattern (for example, dense bone formation, no new bone in extraction sockets or regions of osteosclerosis), as well as subtle thickening of the lamina dura or narrowing of the periodontal ligament space. Staging systems exist to classify MRONJ based on the extent of the necrosis and presenting symptoms; these are summarised in separate sources [36]. Figure 7.6 shows an example of the radiographic appearance of MRONJ and the associated clinical presentation.

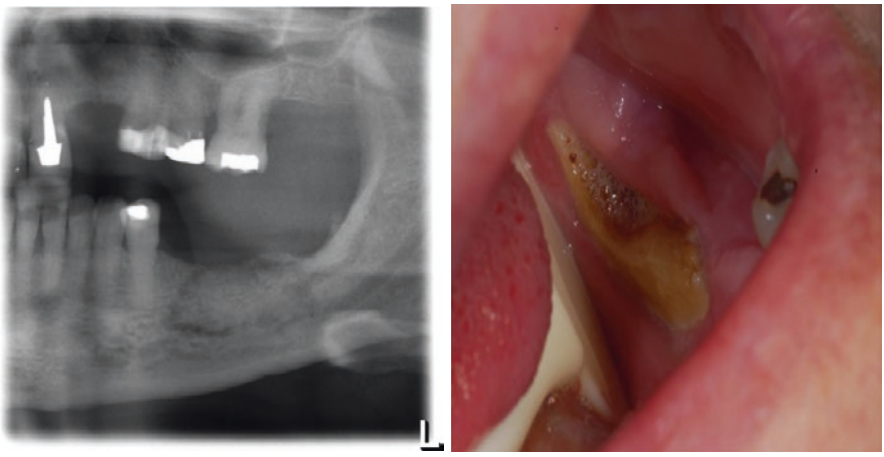

Fig. 7.6 Radiographic image (OPG) and clinical photograph of the same patient who had MRONJ in the left posterior mandible

Prevention and Management of MRONJ

Prevention of dental disease is key to reducing the risk of MRONJ in high-risk patients. If invasive dental procedures can be avoided, then the mandibular and maxillary bone can be left undisturbed. Comprehensives preventative advice and pre-bisphosphonate dental assessments are the cornerstones of preventing MRONJ, and these approaches strive to avoid complex treatments being required as patients age and have prolonged exposure to causative medications [40, 42]. If dental intervention is necessary, alternatives to extraction should be considered, such as root canal therapy or retaining and monitoring asymptomatic retained roots.

Where a dental extraction or other procedure affecting bone is indicated for a patient who is currently or has previously taken a medication related to MRONJ, a risk assessment is warranted as per Fig. 7.7. This should be based on a thorough

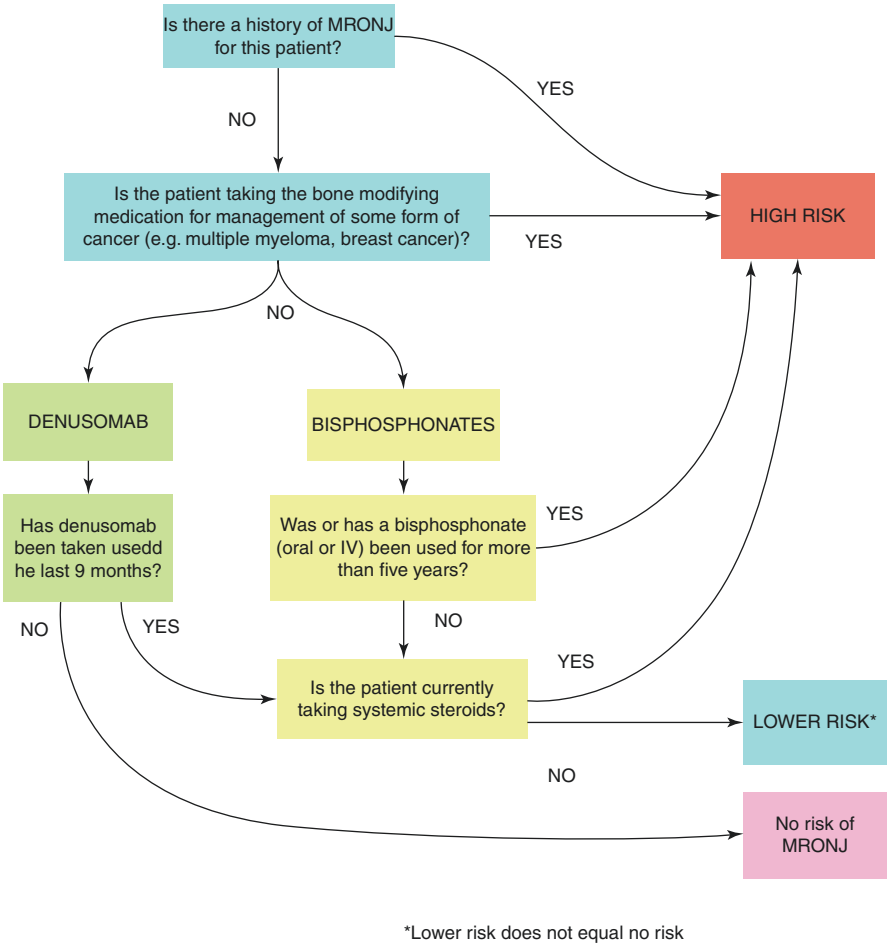

Fig. 7.7 Risk assessment for those who are currently taking drugs associated with MRONJ or have previously taken or been given these therapies

history of drug use, the reason for drugs being taken, the duration of their use and any related conditions' progress. Information may have to be sought from patients' general medical practitioners or oncology teams to support the process of risk assessment. In all instances, the necessity and alternatives to extractions should be considered. If extraction is indicated, no specific procedures or interventions are indicated, and there is no evidence to support the use of antibiotics or chlorhexidine mouth rinses to prevent MRONJ [42, 44].

An atraumatic approach should be employed where extractions are unavoidable, and the socket should be reviewed to determine healing. No specific preventative approach is available for high-risk cases. It may be appropriate to refer a patient to a secondary care setting if the conditions being managed by bisphosphonates or other MRONJ-related medications are associated with other medical concerns or where a practitioner is uncertain about the best way care should be approached. Informed consent from patients is crucial so they can understand the potential risks of MRONJ if they are at a high or lower risk of this and what the implications of MRONJ would be if this was to occur. Management of established MRONJ is in the remit of specialist oral surgery/maxillofacial teams and is outside of the scope of this chapter.

Temporomandibular Disorders

Temporomandibular disorders (TMD) are a group of broad clinical problems involving the muscles of mastication, the temporomandibular joint (TMJ), surrounding bony and soft tissue components [45].

TMD comprises acute and chronic diseases and can be classified into the following:

1. Muscle disorders
2. Disc disorders
3. Joint disorders

Degeneration of the TMJ and its function is the most significant factor in older age. Studies have shown an increasing prevalence of TMJ degeneration with advancing age [46, 47], particularly in patients over the age of 65. This can be seen radiographically in approximately 45–70% of people over 65 [48–50]. The clinical symptoms of TMJ degeneration can be minimal; however, most of those with more severe clinical symptoms find that it is self-limiting, resolving 5–8 years from diagnosis [51, 52]. Fifteen per cent of TMJ degeneration patients can experience ongoing progression of the disease process [52]. The aetiology is unknown, but it has been suggested that as ageing progresses, functional demands of the TMJ may exceed the repair and remodelling capacity of the joint resulting in degeneration [53].

It is unclear whether the incidence of muscle disorders related to the TMJ decreases or remains the same with advancing age [54–56]. In contrast, most studies have found that TMJ disc disorders decrease with advancing age [46]. In addition,

if disc displacement is found in older people, it is usually associated with TMJ degeneration [57].

Conservative treatments are usually recommended as first-line and consist of patient education, jaw exercises, massage, thermal therapy, dietary advice, parafunctional behaviour identification and monitoring [58]. Muscle relaxants and NSAIDs have also been shown to be effective in the relief of TMJ pain [59]. If these treatments are unsuccessful, TMJ arthrocentesis can be advocated [60, 61]. Total replacement of TMJ is the end-stage management of TMD, but this can be associated with morbidity and is generally avoided if possible [62].

Biopsy Procedures

Older people are more likely to present with a range of oral pathology where a biopsy may be indicated to establish a definitive histopathological diagnosis (as well as provide curative intent) and, in the case of premalignant or malignant conditions, can provide prognosis indicators. A biopsy can also facilitate the prescription of specific treatments or management strategies. Biopsy should only be undertaken after thorough history taking and clinical examination (inspection and palpation) that considers the affected anatomical site (ideally mapped), size, shape, colour, consistency and surface texture of a lesion of concern. This could also include clinical photography to support the medical records. Biopsies of potentially malignant or invasive conditions should not be performed in a primary care setting.

Dental clinicians in appropriate specialist services should consider biopsy of any lesion that persists for more than 2 weeks when there is no apparent aetiology. Equally, inflammatory conditions that do not respond to local treatment after 2 weeks or medical management, persistent hyperkeratotic changes, lesions that interfere with function, bone lesions not specifically identified by clinical or radiographic examination and any lesion characteristic of malignancy may require assessment and biopsy by oral surgery/maxillofacial departments. Such departments have access to additional equipment, diagnostic tools and surgical approaches that many primary care practitioners will not be able to utilise, meaning referral is typically appropriate.

Pre-prosthetic Surgery

Oral rehabilitation of older patients can be used to correct or improve the oral hard and soft tissues to provide suitable denture bearing areas or alveolar bone for fixed prostheses. The main aims of pre-prosthetic surgery are to prepare hard and soft tissues for a comfortable prosthesis that will restore oral function, aesthetics and facial form and contribute to optimal quality of life. Examples of pre-prosthetic procedures are removal of lingual tori (shown in Fig. 7.8) that can prevent the seating of a lower denture, frenectomy or removal of denture-related hyperplastic tissue. Pre-prosthetic surgery may be indicated where surgical management can

Fig. 7.8 Clinical photograph to show lingual tori which would impede a denture (courtesy of K Denhard)

feasibly improve the nature of the denture bearing area and offers an overall benefit that outweighs the risks of such surgery in older people.

Conclusion

Surgical management of the older patient should be planned and carried out after taking a thorough clinical and medical history. It may be necessary to liaise with medical colleagues to support the assessment process for further details on the patients' health. Treatment planning should be patient-centred, considering the patient's wishes as part of informed consent. In many instances, with increasing risks and comorbidities, the procedures and approaches used in younger or healthy patients may need to be reconsidered, and surgery should not be offered in all instances, particularly where the risks of intervention could adversely affect patients to a greater extent than their initial presenting complaints. Specialist teams are well placed to undertake more complex procedures or those associated with increased risk to patients oral or general well-being.

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Oral Medicine in Older People

8

Daniel J. Finn, Caroline E. McCarthy, and Bijaya P. Rajlawat

Learning Outcomes

- To review common oral infections, with a focus on the management of oral candidosis and viral infections.
- To understand common oromucosal diseases including inflammatory and autoimmune conditions, oral potentially malignant disorders and oral cancer.
- To review the aetiology of salivary gland dysfunction and the management of xerostomia.
- To appreciate the aetiology, clinical presentations and management of orofacial pain and dysaesthesia.

Introduction

Oral medicine is the practice of treating patients who suffer chronic, recurring or medically related illnesses of the mouth and face [1], which may be associated with an underlying systemic disease. Many of these conditions can negatively impact on a patient's quality of life, both in terms of physical and psychological effects. The prevalence of such conditions is known to be higher in older people, and management often involves a multidisciplinary approach, requiring input from

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various medical and dental specialities. Given the geographic variation in oral medicine service provision, dental professionals should be familiar with local arrangements and referral guidelines.

This chapter will focus on oral diseases that are the most common and potentially significant in older people, highlighting key learning points for the dental professional. Discussion regarding benign conditions or variants of normal anatomy such as sublingual varices, amalgam tattoos, coated/hairy tongue, leukoedema or fissured tongue can be found in other relevant texts.

Oromucosal Disease

This section will provide an overview of the common infections of the oral mucosa, oral ulceration and mucocutaneous diseases. Oral epithelial dysplasia, actinic keratosis and oral cancer will also be considered.

Infections

Oral Candidosis

Candida species are a group of commensal organisms found in the normal oral flora of approximately 50% of the population [2]. An imbalance in host defences may lead to opportunistic overgrowth (candidosis), with this being found in 47% of older, hospitalised patients [3]. Many species of *Candida* are found in the mouth, the most common being *Candida albicans.* The presence of oral candidosis may be the first manifestation of an underlying disease and is aptly described as 'a disease of the diseased'. Some of the factors that predispose an individual to oral candidosis are shown in Fig. 8.1.

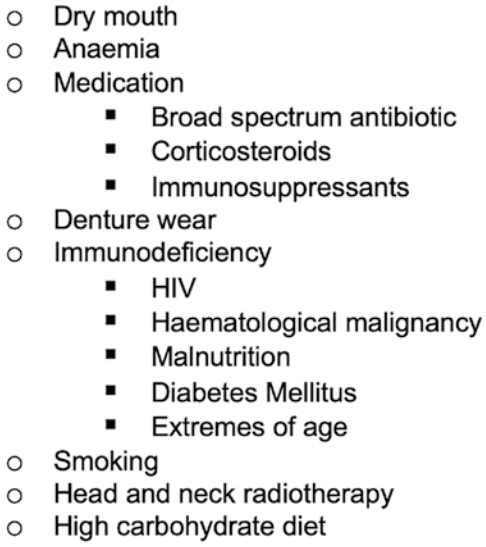

Fig. 8.1 Predisposing factors for oral candidosis

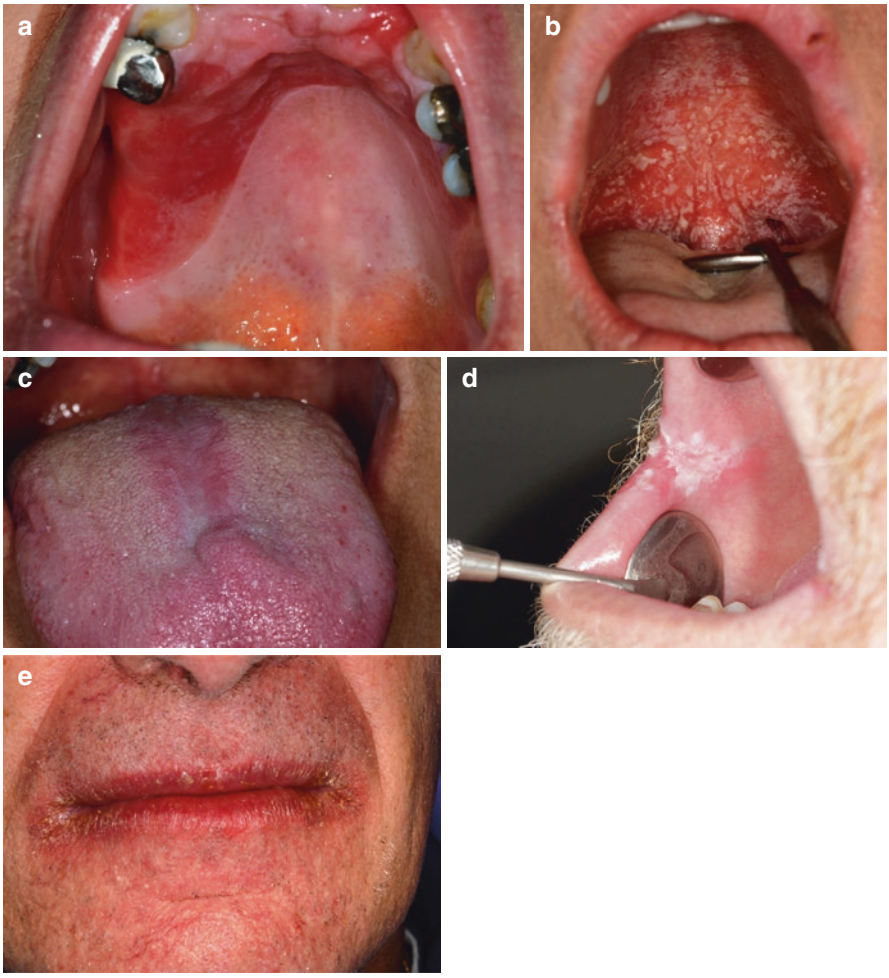

Fig. 8.2 (**a**) Erythematous Candidosis—a well-defined area of erythema of the denture bearing surface. (**b**) Pseudomembranous Candidosis (**c**) Median Rhomboid Glossitis; a depapillated erythematous patch centrally on the dorsal surface of the tongue. (**d**) Chronic Hyperplastic Candidosis; a white plaque is seen at the inner commissure. (**e**) Angular Cheilitis—cracking and crusting at the commissures suggestive of involvement of *Staphylococcal spp*.

Common Manifestations of Oral Candidosis

- Erythematous Candidosis presents as areas of oromucosal erythema and pain. Predisposing factors include denture wear, haematinic deficiencies, broad-spectrum antibiotics, corticosteroids and HIV infection (see Fig. 8.2a).
- Pseudomembranous Candidosis (commonly known as thrush) manifests as white-cream coloured patches which wipe away easily, leaving an erythematous base (see Fig. 8.2b).
- Median Rhomboid glossitis manifests as an area of depapillation affecting the central dorsal tongue which may sometimes have a nodular appearance (see Fig. 8.2c).

- Chronic Hyperplastic Candidosis (Fig. 8.2d) presents as a mixed red and white patch, most commonly seen inside the commissures and tongue. Chronic hyperplastic candidosis occurs when candidal hyphae penetrate the oral epithelium. It is almost exclusively seen in smokers.
- Angular cheilitis presents as erythema and fissuring at the angles of the mouth and is caused by infected saliva colonising the oral commissures (see Fig. 8.2e). Whilst the offending organism is often *Candida*, infection from other organisms, e.g. *Staphylococcus aureus,* may occur, often presenting with yellow crusting, as seen in Fig. 8.2e. Factors predisposing to angular cheilitis include anaemia and haematinic deficiency. A loss of occlusal vertical dimension and lip support in denture wearing patients can also be a contributory factor.

Management

The treatment of oral candidosis should include *correction of predisposing factors* and *management of the infection:*

The underlying cause for oral candidosis may be established by undertaking a thorough history and examination.

Identify and Correct Predisposing Factors

- Optimise denture hygiene: Dentures should not be worn at night and should be appropriately cleaned.
- Ensure good denture fit where possible, with a correct occlusal vertical dimension to ensure adequate lip support.
- Patients who use corticosteroid inhalers should rinse their mouth with water after use and consider a spacer device if available.
- Advise smoking cessation.
- If no obvious cause is found, patients may require further investigations to exclude underlying causes, including anaemia, haematinic deficiency, diabetes mellitus or immunosuppression. Such investigations may include a full blood count (FBC), serum B12 and folate, ferritin, HbA1c and a HIV test.

Treating Infection

Topical antifungals are often the first-line therapy for oral candidosis and can be prescribed according to the British National Formulary (BNF). Examples include nystatin oral suspension or miconazole oromucosal gel. Angular cheilitis may require additional topical treatment, e.g. miconazole and hydrocortisone ointment. The presence of an overlying golden crust may indicate secondary infection with *Staphylococcus aureus.* In this instance, fusidic acid ointment may be appropriate. A microbiological swab taken for culture and sensitivity can help guide the choice of antimicrobial therapy. Lack of response to topical treatments may necessitate the need for systemic antifungals, e.g. fluconazole. Prescribers should check for drug interactions when prescribing azole antifungals, including topical preparations.

Fig. 8.3 Unilateral ulceration of the hard palate in keeping with intraoral HSV infection

Herpes Simplex

Primary herpes simplex 1 (HSV1) infection commonly occurs during early childhood, manifesting as primary herpetic gingivostomatitis. Following this, the virus lies dormant in the trigeminal nerve ganglion but may become reactivated in some individuals, often triggered by sunlight, concurrent illness or immunosuppression. This most commonly manifests as herpes labialis (cold sores). However, in some individuals, lesions develop intra-orally, characterised by clusters of small ulcers, commonly within the keratinised mucosa of the hard palate or gingivae, along the distribution of a sensory nerve (Fig. 8.3). Immunocompromised patients may develop more severe disease more akin to primary infection, with systemic features and the potential to progress to disseminated disease. Such features should prompt investigation for underlying immunosuppression and systemic antiviral treatment, with long-term prophylactic antiviral doses thereafter.

Herpes Zoster (Shingles)

Primary infection with varicella-zoster virus (VZV) tends to occur in early childhood, manifesting as chickenpox. The virus then lies dormant in sensory nerve ganglia and may reactivate later in life, leading to herpes zoster/shingles. The condition is more likely to occur with immunosuppression but has the highest incidence in older people [4]. Herpes zoster is characterised by a vesicular rash in a dermatomal distribution with associated pain. It most commonly affects the trunk but can involve facial dermatomes due to the virus affecting the trigeminal nerve. Involvement of the ophthalmic branch signifies potential corneal involvement which risks blindness. In such cases, the rash may also affect the tip of the nose due to the involvement of the nasociliary nerve (Hutchinson's sign). Management involves antiviral treatments such as aciclovir. Patients may develop persistent pain in the affected dermatome, known as post-herpetic neuralgia. Ramsey Hunt syndrome, which occurs more commonly in older people, manifests as a vesicular rash involving the external auditory canal, facial palsy and unilateral taste loss secondary to VZV infection of the geniculate ganglion. A vaccine for Shingles is available in the UK for people aged 70–79 years old but is not available over 80 as the vaccine is less effective [5].

Oral Ulceration

Oral ulceration may occur for many reasons; however, some of these causes are more common in older people and are explored in greater detail in the following sections.

Traumatic Ulceration

Local causes of ulceration include sharp teeth or ill-fitting dentures. Traumatic ulcers often present as a well-defined lesion with a white, keratotic border (see Fig. 8.4). The cause of the trauma should be addressed, and the area reviewed within 2 weeks to ensure healing. Clinicians should avoid using topical anaesthetics or corticosteroids which may exacerbate trauma or prevent healing.

Medication-Induced Ulceration

Medications commonly implicated in oral ulceration include methotrexate, nicorandil and oral bisphosphonates. Dental professionals should be aware of this potential side effect and liaise with the patient's general medical practitioner should this be suspected. Figure 8.5 shows a patient with oral ulceration secondary to alendronic acid. This patient had dementia and due to swallowing difficulties developed oral ulceration secondary to the alendronic acid tablet being retained in the mouth.

Recurrent Aphthous Ulceration

Aphthous ulcers are more commonly seen in younger people. New onset of recurrent aphthous ulceration in older adults is unusual and should prompt investigation for underlying causes such as anaemia, neutropenia, haematinic deficiency or coeliac disease. This is not an exhaustive list.

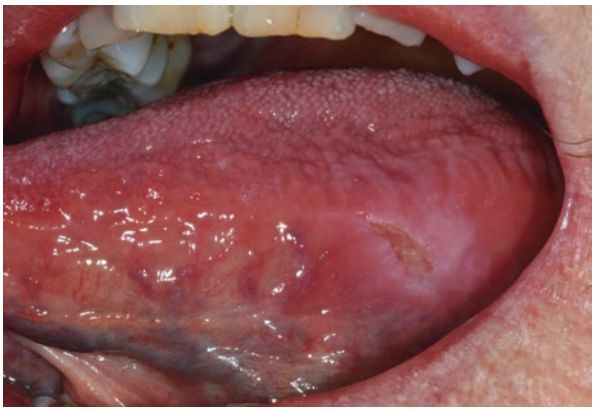

Fig. 8.4 Traumatic ulcer left lateral ventral tongue, showing a classic keratotic border

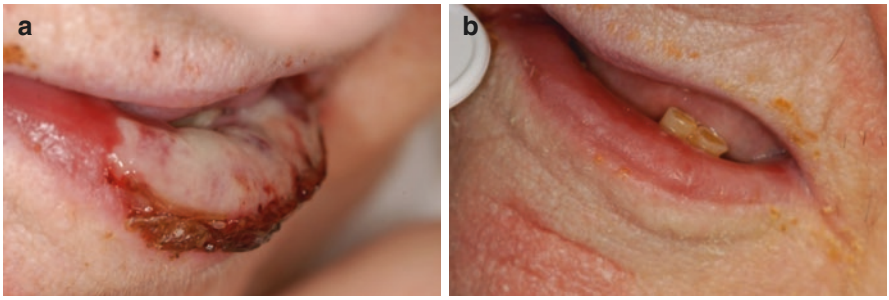

Fig. 8.5 (**a**) 81-year-old patient with oral ulceration secondary to alendronic acid. On examination, it was noted that the patient held their head to the left and saliva pooled in this area. (**b**) Complete healing of the area of ulceration 1 month following drug cessation

Oral Lichen Planus

Oral Lichen Planus is a mucocutaneous condition that affects the oral mucosa. The more generalised condition of lichen planus is a skin condition that can affect any part of the skin, the anogenital mucosa, the scalp and the nails. 50% of patients with cutaneous lichen planus will have oral involvement, whereas only 15% of patients with pre-existing oral lichen planus (OLP) also have skin involvement [6]. Patients with OLP should be questioned regarding any extra-oral symptoms related to the condition. It is a common condition, estimated to affect around 1–2% of the population [7]. Females aged >50 are most at risk, but the disease commonly presents between 30 and 60 years.

Presentation

Patients often complain of a sore mouth, with pain after eating spicy or citrus foods. There may be superimposed candida infection, which can worsen symptoms and patients may report a burning sensation or altered taste (see Infections: Oral Candidosis). Depending on the subtype of lichen planus (see below), patients may also describe episodes of painful ulceration affecting any area of the oral mucosa. Patients may complain of red, sore, bleeding gums and may clinically have desquamative gingivitis (see Fig. 8.6a). Desquamative gingivitis is not exclusively associated with oral lichen planus and can also be associated with conditions such as oral mucous membrane pemphigoid and oral pemphigus.

Diagnosis

A diagnosis of OLP is made based on clinical and histological features. However, in some cases, the clinical appearance alone is sufficient to confirm the diagnosis. The presence of bilateral reticular striated lesions is a prerequisite for the diagnosis of OLP. However, subtypes exist, including plaque-like, atrophic, erosive and bullous oral lichen planus (see Fig. 8.6).

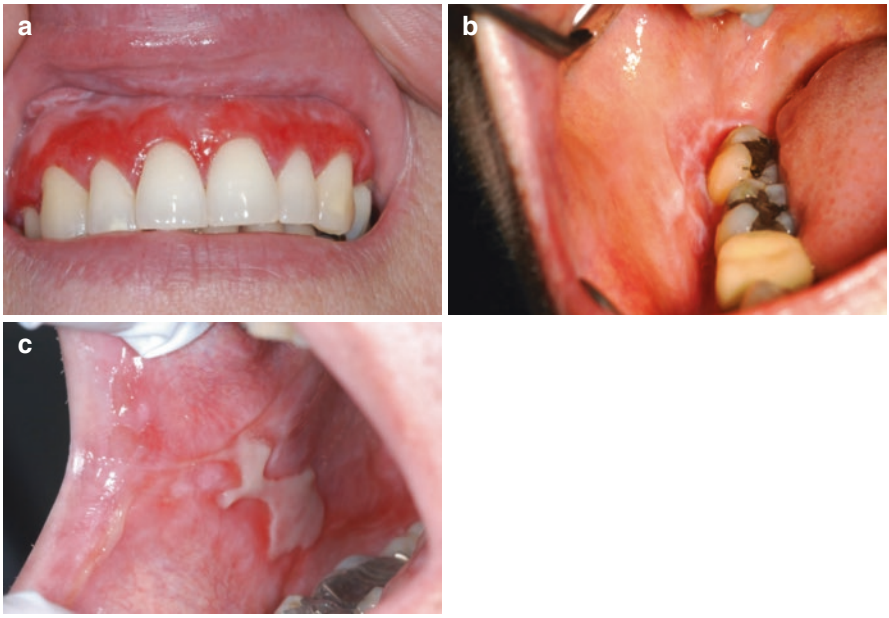

Fig. 8.6 Oral lichen planus. (**a**) desquamative gingivitis, (**b**) reticular OLP in the right buccal sulcus, (**c**) erosive OLP of the right buccal mucosa

Biopsy and histopathological examination can be offered for all suspected cases of OLP but should definitely be considered in cases where subtypes other than reticular OLP are present. The aim of histopathological examination is to look for evidence of oral dysplasia which would inform future management decisions and follow-up intervals. The classic histological appearance includes a hyperkeratotic epithelium with a saw-tooth rete ridge and a sub-epithelial band-like lymphocytic infiltrate.

Potentially Malignant Nature of OLP

OLP is an oral potentially malignant disorder (OPMD); however, the risk of oral cancer development is low. A meta-analysis in 2020 reported a malignant transformation rate of 1%, although the true figure could be lower [8]. If 1% of all patients with OLP developed OSCC, one would expect a vastly increased prevalence of oral cancer. However, vigilance is required and patients should be made aware of the (low) risk of oral cancer development and encouraged to report any red flag symptoms as shown in Table 8.2.

Management

Management of OLP aims to alleviate discomfort and allow oral intake to continue. Initial management would include pain relief using Benzydamine 0.15% mouthwash and prevention of infection using 0.2% Chlorhexidine mouthwash, if tolerated. Topical anaesthetics, for example, Xylocaine spray, can also be suggested.

Barrier pastes, such as Orabase paste, can be helpful for some patients. Topical hyaluronic acid gel or mouthwash aims to promote healing and can also provide a barrier effect.

Topical corticosteroids form the mainstay of treatment for most patients with symptomatic OLP. The aim is to reduce inflammation, improve symptoms and hasten healing time. Betamethasone 500 μg soluble tablets, used as a mouthwash, or Beclometasone 50 μg spray are often used as first-line treatments. The BNF should be consulted for up to date dosing and prescription advice. A mouthwash is more suitable for widespread or difficult to reach areas, whereas a spray is best suited to isolated lesions. Toothpaste containing sodium lauryl sulphate (SLS) and mint flavouring can also irritate the mucosa in patients with OLP, and alternatives without SLS can be used if desired.

Patients with disease that is resistant to first-line topical treatments can be offered alternative off-label topical corticosteroids or systemic therapies by specialists in secondary care. This may include short courses of systemic corticosteroids and steroid-sparing agents such as hydroxychloroquine, methotrexate or azathioprine.

OLP often follows a protracted disease course. Some cases do appear to 'burn out' after a period of several years. In severe and chronic cases, scarring of the buccal mucosa and subsequent reduced mouth opening can occur. Dental professionals should remain vigilant for signs of malignant transformation, as described above.

Oral Lichenoid Reactions

Oral lichenoid reactions are typically associated with medications or with contact to substances such as dental amalgam.

Lichenoid drug reactions (LDRs) to medications appear identical to idiopathic lichen planus; however, the underlying cause is known to be a medication taken by the patient. The period between starting the drug and the reaction occurring can vary from 1–2 months to 2 years. Medications most commonly associated with a lichenoid drug eruption are shown in Table 8.1. If the drug can be safely and appropriately substituted for an alternative, this can be considered by the patient's General Medical Practitioner (GMP). Lesion resolution may take months or years and may not be complete. The management of oral lesions is otherwise the same as for idiopathic lichen planus.

Oral lichenoid reactions can also be associated with dental materials, particularly amalgam and mercury in dental restorations and are known as *oral lichenoid contact reactions* (see Fig. 8.7).

These represent a type IV (delayed) hypersensitivity reaction and may occur months or years after placement of the restoration. The reaction may also occur due to the

Table 8.1 Medications associated with lichenoid drug eruptions

Allopurinol	Anti-hypertensives
NSAIDs	Gold salts
Antimalarials	Penicillamine
Tricyclic antidepressants	Methyldopa
Hypoglycaemics	Anti-retrovirals

Fig. 8.7 Oral lichenoid contact reaction to dental amalgam restoration in the lower left first molar. An area of patchy leukoplakia is seen on the left buccal mucosa adjacent to the large occluso-buccal restoration. At rest, this lesion would be in direct contact with the amalgam restoration

dental amalgam acting as an irritant to the mucosa. In both situations, there is a clear anatomical relationship to the amalgam restoration, with direct contact of the mucosa at rest. Therefore, depending on the distribution of amalgam restorations around the mouth, lesions may be unilateral, in contrast to the bilateral nature of OLP. Patch testing to confirm contact sensitivity may be of value in selected cases. Lichenoid contact reactions associated with an amalgam restoration have been seen to completely resolve when contact between the offending restoration and the lesion is removed [9]; this can be achieved by replacing the amalgam with a suitable alternative or covering the restoration with a crown. These options should be discussed with the patient and amalgam restorations should then be avoided in future. Rarely, patients may also develop oral lichenoid contact reactions to composite and gold restorations.

Other conditions that may mimic OLP include graft versus host disease (GvHD), discoid lupus erythematosus (DLE) and systemic lupus erythematosus (SLE). Oral GvHD is classified as an OPMD and patients should be followed up to monitor for signs of malignant transformation [10].

Immunobullous Diseases

Mucous Membrane Pemphigoid

The term mucous membrane pemphigoid (MMP) encompasses a heterogeneous group of conditions characterised by the development of subepithelial bullae at various mucosal sites due to autoantibodies directed towards various components of the basement membrane zone. The clinical presentation is variable and may affect multiple mucosal sites, including the mouth, conjunctiva, larynx, pharynx, anogenital area and the skin. Cicatrisation (scarring) is more common at certain 'high-risk' sites as shown in Fig. 8.8.

MMP is more commonly seen in older people with an average age of onset of 65 years [11].

Oral manifestations commonly include desquamative gingivitis (see Fig. 8.9), vesicles or bullae and erosive lesions. Sites commonly affected include the gingivae,

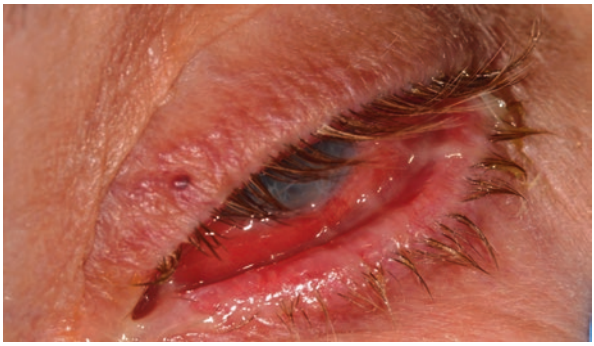

Fig. 8.8 Mucous membrane pemphigoid with ocular involvement. Note symblepharon formation: adhesion of palpebral (eyelid) and bulbar (eyeball) conjunctiva

Fig. 8.9 Mucous Membrane Pemphigoid: widespread desquamative gingivitis and ulceration

palate and buccal mucosa. The tongue is rarely involved. Applying pressure to the mucosa may produce a lesion (Nikolsky sign).

A diagnosis is made by clinical appearance coupled with routine biopsy and immunofluorescence studies.

The severity of the condition varies widely. Whilst some patients may only display features of mild desquamative gingivitis with minimal impact on quality of life, others will experience more aggressive disease. Oral lesions may be widespread, significantly impacting on the ability to eat. Involvement of high-risk sites, such as the conjunctiva, can lead to the deterioration or complete loss of vision.

The management of MMP often requires a multidisciplinary approach, with input from ophthalmology, ENT and dermatology. For oral disease, mild forms may be managed effectively with topical corticosteroids. Patients with severe disease involving high-risk sites may require escalation of treatment to therapies such as Mycophenolate Mofetil, Dapsone, Cyclophosphamide, intravenous immunoglobulin or Rituximab.

Pemphigus Vulgaris

Pemphigus vulgaris (PV) is an immunobullous disease that occurs due to autoantibodies towards desmoglein 1 and 3, proteins that form intercellular connections within the epithelium. This leads to the formation of intraepithelial vesicles and bullae with subsequent loss of surface epithelium from mucous membranes (and

epidermis from skin). On average, the condition occurs earlier in life than MMP, with a peak age of onset between 45 and 65 years old [12]. The condition commonly affects the oral mucosa, skin and other sites, including genitalia, pharynx, nasal mucosa and eyes. Oral lesions manifest as ragged, superficial ulceration; vesicles may be present but rupture quickly. Small areas of petechiae are a common finding. Desquamative gingivitis may also be present. Prior to corticosteroids, the condition was often fatal due to disseminated infection of affected skin. Diagnosis involves the use of routine biopsy and immunofluorescence studies. Initial treatment is with systemic corticosteroids to gain disease control and is then replaced with steroid-sparing agents such as Mycophenolate mofetil, Azathioprine or Rituximab.

Oral Epithelial Dysplasia

Oral epithelial dysplasia is an oral potentially malignant disorder, with progression to oral cancer in 12% of cases [13]. The clinical presentation is usually a white or red patch on the oral mucosa (see Fig. 8.10).

Referral to secondary care is required for an incisional biopsy to confirm the histopathological diagnosis. OED can be graded using the WHO grading system of mild, moderate or severe OED. Higher grades of dysplasia are associated with a greater risk of oral cancer development. Likewise, larger lesions, speckled lesions and lesions of the lateral tongue or floor of the mouth are at greater risk of malignant transformation.

Oral cancer development occurs in a mean time of 36 months following diagnosis [14]. This demonstrates the need for long-term surveillance in primary or secondary care.

The aim of management is to prevent the development of cancer, or in cases where cancer does develop, to detect this at the earliest possible stage, when treatment is likely to be most effective. Despite several studies exploring the use of non-surgical treatments (chemopreventive agents) in OED, none has been found to be effective to date [15]. Therefore, the options for management are limited to close

Fig. 8.10 Homogenous leukoplakia left lateral tongue with evidence of moderate oral epithelial dysplasia on histopathological examination. Note the subtle speckled area at the posterior aspect of the lesion

clinical surveillance or surgical excision [16]. Close clinical surveillance usually involves oral examination at intervals not greater than 6 months, with a re-biopsy in the event of a change in the appearance of the lesion that suggests disease progression [17]. Red flags that may indicate progression and warrant further investigation are shown in Table 8.2.

GDPs form an important part of the multidisciplinary team in caring for patients with OED. Patients must attend regular dental visits, where disease progression may be detected and the appropriate specialist informed. These visits also provide an opportunity for risk reduction advice, such as discussions around tobacco cessation and limiting alcohol use.

Actinic Keratosis (Solar Keratosis)

Actinic keratosis (AK), also known as solar keratosis, are keratotic lesions which develop on sun-exposed areas of skin as a rough, scaly patch (macule, papule or plaque)—see Fig. 8.11. Surrounding hyperpigmentation, telangiectasias and solar elastosis may provide clues to the underlying aetiology related to sun damage. AK is most common amongst older, Caucasian and immunocompromised individuals and around 70% are in the head and neck region [18]. Prevalence is reported to be between 25% and 50% in patients aged over 70 years and incidence increases with age [19, 20]. Cumulative sun exposure is the most important risk factor and patients should be questioned about previous sunburn and sun exposure, for example, an outdoor occupation. Some lesions spontaneously regress; however, there is an increased risk of skin cancers in patients with multiple AKs. Referral to secondary care is advisable to confirm a diagnosis and any necessary management. Patients should be advised on the use of appropriate sun

Table 8.2 'Red Flag' signs associated with oral cancer development in OED

Persistent oral ulceration (>2 weeks)	New area of persistent redness
Increasing size of lesion	New area of pain or swelling
Increasing thickness of lesion	New and persistent neck lump
Bleeding on contact with the lesion	New onset of paraesthesia

Fig. 8.11 Actinic keratosis of the lower lip

protection. Management options include emollients, topical treatments (e.g. 5-fluorouracil, imiquimod, diclofenac), cryosurgery (liquid nitrogen therapy), surgical intervention and photodynamic therapy [21]. Patients should be encouraged to self-examine and advised to report any signs of malignant transformation of an AK, including bleeding, new onset of pain, significant growth of lesion or if the lesion becomes protuberant.

Oral Submucous Fibrosis

Oral submucous fibrosis (OSMF) is 'a chronic, insidious disease that affects the oral mucosa, initially resulting in loss of fibroelasticity of the lamina propria and, as the disease advances, fibrosis of the lamina propria and the submucosa of the oral cavity along with epithelial atrophy' [10]. Malignant transformation is observed in between 2% and 9% of cases [22]. The risk is higher if there is a concomitant presence of oral leukoplakia [23] and therefore, patients require close review.

The prevalence is highest in South and South-East Asia, with up to 4% of the population affected [24]. This is primarily due to the higher prevalence of areca nut chewing in this part of the world. The main causative agent is Areca nut and its derivatives (Gutkha, Pan masala, mawa, betel quid). Other factors such as chewing smokeless tobacco, nutritional deficiencies and genetic predisposition also increase the risk of developing OSMF. It mainly presents between the ages of 20 and 60 years [24] and is a progressive and unremitting disease, which will therefore also be seen in the older population, possibly at an advanced stage.

The clinical symptoms in early disease include mucosal inflammation, excessive salivation, burning sensation, blanching of the oral mucosa, presence of thin palpable fibrous bands and areas of brown/black pigmentation. The fibrous bands become more significant as the disease progresses, resulting in reduced mouth opening, with prominent, hypertrophic and stiff masseter muscles, restricted tongue movement, sunken cheeks and shrunken or deformed uvula. Ankylosis of the temporomandibular joint, loss of the nasolabial fold and progressive dystonia and hearing loss may also be seen [24]. Several treatment strategies exist but there is no strong evidence for any individual approach. Anti-oxidant therapies including micronutrient therapies [25], intra-lesional steroids [26], colchicine, hyaluronidase, ultrasound and physiotherapy and surgery using various protocols have shown promise in some reports; however, this remains a disease that progresses despite treatment in most cases [24, 27, 28]. Primary prevention at the individual and population level to minimise and ultimately eradicate areca nut use is of utmost importance [24].

Oral Cancer

Oral cancer belongs to a group of cancers known as head and neck cancers (HNC). It arises on the lining of the mouth or lips and over 90% are squamous cell carcinomas.

Risk Factors for Oral Cancer

Age is a well-established risk factor for the disease, with greater than 60% of cases of HNC occurring in patients aged over 60 years [29]. Around three-quarters of oral cancers are caused by tobacco or alcohol, either alone or in combination [30]. The risk increases with increasing frequency and duration of smoking and an increasing quantity of alcohol. Table 8.3 shows other risk factors for oral cancer.

Human papillomavirus has emerged as an important risk factor for oropharyngeal cancer; however, this is less prevalent in oral cancers [31]. It is hoped that introducing a vaccination programme for both boys and girls in the UK will see a marked reduction in the number of cases of HPV-related cancers in the next 30 years.

Presentation

Oral cancer usually presents as a painless ulcer on the lining of the mouth, with the lateral tongue and floor of the mouth as the most common sites. It may also arise within a red or white patch or lump on the oral mucosa (see Fig. 8.12). Other signs and symptoms associated with oral and other HNCs are shown in Table 8.4. An urgent referral to an appropriate specialist should be arranged as per national guidelines.

Table 8.3 Risk factors for oral cancer

Male gender	Increasing age
Smoking tobacco	Lower socio-economic status
Alcohol	Smokeless tobacco (betel quid: Pan/areca nut)
Diet low in fruit and vegetables	Human papillomavirus (particularly for oropharyngeal cancers)
Lack of exercise	Sun exposure (for lip cancers)
Immunosuppression	Inherited cancer syndromes, e.g. Fanconi anaemia, Bloom's

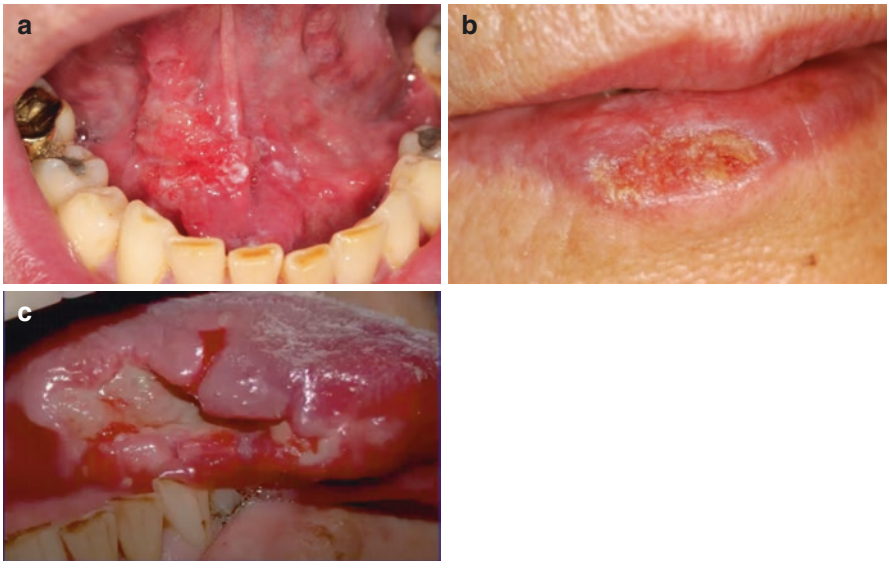

Fig. 8.12 Oral cancer. (**a**) An erythematous ulcerated mass on the floor of mouth. (**b**) A non-healing ulcer on the lower lip. (**c**) An ulcerative mass on the right lateral tongue

Table 8.4 Signs and symptoms of head and neck cancers

Non-healing ulcer (>3 weeks)	Dysphagia
Mucosal swelling/lump	Halitosis
Neck lump	Unexplained numbness
Weight loss	Unexplained pain
Red or red and white patch of the oral mucosa	Trismus

The National Institute for Health and Care Excellence (NICE) and Cancer Research UK (CRUK) have produced guidelines for healthcare professionals on the referral of suspected oral cancers, with which all relevant health professionals should be familiar [32, 33].

Diagnosis and Staging

Patients with lesions suspicious for oral cancer will usually undergo incisional biopsy under local anaesthetic in a secondary care setting. If cancer is confirmed, a series of investigations and scans are required to stage the disease (TNM classification) based on size, nodal spread and distant metastases.

Management

All patients with oral cancer require the input of a multidisciplinary team and the British Association of Head and Neck Oncologists have published guidelines on the management of HNC [34]. In favourable cases, patients are offered surgery with the aim of excising the entire tumour with a surrounding margin of normal tissue, with reconstruction to maintain function. In most cases, an elective neck dissection is performed at the same time to remove any pathological lymph nodes; this is recommended even in the absence of evidence of neck disease on scans, as 20–30% of neck dissections contain evidence of occult disease when assessed histopathologically [35]. Elective, as opposed to therapeutic, neck dissection has been shown to improve overall and disease-free survival. Patients with evidence of disease spread may be managed with radiotherapy and/or chemotherapy and immunotherapy. Oral rehabilitation is an important aspect of managing oral cancer and requires the input of relevant specialists before treatment begins to stabilise the dentition and instigate appropriate preventive strategies. General dental practitioners, dental therapists and hygienists have an important role in supporting prevention regimes and in the management of xerostomia and mucositis.

Morbidity and Mortality

The morbidity associated with oral cancer treatment can be significant and is also related to the stage at diagnosis. Smaller cancers, treated with local excision without the need for reconstructive surgery and adjuvant treatments, often present fewer long-term problems. Treatment for larger, more advanced tumours can lead to problems with speech and eating. Patients managed with radiotherapy can experience debilitating oral mucositis and xerostomia. There can also be a profound effect on mental health.

Despite advances in treatments, mortality rates for oral cancer have remained static over several decades. 2-year survival rates for stage I tumours are around 85% but this drops sharply to 40% for stage IV tumours [34]. Lymph node involvement (particularly extra-capsular spread of disease) and presence of cancer at surgical excision margins are indicators of poor prognosis [36] [37]. Patients over 75 years have significantly worse disease-free survival rates following treatment for oral cancer. They are at over three times at greater risk of dying from the disease than patients aged less than 55 years [37]. Rates of recurrence and second primary tumours are high and dental professionals should remain vigilant in examining the head and neck region for signs of recurrence or new disease at follow-up appointments.

Salivary Gland Disease

This section will consider the common presentation of dry mouth, the possible underlying causes, including Sjogren's Syndrome and the importance of appropriate management in primary care. Salivary gland infections are covered briefly, along with sialorrhoea, which is commonly encountered in older patients with neurodegenerative disease.

Dry Mouth

Saliva performs many essential functions in maintaining a healthy oral environment. These include lubrication, digestion, maintaining oral pH and facilitating gustation. The sensation of dry mouth (xerostomia) is a common complaint amongst older people. However, it is important to note that this may or may not be associated with reduced salivary flow rates as patients may have a subjective sensation of dry mouth with clinically normal salivary flow.

A dry mouth may significantly impact a patient's quality of life and may inhibit many daily functions such as eating, deglutition, speaking and denture wear. In addition, other sequelae such as dental caries or candidosis may result in pain and discomfort. With this in mind, it is important to investigate and where possible correct the causes of dry mouth. The overall strategy should be introducing a care programme to maintain oral health.

Epidemiology

Whilst it is difficult to ascertain the prevalence of dry mouth within the population, estimates suggest the prevalence of dry mouth in older people is between 15% and 23%, rising to 17–60% in older people in the hospital setting [38]. It is important to note that increasing age is not a known cause for dry mouth but rather a risk indicator. Older patients are significantly more likely to have other risk factors for dry mouth, particularly medication.

Table 8.5 Examples of xerogenic medications

Drug class	Examples
Antidepressants	Amitriptyline, citalopram
Diuretics	Furosemide
Anti-cholinergics	Hyoscine, solifenacin, oxybutynin
Anti-hypertensives	ACE inhibitors, beta-blockers
Antipsychotics	Aripiprazole, olanzapine

Causes of Dry Mouth

- *Medication:* The most common cause of dry mouth is medication and the risk of dry mouth increases with the number of medications taken. There are over 400 different medications known to cause dry mouth [39]. Some examples of these are listed in Table 8.5.
- *Diabetes mellitus*
- *Sjogren's syndrome*
- *Dehydration*
- *Head and neck radiotherapy*
- *Psychogenic causes*—anxiety, depression

Clinical Features

- Frothy or thick/mucousy saliva
- Sensation of dry mouth and oral discomfort
- Difficulty swallowing food without drinking additional liquid
- Smooth, glazed mucosa
- Lack of saliva pooling in the floor of mouth
- Cracked, fissured tongue
- The dental mirror sticking to the mucosa
- Poor oral clearance with debris adhered to oral mucosa
- Dental caries—particularly at 'high-risk' sites such as the cervical margins

Investigations in Secondary Care

- Sialometry: Low unstimulated whole saliva flow is defined as <0.2 ml per minute. Measurement of stimulated salivary flow rates may help to guide management as patients with residual salivary function may benefit from sialogogues.
- Further investigations for systemic causes of salivary gland hypofunction such as diabetes mellitus, Sjogren's syndrome or renal failure may be undertaken.

Management

Patients should maintain hydration by ensuring adequate fluid intake and ensuring cariogenic substances are minimised. A variety of products to provide symptomatic relief are available; however, their effects tend to be short-lived and patients may need to trial several options to find the most suitable product for them. Saliva replacement sprays or gels may be most helpful for patients with little or no stimulated saliva flow. For those with some remaining salivary gland function, sialagogues (salivary stimulants) may be effective. These may be in the form of pastilles which are sucked to

stimulate salivation through gustatory reflexes. Alternatively, Pilocarpine, a muscarinic agonist, may be prescribed to stimulate salivary flow. However, common side effects include increased sweating, flushing and palpitations and should be used with caution in patients with uncontrolled cardiovascular or respiratory disease.

Patients with symptoms suggestive of Sjogren's syndrome (see below) or with severe xerostomia and no obvious underlying cause should be referred to secondary care for further investigation. Liaison with the patient's GMP is appropriate for patients with xerostomia related to medications or with known or suspected diabetes.

Sequalae

- Dental caries: Patients with dry mouth are at increased risk of dental caries. This group of patients requires enhanced preventative measures including dietary advice, high concentration fluoride toothpaste and professional topical fluoride application.
- Periodontal disease
- Ascending salivary gland infections
- Oral candidosis
- Oral ulceration/susceptibility to mucosal trauma
- Difficulty wearing dentures/removable prostheses

Sjogren's Syndrome

Sjogren's syndrome is a systemic autoimmune disease characterised by the progressive destruction of exocrine tissue, particularly the salivary and lacrimal glands, therefore key features of the disease include severe dry mouth and dry eyes. Other organ systems may be involved, presenting a myriad of possible features such as Raynaud's phenomenon, skin rashes, neuropathy, renal disease and cytopenias. The condition may occur in isolation or secondary to other autoimmune diseases. Patients with primary Sjogren's syndrome have a 5–10% lifetime risk of developing lymphomas of mucosa-associated lymphoid tissue (MALT lymphomas). These most commonly affect the parotid gland and are mostly low-grade. Dentists should be aware of this and ensure salivary glands and cervical lymph nodes are examined during patient examination. Management of dry mouth in Sjogren's syndrome includes the use of saliva replacement products and sialogogues, in addition to a strong focus on preventative dentistry.

Sialorrhoea

Hypersalivation, also called ptyalism or sialorrhoea, may result from an excess production of saliva or a reduction in salivary clearance. An increased production of saliva is defined as >5.0 mL of unstimulated whole saliva in 5 min. This would rarely cause problems as any excess saliva would be swallowed without difficulty. However, if saliva is not swallowed there is a risk of aspiration (which may lead to aspiration pneumonia) or drooling, defined as excess saliva beyond the lip margin. The latter is also referred to as anterior sialorrhoea and can cause peri-oral

Table 8.6 Common causes of sialorrhoea

Causes of sialorrhoea
Neurological disease • Parkinson's disease (56%) • Cerebral palsy (22%) • Motor neurone disease (42%) • Acquired brain injury (44%)
Medications • Pilocarpine • Clozapine • Risperidone • Lithium
Systemic infection, e.g. rabies
Gastroesophageal reflux disease
Local causes • Macroglossia • Dental or oropharyngeal infection • Ill-fitting oral prostheses

dermatitis, social embarrassment and result in a decreased quality of life. Common causes of hypersalivation and conditions associated with reduced salivary clearance are shown in Table 8.6. Consideration should be given to rarer causes of hypersalivation such as heavy metal poisoning, androgen-excreting tumours, stroke or central nervous system (CNS) tumour, in acute-onset cases.

Management

No single approach is effective in the management of sialorrhoea and a multidisciplinary team is required to optimise outcomes [40]. Where possible, removal or management of the underlying cause is required. If this is not possible, the aim of sialorrhoea management is to reduce the saliva flow rate, reduce incidence of respiratory infections due to aspiration and to improve social interaction. First-line treatment would usually focus on non-invasive therapies such as behavioural interventions, particularly speech therapy to improve swallowing behaviours. Invasive treatments including anticholinergic medications and botulinum toxin injections may be required in addition to non-invasive strategies and have been found to be useful but not without side effects. Surgery and radiation therapy may also be considered as a last resort [40–42].

Sialadenitis

Sialadenitis refers to infection of the salivary glands, usually caused by bacteria or viruses. It is most common in older people and is associated with dehydration and hyposalivation. The infection would usually present with an acute onset of painful swelling of one (major) salivary gland and the patient may be febrile. The gland will feel firm on palpation and there may be erythema of the overlying skin. Pus may be expressed from the salivary duct opening when massaging the affected gland.

Staphylococcus aureus is the most common bacterial pathogen but viral sialadenitis is also common. As with any infection, the aim is drainage, removal of the cause and prescription of antimicrobials. Culture and sensitivity testing is recommended, with targeted antibiotic therapy. However, empirical antibiotic therapy with flucloxacillin and/or metronidazole may be considered pending the results of microbial investigations [43]. Local measures including hydration, sialogogues, gland massage should be implemented. Analgesics can be recommended in line with NICE guidance [44].

In cases of recurrent swelling, chronic sialadenitis due to gland strictures, sialolithiasis or other gland pathology should be considered. These patients will require investigations in secondary care with appropriate salivary gland imaging.

Salivary Gland Neoplasms

Salivary gland neoplasms may be categorised as benign or malignant and as affecting the major or minor salivary glands. They are most commonly encountered in adults over the age of 40 years. All salivary gland neoplasms have a slight female preponderance, with a male female ratio of 0.8:1 [45].

Any newly reported major salivary gland mass should be evaluated using appropriate imaging techniques, usually MRI or ultrasound. This may be supported by fine needle aspiration and in some cases an open biopsy is required to confirm the diagnosis.

The parotid gland is the most common site for salivary gland neoplasms and 80% are benign. The most common benign salivary tumour affecting the parotid gland is the pleomorphic adenoma. They are usually slow-growing, rubbery and lobulated swellings. Rarely, carcinoma can develop within a pleomorphic adenoma. Treatment for pleomorphic adenoma is by wide local excision and recurrence rates of around 3% are reported [46]. Warthin's tumour is the second most common benign salivary neoplasm; it has a strong association with smoking and most commonly arises from the parotid tail. Prognosis is good and the tumour responds well to complete excision.

Mucoepidermoid carcinoma is the most common malignant neoplasm of the parotid gland and peak incidence is in adults aged 20–40 years; treatment is via complete surgical resection. Adenoid cystic carcinoma (ACC) is the most common malignant salivary gland tumour of the submandibular, sublingual and minor salivary glands and tends to present in the fifth to seventh decades [45]. ACC is strongly associated with perineural spread and may present with cranial nerve palsies of the facial, lingual and/or hypoglossal nerves. Prognosis is poor due to advanced stage and diagnosis high rates of loco-regional recurrences.

In contrast to the parotid gland, the submandibular gland has an almost equal distribution of malignant and benign tumours. Furthermore, malignant tumours account for 80–90% of all sublingual and minor salivary gland tumours, with almost all tumours being ACC and mucoepidermoid carcinomas [47]. Therefore, swellings or masses affecting these anatomic locations must be investigated via histopathological examination of the affected tissue and appropriate imaging, to confirm the diagnosis.

Tumour-Like Salivary Swellings

Necrotising Sialometaplasia

This condition predominantly affects male smokers in the fourth to sixth decades and can present as a painless, ulcerated mass, most commonly on the hard palate. There is distinct resemblance to a carcinoma and this similarity can extend to the histological appearance. Specialist histopathological assessment is required to confirm the diagnosis. Healing is spontaneous within 8–10 weeks.

Neurological Disease and Facial Pain

Older patients are at greater risk of neurological diseases, particularly trigeminal neuralgia. The presentation, investigations and management will be considered. Burning mouth syndrome is an important condition to recognise; underlying causes and management options will be discussed. Temporal arteritis carries a risk of blindness if treatment is delayed; therefore, consideration is given to recognising this important condition. Taste disorders are commonly encountered in the older population and are important cause of weight loss and malnutrition; the causes and limited management options will be considered.

Facial Pain

Trigeminal Neuralgia

Trigeminal neuralgia is characterised by sudden paroxysms of lancinating, sharp, electric-shock-like pain affecting one or more divisions of the trigeminal nerve lasting seconds. The pain is nearly always unilateral (unless due to a secondary cause, e.g. multiple sclerosis) and may be triggered by innocuous stimuli such as cold air, washing or touching the face. There is often a refractory period after an attack, where pain cannot be triggered. The condition may be purely paroxysmal or there may be a concomitant continuous pain alongside the paroxysms.

Classification

Trigeminal neuralgia is classified based on the aetiology [48]:

- Classical: Due to neurovascular conflict between the trigeminal nerve and a vessel near the root entry zone, causing compression of the trigeminal nerve.
- Secondary: Due to pathology, e.g. space-occupying lesion or demyelinating disease such as multiple sclerosis.
- Idiopathic: Where no obvious cause for symptoms is apparent following imaging.

Investigations

Imaging with magnetic resonance imaging (MRI) may be used to assess for neurovascular conflict, space-occupying lesions or demyelination.

Management

Patients with trigeminal neuralgia are likely to require referral to a specialist service for full assessment and imaging, which may be provided by oral medicine or neurology. First-line treatment usually includes carbamazepine or oxcarbazepine. Particular issues when prescribing these in older people include effects on cognition, motor coordination and increasing the risk of falls. Hyponatraemia, which can occur with both carbamazepine and oxcarbazepine, is more common in older people on diuretics. Drug interactions may also occur, particularly with carbamazepine. Alternative medical options include lamotrigine or phenytoin. Surgical options can be considered for patients who are unable to tolerate or do not respond to medical therapy.

Burning Mouth Syndrome

Patients may present complaining of a burning mouth; there are multiple possible underlying causes as detailed in Table 8.7. Burning mouth syndrome (BMS) is a condition characterised by a burning sensation of the oral mucosa, in clinically normal oral tissues and in the absence of another identifiable underlying cause. The condition is therefore a diagnosis of exclusion. The prevalence of BMS has been estimated to be up to 15%, being significantly more common in females. The average age of onset is 60–69 years old and is more common in post-menopausal women [49]. Patients may present with a sensation of burning, tingling or sensitivity, felt superficially within the oral mucosa, commonly affecting the dorsal tongue, labial mucosa and palate bilaterally. Other associated symptoms of xerostomia or taste disturbance may be reported. The mucosa will be normal on clinical examination. The cause of BMS has not been clearly identified. Studies have shown that lingual mucosa of patients with BMS contains fewer small diameter nerve fibres than controls and that the remaining nerve fibres have upregulated TRPV-1 channels (which are stimulated by capsaicin) [50]. These findings suggest the condition may have a neuropathic component. There is also an association between the condition and anxiety/depression.

Management

The management of BMS is challenging, owing to the limited availability of effective treatments and the level of distress patients may experience. It may be helpful to employ a combination of psychological and pharmacological interventions including:

- Management of any underlying cause
- Patient information on the nature of the condition, in an empathetic manner. One should reassure the patient that their symptoms are common and benign, but explain that treatment options and to ensure expectations are managed.

Table 8.7 Causes of burning mouth

Haematological	Anaemia, vitamin B_{12}, folate or iron deficiency
Endocrinopathy	Hypothyroidism, diabetic neuropathy
Infection	Candidosis
Connective tissue disease	Sjogren's syndrome
Iatrogenic	Medication
Traumatic	Chemical burns/trauma

- Encourage the development of self-management strategies such as regular exercise and distraction techniques.
- Psychological therapies: Cognitive behavioural therapy is an approach often suggested for the management of BMS. This involves helping patients to change their negative response to their symptoms, enabling them to develop more effective coping strategies for their symptoms and to not be deterred from usual activities or pursuits because of these.
- Pharmacological therapies used in the management of BMS include neuropathic pain medication, e.g. amitriptyline, duloxetine, pregabalin, gabapentin and topical agents such as clonazepam.

Prognosis

The symptoms of burning mouth may persist for many years. Some patients report a degree of improvement of their symptoms with treatment, whilst only a small proportion experience spontaneous resolution [51].

Temporal Arteritis

Temporal arteritis (giant cell arteritis) is a vasculitis affecting medium to large sized blood vessels. The condition is more common in females, those with polymyalgia rheumatica and is seen almost exclusively in people aged 50 years and over, with the mean age of individuals being 74–76 years [52]. The condition is considered a medical emergency, given the potential for significant sequelae including blindness or stroke.

Clinical Features

Patients may present with a new onset unilateral headache, most often in the temporal region. The overlying skin may be tender (patients report pain on brushing hair). Loss of vision or diplopia may occur. Patient may report jaw claudication with pain developing in the masseter muscles after chewing. The tongue may also become involved leading to claudication or necrosis. Patients may have systemic symptoms including low-grade fever, weight loss and fatigue.

Examination may identify pain in the temporal region or swelling, with loss of temporal arterial pulse.

Diagnosis

Tests to diagnosis temporal arteritis include:

- Temporal artery biopsy
- Ultrasound/other imaging modalities
- Bloods: Show raised inflammatory markers (ESR/CRP), high platelet counts and anaemia.

Management

Patients with suspected temporal arteritis should be treated as a medical emergency, with immediate referral to medical teams for assessment due to the risk of

blindness. For dentists working in primary care, it may be most appropriate to direct the patient to an accident and emergency department. Initial management involves high-dose corticosteroids which are gradually tapered as the condition improves. Other steroid-sparing agents commonly used include methotrexate and tocilizumab.

Dentists should be aware of the signs and symptoms of temporal arteritis and include these in their differential diagnosis for patients, particularly those with temporal pain or jaw claudication. Dentists may also treat patients who have already been diagnosed with the condition. Commonly, these patients will have been treated with high-dose corticosteroids and may be susceptible to adrenal crisis. Therefore, patients may require corticosteroid cover during periods of infection or surgery. Patients may also be taking bisphosphonates for corticosteroid-induced osteoporosis prophylaxis or have impaired glycaemic control.

Other Neurological Conditions

Taste Disorders

Disorders of taste may be described as a reduced ability to taste (hypogeusia), distortion of taste (dysgeusia) or total lack of taste (ageusia). The disruption in taste is associated with altered food choices which can ultimately result in weight loss, malnutrition, impaired immunity and worsening quality of life [53]. The estimated incidence is around 19% of the population increases in older age groups [54].

Established causes of taste disturbance include drug use (21%), zinc deficiency (14.5%) and oral and systemic diseases (7.4% and 6.4%) [55]. Around 20% of prescription medications are associated with taste disturbance and of these 40% are also associated with the side effect of dry mouth which may exacerbate the dysgeusia [56]. Hyposalivation means that tastants cannot be dissolved and distributed around the taste buds as effectively and there may be increased damage to taste buds through the loss of barrier effect from saliva.

The normal ageing process results in fewer taste buds but smoking, infection, neuropathies, cancer and cancer treatment and poor oral hygiene are also implicated in taste disorders.

Taste and smell are closely linked with the flavour of foods being perceived via a combination of olfactory, thermal and tactile sensations in conjunction with taste. Therefore, taste disturbance may be associated with olfactory disturbance and this should be explored in patients presenting with disorders of taste.

The older population with taste disorders tends to consume more sweet and salty food which can result in deterioration of dental and general health [57]. Appropriate preventive advice should be offered and regularly reinforced.

Zinc is an important element in the maintenance and repair of taste buds and has been explored as a treatment modality in cases of dysgeusia; however, only low-quality evidence is available to support its use [58]. In cases of established zinc deficiency and dysgeusia, improving zinc levels through supplementation may be beneficial but indefinite therapy (>2 months) is not advised without rechecking levels.

Conclusion

This chapter has discussed some of the more common oral diseases affecting older people. Dental professionals should be aware of the possibility of underlying systemic disease when patients present with oromucosal disease. The ageing population often have comorbidities and polypharmacy is increasing; the BNF should be consulted when prescribing topical and systemic treatments to ensure patient safety. Suspicious lesions must be referred in a timely manner to the appropriate speciality.

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Pain, Anxiety Control and Behavioural Support for Older People

9

Mili Doshi, Sophie Liu, and Zahra Shehabi

Learning Outcomes

After reading this chapter, readers should be able to:

- recognise why the maximum dose of local anaesthesia for an older person is lower than that of a younger adult,
- describe the increasing need for dental treatment under sedation and general anaesthesia for older adults,
- be aware of how the physiological changes of ageing will impact on the safe delivery of care,
- understand the importance of a comprehensive pre-assessment for older people when planning treatment under sedation and general anaesthesia.

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Introduction

Adequate pain and anxiety control is an essential part of dentistry for patients of all ages and methods in behavioural support, anaesthetic drugs and sedation techniques have significantly improved over the last century. Local anaesthesia is considered the first-line approach for dental treatment as it is safe and effective for older people, including those with multimorbidity. Dental anxiety in older adults or difficulty accepting treatment due to a cognitive or medical condition may warrant the use of conscious sedation to facilitate treatment. Conscious sedation is a well-established safe technique used widely for dental care in the UK.

The need to sedate older people for dental treatment will increase due to:

- an increase in the number of older people within the population,
- a growing need to maintain heavily restored teeth, and an increased frequency of caries and periodontal disease requiring intervention [1],
- a continuing need for treatment under conscious sedation in older patients with dental anxiety who have routinely had past treatment undertaken in this way,
- an increasing number of people with dementia or movement disorders such as Parkinson's disease, where treatment would be difficult to deliver safely without pharmacological intervention,
- improvements in medical care and increasing life expectancy for people with disabilities, including those with learning disabilities who may require sedation for treatment.

General anaesthesia is indicated when extensive treatment is needed or when sedation is not appropriate. A comprehensive pre-assessment is essential to identify risk, and robust, pragmatic treatment planning will help prevent the need for repeat anaesthesia in the future. Each approach to care will be discussed in this chapter.

Local Anaesthesia and the Older Person

Effective local anaesthesia (LA) is essential for delivering painless dentistry and reducing surgical bleeding. Older people are more likely to have chronic conditions such as cardiovascular and respiratory disease, which can be exacerbated by pain during dental treatment [2]. The most appropriate local anaesthetic technique will depend on the type of dental treatment being undertaken and any underlying

systemic conditions. Limited mouth opening and loss of landmarks due to missing lower teeth can make administrating inferior dental blocks more challenging.

Local anaesthetics are vasodilators, and so the addition of a vasoconstrictor like adrenaline improves the anaesthetic onset and duration, reduces bleeding and decreases the systemic absorption rate of local anaesthetics by reducing the plasma concentration. There have been concerns that vasoconstrictors may potentially affect the cardiovascular condition in people with underlying cardiac disease [3]; however, local anaesthetics with vasoconstrictors are **not** contraindicated in older medically compromised patients as good anaesthesia is essential. Care needs to be taken with the dose administered and awareness of how to calculate the maximum recommended dose of LA is essential, taking into account that many older people with morbidities are underweight.

Example of calculating the maximum dose of LA

- **Lignocaine max safe dose = 4.4 mg/kg**
- **2% lignocaine contains 20 mg/ml**
- **A patient weighing 65 kg can have a maximum dose of 286 mg (65 × 4.4 mg)**
- **286 mg/20 mg = 14.3 ml of 2% lignocaine**
- **Number of cartridges = 14.3 ml/2.2 ml (standard cartridge) = 6.5 cartridges**

Traditionally inferior dental blocks have been the primary technique for delivering mandibular anaesthesia. However, with the availability of newer anaesthetics like articaine (both 2% and 4% strength), adequate pulpal anaesthesia for mandibular teeth is possible with infiltrations alone [4].

Table 9.1 lists the main forms of local anaesthetic used in the UK and their doses and applications.[1]

Topical anaesthesia is very useful, especially when patients are anxious about dental injections. It works by altering pain thresholds and controlling pain sensations through a blockade of signals transmitted from the peripheral sensory nerve fibres in the superficial layer of the mucosa [6]. Topical anaesthesia is available as sprays or gels that can be applied to the desired area with cotton wool or an applicator. Older people often have a dry mouth, and care should be taken when placing cotton wool on dry mucosa as it can lead to mucosal trauma when removed.

[1] Methemoglobinemia is a very uncommon but potentially severe adverse reaction to local anaesthetics. It is an altered state of haemoglobin in which the ferrous irons of haem are oxidised to the ferric state, leading to rapid oxygen desaturation [5].

Table 9.1 A comparison of the types and features of local anaesthetic agents used in dentistry

Local anaesthetic name	Duration of action	Type	Amount LA/2.2 ml cartridge	Max safe dose (2.2 ml) cartridges based on a 70KG person	Side effects	Application
Lignocaine *Xylocaine 2% with 1:80,000 adrenaline*	0.5–2 h Active in 2–3 min	Amide	44 mg	300 mg 4.4 mg/kg Max 6.5 cartridges	Methaemoglobinemia [1] Neuropathies	ID nerve block, infiltrations
Articaine *Septanest 4%* *Articaine with 1:100,000 or 1:200,000 adrenaline*	1–3 h	Amide with ester group	88 mg	500 mg 7 mg/kg Max 5.5 cartridges	Methaemoglobinemia Non-surgical paraesthesia reported but evidence inconclusive	Infiltrations
Prilocaine Citanest *3% with 0.03 IU felypressin; Citanest 4% plain 2.2 ml*	0.5–1 h	Amide	66 mg	400 mg 6 mg/kg Max 6 cartridges (3 if have ischemic heart disease as felypressin causes coronary artery constriction)	Methaemoglobinemia Oxytocin derivate—Avoid in pregnancy	When adrenaline should be avoided (allergy to reducing agent) Allergy to lignocaine Concurrent use of cocaine or illicit stimulants
Mepivacaine *Scandonest 3%, plain* *Scandonest 2% with 1:100,000 adrenaline* 2.2 ml	2–2.5 h	Amide	66 mg	300 mg 4.4 mg/kg Max cartridges = 4.5 for 3%	Methaemoglobinemia	When adrenaline is contraindicated or if LA needs to wear off quickly to avoid postoperative trauma

Fig. 9.1 The computer-controlled local anaesthetic device

Alternative Methods of Delivering Local Anaesthesia

Aside from the conventional LA agents, techniques have been developed that focus on a less painful experience. Oraqix is marketed as 'needle-free anaesthesia' and combines prilocaine with lignocaine to achieve soft-tissue anaesthesia, and it is primarily used for localised anaesthesia in periodontal pockets [6]. The Computer-Controlled Local Anaesthetic Device (CCLAD) system (Milestone Scientific, NJ), formerly referred to as the Wand, has the advantage of administering a slow injection that is less painful compared to conventional methods. The CCLAD system delivers 1.4 ml of anaesthetic solution over 4 min and 45 s (referred to as ControlFlo) [7] and may benefit patients who have needle phobia (Fig. 9.1).

Adjunctive Behavioural Support Techniques

Good chairside behavioural support is an integral part of dentistry for all ages. Older adults are just as likely to experience dental anxiety as younger adults. Dental settings can provoke anxiety in people with cognitive conditions. Older patients are more likely to have hearing or visual impairments and may find it harder to understand and communicate with the dental team. Some patients will require more time and explanation in an environment with minimal background noise. Behavioural support techniques, including systematic desensitisation, cognitive therapy, positive reinforcement and breathing techniques, can be useful in older people [8]. Musical therapies have shown to be a valuable adjunct for adults with dental anxiety and for people living with dementia [9].

Clinical Holding

The use of gentle clinical holding for older people by trained dental staff may be appropriate to deliver safe care in their best interest. Clinical holding is defined as: 'the use of physical holds to assist or support a patient to receive dental care or treatment in situations where their behaviour may limit the ability of the dental team to deliver treatment effectively, or where the patient's behaviour may present a safety risk to themselves, members of the dental team or other accompanying persons' [10].

The use of clinical holding may be appropriate for an older adult in the following situations:

- Gently holding the patient's hands when administering LA.
- Gentle resistance of the head to reduce movement when it is not possible to carry out a dental examination due to limited cooperation or uncontrolled head movements, for example, in a patient with Parkinson's disease.
- To minimise limb movement when cannulating a patient for IV sedation.

Clinical holding must be discussed with the patient or accompanying carer or family member and recorded in the dental records. In addition, staff must have had training in clinical holding and use the least restrictive technique.

Premedication

An oral dose of a benzodiazepine can be prescribed to provide pre-operative anxiolysis before dental treatment. A common regime is diazepam 2 or 5 mg to be taken the night before, the morning of and 1 hour before the dental appointment. The patient should be advised that they should not drive and need to be escorted to and from the dental appointment [11].

Local anaesthesia with behavioural support should be considered the first-line approach when providing dental treatment; however, conscious sedation or general anaesthesia may be indicated when this is not possible.

Sedation and General Anaesthesia for Older People

Impact of Age-Related Physiological Changes on Sedation and General Anaesthesia

The natural process of ageing will lead to reduced physiological reserve, impacting on several organs within the body. Knowledge of age-related physiological and pharmacological changes discussed in the following section is important as drugs administered both for sedation and general anaesthesia may be more potent in older people and have increased metabolism and excretion times.

Central Nervous System

Normal physiological ageing results in cerebral atrophy. After the age of 40, neuronal loss leads to a progressive 5% reduction of brain weight per decade. As a result, pharmacological sensitivity for all IV agents increases with age and should be considered when calculating and titrating drug doses [12]. Autoregulation of cerebral blood flow helps maintain a constant cerebral blood flow despite changes in arterial blood pressure, hypoxemia or hypercapnia [13]. Autoregulation decreases with age and administering IV drugs may lead to hypotension resulting in a decrease in cerebral blood flow and increased risk of falls. The minimum alveolar concentration (MAC) of volatile sedation/anaesthetic gases decreases by approximately 6–7% every decade after age 40, which is important when administering inhalational agents [14]. Nitrous oxide has a low potency with a MAC of 104% for a 40-year-old, but this decreases to 81% in an 80-year-old [14], and so more care should be taken when titrating nitrous oxide for older people.[2]

Respiratory System

Advanced age may lead to impaired pulmonary reserve due to increased stiffness of the chest wall, reduced compliance of the lungs and coexisting diseases such as chronic obstructive pulmonary disease (COPD). The respiratory depressant effects of drugs such as opioids, benzodiazepines and volatile anaesthetic agents are increased, and the ventilatory response to hypercapnia and hypoxaemia is dampened [15]. Increased fatty deposits in the parapharyngeal area, age-related lengthening of the soft palate and change in the bony shape of the pharynx cause an increase in the incidence of sleep apnoea [16]. Reduction in muscle mass becomes increasingly evident in the fifth decade, shoulders becoming more rounded and the spine kyphotic [17]. Weakening of muscle fibres can result in a forward head posture, affecting thoracic expansion and reducing respiratory function. Airway manipulation necessary

[2] MAC is the alveolar concentration of an inhalation agent that prevents purposeful movement in response to a surgical stimulus in 50% of patients.

after administering sedative and anaesthetic drugs can be more challenging in the older patient with advanced physical limitations in the head and neck region.

Cardiovascular System

Hypertension, congestive cardiac failure, ischaemic heart disease and atrial fibrillation are more common in older age [18]. Poor mobility and limited exercise tolerance may mean that usual symptoms such as angina or exertional dyspnoea may be absent. Even without evidence of cardiovascular disease, all older patients should be managed as having an increased cardiovascular risk. The reactivity of the sympathetic and parasympathetic autonomic responses that regulate heart rate and blood pressure decreases in older age, increasing the risk of heart failure. Most intravenous and inhaled anaesthetic agents result in decreased cardiac and smooth muscle contractility, which can result in profound hypotension. Due to a reduced cardiac output compared to younger patients, the arm to brain circulation is often slower, resulting in a slower onset of drug action. Therefore, any agent must be given slowly and titrated to effect to minimise the risk of overdose [13].

Hepatic System

Changes to hepatic function will impact the pharmacokinetics of administered drugs. Prolonged drug effects can result from age-related reduced hepatic metabolism and decreased hepatic blood flow. Reduced albumin (a protein produced in the liver) production results in an increased free-drug concentration of highly protein-bound drugs such as midazolam and propofol [19].

Renal System

Kidney function can decline with age, leading to increased plasma concentration of drugs that rely on renal excretion. Non-steroidal anti-inflammatory drugs (NSAIDS) should be avoided in people with renal impairments or risk factors due to their nephrotoxic side effects [19].

Age-Related Pharmacokinetic Changes

Ageing leads to a decrease in total body water by 10–15%, which results in a lower central volume of distribution and a higher initial plasma concentration of water-soluble drugs such as midazolam [20]. Body fat increases by 20–40% with a larger volume of distribution for lipid-soluble drugs like propofol. Slow release from a relatively large adipose reservoir prolongs the drug's clinical effect. In addition, the elimination half-life may be longer, and clearance of drugs may be reduced due to renal and hepatic changes [13].

Conscious Sedation for the Older Person

Conscious sedation in dentistry is: 'A technique in which the use of a drug or drugs produces a state of depression of the central nervous system enabling treatment to be carried out, but during which verbal contact with the patient is maintained throughout the period of sedation. The drugs and techniques used to provide conscious sedation should carry a margin of safety wide enough to render loss of consciousness unlikely' [21]. Conscious sedation is a widely used technique in the UK and is indicated in a range of circumstances that may be more likely in older age, such as:

- severe dental anxiety,
- for people undergoing more complex procedures such as complicated extractions, cyst removals and implant-related surgery,
- to reduce movement, for example, in patients with Parkinson's and Huntington's disease,
- when patients are unable to cooperate with dental treatment due to cognitive conditions such as dementia.

It is vital that during sedation and recovery, the patient remains conscious and is able to respond to verbal commands either alone or accompanied by a light tactile stimulus. For individuals who cannot respond to verbal contact in their pre-sedation state, the standard method used to communicate with them must be maintained.

Sedation techniques for adults can be defined as standard or advanced as described in Table 9.2 [22].

Assessing the Older Patient for Sedation

A comprehensive assessment of the older person is important when deciding which sedation technique to choose and whether they should be treated in general dental practice, community dental services or hospital settings. When patients are particularly frail or have multimorbidity, consideration should be given to having a separate dentist and sedationist for monitoring purposes or anaesthetist led sedation within a theatre setting. The use of surgical checklists serves as a prompt and can be beneficial in preventing errors related to human factors.

Table 9.2 Standard and advanced sedation techniques

Standard	• Inhalation sedation with nitrous oxide • Midazolam (for patients 12 years and older) by any route (oral, intranasal or intravenous)
Advanced	• Certain drugs used for sedation (e.g., ketamine, propofol, fentanyl, sevoflurane) • Combinations of drugs used for sedation (e.g., opioid plus midazolam, midazolam plus propofol, sevoflurane plus nitrous oxide/oxygen) • Combined routes of administration (e.g., oral plus intravenous)

Medical Assessment

Older people are much more likely to have underlying systemic conditions and be prescribed multiple medications that can impact their fitness for sedation or anaesthesia. Sedation can be hugely beneficial in patients where stress and anxiety can exacerbate their medical conditions such as angina or asthma. The muscle relaxant effect of midazolam can help reduce movement in conditions such as Parkinson's or Huntington's disease, which are more common in the older population. When there is any doubt over the medical status, contacting relevant medical professionals for details of health conditions and medications will facilitate assessing risk factors and planning care. The patient should be assigned an ASA grading (see Table 9.3). In general, ASA 1 and 2 patients are suitable for sedation in general practice whilst ASA 3 or IV patients should be treated in specialist services such as the community services or hospital dental services where staff are suitable trained to treat this group in clinical settings or operating theatres if needed.

Clinical Frailly

As discussed in Chap. 4, the clinical frailty scale (CFS) is a judgement-based frailty tool that evaluates specific domains, including comorbidity, function and cognition, to generate a frailty score. The CFS can be used as part of the pre-assessment process for patients having sedation or a general anaesthetic to indicate postoperative outcomes and help decide when surgical intervention may not be in the overall patient's best interest [23].

Sedation History

Past sedation experience can prove helpful when choosing the most appropriate sedation technique. Useful information includes the type of previous sedation and whether treatment was successful, sedation for other medical procedures and any complications such as paradoxical effects. Previous cooperation with blood tests and known venepuncture difficulties can help prepare for potential challenges with cannulation.

Table 9.3 ASA classification

ASA I	A normal healthy patient
ASA II	A patient with mild systemic disease
ASA III	A patient with severe systemic disease
ASA IV	A patient with severe systemic disease that is a constant threat to life
ASA V	A moribund patient who is not expected to survive without the operation
ASA VI	A declared brain dead patient whose organs are being removed for donor purposes

Anxiety and Behavioural Assessment

The most commonly used tool to assess dental anxiety is the modified dental anxiety scale (MDAS), where the patient is asked to specify their degree of anxiety related to dental procedures on a 5-point Likert scale. The indicator of sedation need is a tool developed to help dentists with decision-making and combines the MDAS with a medical and treatment complexity score [24]. In patients with cognitive impairments, situations that may trigger agitation or care resistant behaviour should be recorded. These may include being in an unfamiliar environment, unfamiliar people surrounding them, not understanding the need for the dental assessment or waiting too long. The presence of carers who can facilitate treatment and improve cooperation should be encouraged to attend the sedation appointment.

Baseline Pre-operative Recordings

Several baseline measurements should be undertaken as discussed below when planning to treat a patient under IV sedation.

Blood Pressure

Hypertension risk increases with age and is the most common chronic disease in older adults, prevalent in over 75% above 80 years [25]. Although a reading of around 120/80 mmHg is desirable, this may be far higher in the anxious or uncooperative patient due to stimulation of the sympathetic response. In a situation where the systolic exceeds 180 mmHg or the diastolic 110 mmHg, several measurements at intervals may be necessary. Asking the patient to take their blood pressure at home when they are more relaxed may also help ascertain whether an abnormally high reading results from severe anxiety and not an underlying pathological condition. Persistently high readings may necessitate a referral to the patient's medical practitioner for further investigation and dental treatment in a specialist setting. In patients with compromised cooperation, taking the baseline readings may only be possible following initial sedation, which must be documented in the patient records. Hypotension (blood pressure below 90/60) can occur postoperatively due to the cardiovascular depressant effect of sedatives in older adults, leading to fainting and falls. It is imperative to allow sufficient recovery time and then to sit the patient up slowly and wait a few minutes before asking them to stand.

Resting Pulse Rate

The resting pulse rate will vary depending on the patient's anxiety levels, fitness and medical state, including cardiovascular disease. The main age-related change for

older people is that the pulse rate will not increase in response to physical exercise or stress at the same level as when they were younger [26]. Patients may present with tachycardia (i.e., a pulse >100 bpm) in response to anxiety or stress. A low pulse rate (bradycardia) is typical in patients on antihypertensives such as beta-blockers. If a patient has a persistent pulse rate above 120 or below 50 at rest, medical advice should be sought before sedating them. Further investigations and referral to an experienced sedation team may be warranted.

Baseline Oxygen

Older people typically have lower oxygen saturations than younger people, often related to underlying cardiovascular or respiratory disease, obesity or smoking. Lower readings can be due to decreased peripheral perfusion and cold extremities. Midazolam is a respiratory depressant, and so it is vital to record the baseline figure before administering the drug. If a patient has a baseline of under 95%, smaller depletions in oxygen will have a much more significant impact hence the importance of slow titration. Anaemia, which is more common in older people, is not picked up with pulse oximetry, which measures the ratio of oxygenated haemoglobin to deoxygenated haemoglobin, not the amount of haemoglobin. A patient with anaemia may not have sufficient functioning haemoglobin in the blood to oxygenate the tissues. The blood's small amount of functioning haemoglobin may be well saturated with oxygen so that the patient may have a normal SpO_2 reading, but the patient may not have enough oxygen being delivered to the tissues.

Airway Assessment

An airway assessment helps identify airways that may be challenging to manage in the event of respiratory depression. If there are airway concerns, consideration should be given to the most appropriate setting and team to manage them. There are different ways to assess the airway; a useful method is using the LEMON assessment tool.

L—Look externally—Is the patient obese, do they have a high arched palate, a short neck, facial or neck trauma?

E—Evaluate the 3:3:2 rule—3 cm mouth opening, 3 cm thyromental distance (the distance from the tip of the chin to the notch of the thyroid), 2 cm between hyoid bone and thyroid notch. If unsure as to how much a cm is, just use the three fingers or two fingers approach (1 cm = 1 finger width). These lengths decrease with age and pharyngeal muscles become weaker.

M—Mallampati Score—Class I–IV (see Fig. 9.2).

O—Obstruction—Is there a tumour, epiglottitis, recent neck surgery?

N—Neck mobility—Is the patient in a cervical collar, older people tend to have reduced neck extension.

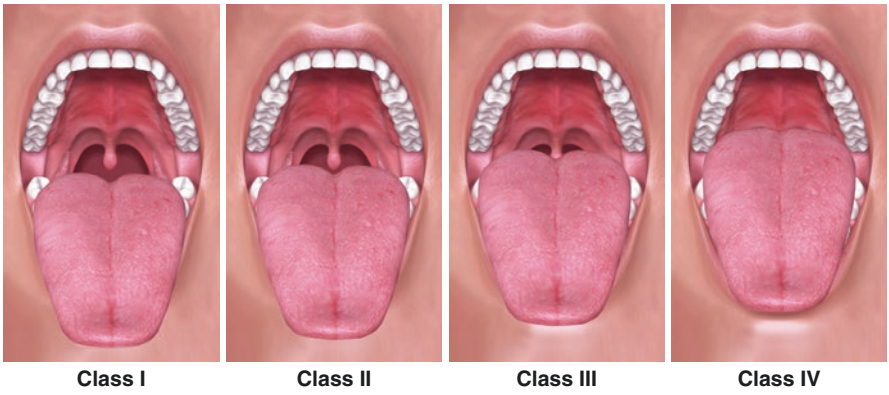

Fig. 9.2 Mallampati score

Body Mass Index (BMI)

It is important to record low and high BMIs when planning sedation for older adults. In older people, being overweight is not associated with an increased risk of mortality; however, there is an increased risk for those at the lower end of the recommended BMI (less than 23) [27]. For this group, experienced clinicians should provide sedation in an appropriate setting. Assessing body fat distribution, including increased adipose tissue around the neck, may indicate potential airway complications. Modifications such as not placing the patient supine to alleviate pressure on the respiratory systems may need to be made.

The prevalence of sleep apnoea increases between 13% and 32% in people over 65 years [28].

Sedation can lead to morbidity in patients with obstructive sleep apnoea (OSA) due to the risk of pharyngeal collapse and respiratory failure and should be treated by an experienced sedation team in a hospital setting. If patients use a continuous positive airway pressure (CPAP) machine, they should bring it to their sedation appointment for use in the recovery phase of sedation.

Social History

It is essential to ask about living arrangements. An increasing number of older people live alone, which has implications for several reasons, including the availability of a suitable escort, the need for transport services and aftercare. In addition, people living in residential settings or supported living need support from carers, so information should be obtained regarding living arrangements and overnight supervision.

Assessing Capacity and Consent for Treatment

Specific verbal and written consent must be obtained from all patients receiving treatment under sedation or general anaesthesia as per the principles set out in a reference guide for examination or treatment published by the department of health [29]. The capacity to consent to treatment should be assessed at every visit as this may fluctuate in some patients, including those in the early stages of dementia. The relevant legislation is described in Chap. 10. It should be noted that capacity assessment is decision-specific, meaning patients may be able to consent for treatment under local anaesthesia but may not be able to weigh up the risks of sedation or general anaesthesia and hence lack the capacity to consent for more complex approaches to care.

Dental Treatment Planning Considerations

The dental treatment plan must be agreed collaboratively with patients or their advocates to ensure it is person-centred and takes into consideration the patient's:

- previous and current preferences
- ability to maintain dental treatment in terms of adequate oral care
- medical history, particularly regarding the risk of future interventions requiring anaesthesia or sedation, the risk of intra- or postoperative haemorrhage or infection and any factors that may affect healing
- ability to comply with future assessments and dental treatment utilising less restrictive treatment modalities.

The benefits of treatment must be balanced against the risks of the procedure. If a patient is assessed to lack the capacity for a sedation-related decision, the factors informing this assessment and the outcome of this assessment should be documented. In this scenario, the options for dental care should be discussed, with the patient where possible, and as part of the best interest decision-making processes with family/carers and advocates. A definitive treatment plan may not be possible in all situations; patients with capacity or relatives/advocates should be informed that a degree of flexibility regarding the treatment plan may be required as part of the consent or best interest process. This is so any necessary treatment can be carried out where needed without having to plan a review visit where the patient is not sedated to discuss and gain consent for further treatment. Where capacity is lacking, pre-emptive discussions should avoid the need for revised best interests discussions with advocates which could further delay necessary treatment.

Patients/carers should be provided with verbal and written information as described in Table 9.4.

Table 9.4 Postoperative sedation information

Risks	Postoperative drowsiness Failure of sedation to effectively deliver care Bruising at cannulation site Change in breathing/heart rate Allergy to drugs
Pre-operative information	Information about the sedation procedure Escort requirements and responsibilities Fasting instructions Specific information regarding diabetic medication (i.e., eat after taking medication for diabetes)
Postoperative information (also provide preoperatively)	Patients should avoid the below until the next day: Driving/riding a bicycle or scooter Operating any type of machinery, including cooking and ironing Drinking alcohol or taking recreational drugs Going to work Signing legal documentation Using the internet (sending emails, posting on social media)

Sedation Techniques

Inhalation Sedation

Inhalation sedation using nitrous oxide and good behavioural management for older people is a safe, non-invasive technique. Nitrous oxide has sedative, anxiolytic and analgesic properties with minimal depression of the cardiac and respiratory systems. Nitrous oxide is not metabolised or excreted by the liver and kidneys and is the safest option in older people with underlying medical conditions. Inhalation sedation is most useful for people with a mild cognitive impairment/mild to moderate dental anxiety or a gag reflex. Much of the success of this type of sedation relies heavily on the semi-hypnotic suggestion, so it requires a degree of comprehension and cooperation with wearing a nasal hood. Oxygen is initially delivered, and then nitrous oxide is titrated against the patient's responses via a dedicated sedation machine with several safety features. As described earlier, the MAC decreases with age, so it is important to closely monitor the patient as nitrous oxide is administered.

Caution should be taken in patients with COPD and type II respiratory failure whose SpO_2 is maintained at 88–92% and have a hypoxic respiratory drive rather than hypercapnic drive. Providing more oxygen as part of the sedation technique can lead to a reduction in respiration.

Intravenous Sedation

Midazolam is the most commonly used IV drug for dentist-led sedation in the UK. As discussed earlier in the chapter, pharmacological age-related changes

impact the blood level of circulating drugs and the metabolism and excretion. Plasma binding proteins such as albumin reduce with age and result in increased free drug levels for longer periods, which is why older patients require smaller doses for the same clinical effect. As midazolam is a water-soluble drug for older people who have a reduced body water content, the dose administered may produce an increased effect. Respiratory depression may therefore be more significant in older patients due to increased sensitivity to midazolam. It is important to clinically monitor the respiration rate and oxygen saturation via the pulse oximeter during treatment and recovery.

For these reasons, the following titration regime should be followed when administering midazolam intravenously in anyone over the age of 65 years: [30].

- Administer 1 mg midazolam intravenously over 30 seconds and wait for 4 min.
- Titrate further amounts in increments of 0.5 mg every minute until the patient appears relaxed enough to allow treatment.

The overall dose of midazolam for older people will be lower and is often under 3 mg [31].

Although most drug interactions are not absolute contraindications to sedation, an awareness is beneficial. Certain drugs such as rifampicin will result in faster metabolism of midazolam whilst those that inhibit like erythromycin and fluconazole will prolong its metabolism and recovery.

Cannulation can be more challenging in older people compared to younger adults as described in Table 9.5 (Fig. 9.3).

Table 9.5 Cannulation challenges in older people

Problem	Effects on cannulation	Recommendations
Obesity	Vein palpation Vein visualisation	Take time to feel Use a BP cuff to improve palpation Aim cannula deeper Use a larger size cannula
Mobile veins due to a reduction in subcutaneous tissue	Veins move, so the cannula will penetrate the vein and into the subcutaneous tissue	Fix veins by making the skin taut Be gentle Go in shallow Anchor the vein to stabilise before entry Insert from on top of vein, avoid side entry and take time If bleeding occurs, hold pressure to the area for a longer period
Fragile 'paper' thin skin and veins (Fig. 9.3)	Risk of vein penetration leading to a haematoma	Use small 24-gauge cannula and cannulate slowly

Fig. 9.3 Veins on the dorsum of the hand of a nonagenarian

Monitoring During Sedation

In addition to monitoring the depth of sedation and patient cooperation, both clinical and electromechanical methods should be used. Clinical monitoring includes assessing patient demeanour, colour, respiratory rate and level of consciousness. For inhalation sedation with nitrous oxide, clinical monitoring will usually suffice. For IV techniques, monitoring should include:

- Non-invasive blood pressure monitoring preoperatively, at appropriate intervals during the procedure and postoperatively.
- Pulse oximetry to measure the pulse rate and oxygen saturation of the blood.

The interest in capnography for dental conscious sedation is growing and may be useful in older people who are more at risk of respiratory depression. Whilst pulse oximetry measures oxygenation or the amount of arterial blood oxygen, capnography provides a measure of ventilation or end-tidal carbon dioxide via a nasal sampling cannulae (Fig. 9.4) and detects respiratory depression earlier. Therefore, capnography may be indicated for patients at increased risk of respiratory depression, including older adults, especially those with underlying respiratory conditions. For more medically compromised older adults, consideration should be given to having a separate sedationist and operator for close monitoring or having an anaesthetist provide the sedation in a hospital theatre setting.

Recovery After Sedation

Orthostatic hypotension is more likely in older rather than younger patients and those on antihypertensive medications and diuretics. Raising the patient slowly from the supine position at the end of the procedure and during recovery is

Fig. 9.4 End-tidal carbon dioxide nasal sampling cannula

paramount. Older people may have mobility issues and are more prone to falls which can have detrimental consequences. The impact of the muscle relaxant effect of midazolam increases the risk of falls when a patient starts to walk or transfers to a wheelchair. Older people with kidney and liver disease may take longer to recover due to impaired metabolism and excretion in patients.

Use of Flumazenil

Flumazenil is a benzodiazepine antagonist with a shorter half-life than midazolam. It can be used to reverse sedation in an emergency, and electively for some patients, such as those with mobility issues or prolonged recovery, to make the discharge process safer. Some concerns have been raised in other medical specialities when flumazenil has been used to reverse sedation too quickly, and older patients have become re-sedated [32, 33]. Care must be taken when reversing older people with sedation where there is slower metabolism and excretion of midazolam as there is a risk of re-sedation. Teams should allow additional time

for recovery and ensure patients are back to their pre-sedation levels of consciousness and function.

Oral and Intranasal Sedation

Oral and intranasal (sometimes referred to as transmucosal) sedation is useful in patients where cooperation, involuntary movement or needle phobia prevents the placement of an intravenous cannula in a routine manner. These approaches are only suitable for use when less invasive or straightforward adjuncts to cannulation, such as the use of topical anaesthetic cream are not sufficient. This is because both oral and intranasal sedation involve administering a bolus dose of midazolam. Older people have an increased sensitivity to benzodiazepines and slower metabolism and excretion. This means the response to bolus doses of midazolam is even less predictable and the risk of oversedation is increased. On this basis, these approaches are not the first-line choice for sedation in older people and should only be provided by dental teams who are experienced in treating this cohort of patients.

Orally, midazolam undergoes first-pass metabolism, which means that the liver will break down a proportion of the drug before entering the systemic circulation, where its desired effects will be achieved. Therefore, it is administered at a higher dose, typically 20 mg and may be mixed with a flavoured drink to make it more palatable. Historically, the intravenous formulation of 10 mg/2 ml was given orally using two ampoules. Licenced oral formulations are now available (e.g. 2.5 mg/ml and 5 mg/ml) and should be the preferred option (Fig. 9.5). As first-pass metabolism decreases within older age, the usual dose of 20 mg may be reduced in patients of smaller size and weight. Administration of a bolus dose to an older patient should be approached with caution as the risk of oversedation and complications become more likely, so a dose of 10–15 mg may be considered. Most patients will take around 20 minutes to achieve the desired effect, but as protein binding is reduced in the older patient, this may take longer.

Another option is intranasal sedation using midazolam to achieve a level of cooperation to facilitate cannulation. The formulation is available in a 40 mg/ml strength and comes premixed with lignocaine to reduce the pH and ‘sting’ on administration.

The recommended administration dose is between 0.2 and 0.3mls (8–12 mg), which factors in approximately 2 mg of midazolam lost in the mucosal atomisation device used to deliver the drug. Again, a lower dose of 0.2 ml (8 mg) needs to be considered for an older person. Pressure should be used to create the aerosol, and the patient or carers should be warned that this may induce nasal bleeding (Fig. 9.6). The nose should be cleared of excess mucous and debris before administration, and the time taken to achieve the desired effect is approximately 7–10 min.

Fig. 9.5 Amsed—oral sedation solution

Cannulation is still required for oral and intranasal sedation even if no additional midazolam is administered. This allows a clinician to administer additional midazolam via the intravenous route or to enable administration of flumazenil if needed.

Advanced Sedation

Most older patients can be managed by the standard sedation techniques, but in some cases, for example, when it is preferable to use a drug with a lower respiratory effect, it may be more appropriate to use advanced techniques (Table 9.6). Advanced sedation should be carried out in a secondary care setting by experienced dental sedation teams or as part of anaesthetist led sedation [21].

The opioid fentanyl is twice as potent in the older population as the brain becomes more sensitive to opioids. Drug clearance is reduced and combining drugs can produce synergistic effects (e.g., fentanyl and midazolam), narrowing the safety margins. Propofol is a potent anaesthetic drug with a short distribution half-life which can also be used as a sedation drug. Given the narrow margin of safety, the

Fig. 9.6 Administering nasal midazolam

Table 9.6 Sedative drugs onset and half-life

Name	Type of drug	Peak onset	Alpha half-life (min)	Beta half-life (h)
Midazolam	Benzodiazepine	6–15 min	30	4
Fentanyl	Opioid	3–5 min	15	4
Propofol	Alkylphenol	15–30 s	4	3

justification for selecting propofol as an alternative to midazolam must be documented. The absence of a reversal agent can make managing respiratory depression in the event of oversedation more difficult. Therefore, this technique must be performed with a dedicated sedationist separate from the operator. Its short half-life is ideal for quick procedures such as extracting periodontally involved teeth. It can be useful in older people with mobility issues as they recover faster than with midazolam. Propofol causes less respiratory depression than midazolam, but renal clearance is slower in older people extending excretion times.

Dentists who provide advanced techniques must be appropriately trained and experienced.

General Anaesthesia

General anaesthesia (GA) for older patients may be necessary when: sedation is not appropriate due to medical factors; where sedation has not previously been satisfactory; or due to the nature and extent of the dental treatment required. A larger number

of drugs are required, each subject to the altered physiology of the older person. The drugs used to achieve general anaesthesia can affect cardiac contractility, lower blood pressure and depress the respiratory drive. Age-related loss of functional reserve, along with the increased prevalence of coexisting systemic diseases, can put the older patient at higher risk of morbidity and mortality when exposed to the stresses of surgery and anaesthesia. The British Society of Disability and Oral health has produced evidence-based recommendations for GA for dental care for adults within Special Care Dental Services that emphasises person-centred assessment and planning [34].

Pre-assessment of the Older Patient

All older surgical patients should have an anaesthetic assessment virtually or face to face prior to admission to hospital to allow risk stratification and any necessary medical optimisation to occur. In addition to a comprehensive medical history, specific conditions associated with advanced age need to be explored and addressed. As discussed later in this chapter, patients with pre-existing cognitive impairment are at higher risk of postoperative neurocognitive disorders such as delirium, confusion and inattention [35, 36]. As with all patients, the benefit of the procedure should be balanced with the risk of complications. Even a short anaesthetic may have negative effects on the quality of life of an older very frail patient, so treatment planning needs to be robust to prevent the need for a future anaesthetic. For minor dental surgery under short anaesthetic, extensive pre-operative investigations are not usually necessary, but this is at the discretion of the dental and anaesthetic team and may include blood tests and cardiac monitoring.

Pre-operative Instructions

Nationally, the current guidance for fasting is 6 h for food and 2 h for clear fluids. Use of diuretics, antihypertensive drugs and chronic dehydration may precipitate orthostatic hypotension, especially in the fasted older patient. For this reason, fasting periods should not be longer than is necessary.

Operative Procedure

Most dental surgery is performed as day case surgery. This is preferable as it is less disruptive to the patient, reduces the length of stay in hospital and cuts the overall cost of the admission. Fitness for day surgery should not be based on an ASA score, age or BMI, but on a functional assessment of the patient [37]. A patient with a stable chronic disease such as diabetes is often better managed as a day case as it reduces the disruption to the patient's routine. If a patient has any disease processes requiring intervention, admission the night before may be necessary. Obstructive sleep apnoea is not an absolute contraindication to day surgery if the patient is

anaesthetised early in the day, short-acting drugs are used and opioids avoided. If the patient is well, after a period of observation, they can be safely discharged home. When possible, patients with dementia should be prioritised for surgery earlier in the day to reduce disruption to normal routine, prolonged starvation and interruption to medication schedules. A carer or relative familiar to the patient should accompany the patient, and provisions should be made for them to be present up until anaesthetic induction and soon after emergence in the postoperative recovery area. The pre-assessment process allows the hospital-based team to consider whether pre-operative sedation or premedication is needed—this can be discussed collaboratively with the dental team to optimise the patient's care experience.

Type of Anaesthesia

The chosen anaesthetic technique is dependent on patient factors, surgical factors and the preference and skill set of the anaesthetist. The following section gives a brief explanation of several techniques.

Induction

Anaesthesia can be induced using intravenous agents or inhalational gas. Propofol is the most common intravenous induction agent. This induces a rapid onset of anaesthesia and apnoea. Older patients are up to 30% more sensitive to propofol, and the renal clearance is slower [19]. A reduced induction dose should be slowly administered to allow for this and the reduced arm brain circulation. All induction agents except ketamine and etomidate cause a reduction of systemic vascular resistance and reduction in cardiac contractility. In the older patient, this can cause a significant drop in blood pressure; therefore, careful titration and the judicious use of vasopressor drugs may be necessary. A gas induction has a much slower onset of anaesthesia, where spontaneous respiration is usually maintained. It can be a useful tool in patients who may not tolerate an intravenous cannula whilst awake such as those with dementia or needle phobia.

Choice of Airway Management

The decision regarding airway should be made after discussion between the dentist and anaesthetist. This should be based on the need for surgical access, risk of airway dislodgement and patient factors. Some of the most common airway devices are listed below.

Laryngeal mask airways (LMA) are supraglottic airways that sit above the larynx. They enable the patient to breathe spontaneously and require a lighter anaesthesia plane than an endotracheal tube. As this is not a definitive airway with a complete seal, there is a risk of aspiration, so LMAs should not be used in patients who have gastro-oesophageal reflux disease, high body mass index or are at risk of vomiting. In the older patient, an LMA may fit poorly due to poor muscle mass and loss of dentition. LMAs are suitable for short, simple procedures, but intubation with an endotracheal tube may be required for longer complex cases. Endotracheal tubes provide a definitive airway with an inflatable cuff that lies below the vocal cords. The

cuff protects from aspiration of debris from the oropharynx into the trachea. A pharyngeal throat pack may be placed to reduce the amount of blood and debris above the cuff that could fall into the airway once the cuff is deflated. If a throat pack is used, the dentist and anaesthetists should jointly determine who is best positioned or trained to place this. The insertion and removal of the throat pack must be recorded on the swab count as failure to remove the pack prior to extubating can cause fatal airway obstruction [38]. *A* nasal tube has the advantage of a clear oral field to enable comprehensive dental care provision such as radiographs, minor surgical procedures and restorative rehabilitation however, they can cause more nasal trauma. Both nasal and oral endotracheal tubes require administration of a paralysing agent, thereby increasing recovery times.

The anaesthetic and dental team should discuss airways for each patient and agree on what is most appropriate for the case.

Maintenance of Anaesthesia

There are two types of anaesthetic maintenance: volatile gaseous agents or TIVA (total intravenous anaesthesia). Volatile is the most familiar, most readily available and most inexpensive method. TIVA uses intravenous agents to maintain a constant blood plasma level to maintain unconsciousness. The most commonly used agent is propofol with a short-acting opioid such as remifentanil. Processed EEG monitors such as BIS (Bispectral Index) can be used to measure the depth of anaesthesia and allow drug titration. This is important in the older population as some studies have shown an association between low BIS values and an increase in postoperative delirium [39–41]. TIVA is particularly useful in patients with a high risk of postoperative nausea and vomiting or those susceptible to malignant hyperthermia.

Intraoperative Monitoring

Standard monitoring for general anaesthesia consists of ECG, oxygen saturation monitoring, non-invasive blood pressure, and capnography. It should be commenced before induction and continued through to the recovery room [42].

It is important to check that all pressure areas are adequately padded. Older patients often have reduced muscle and less subcutaneous fat; therefore, bony prominences are susceptible to pressure sores. Thinner, more fragile skin can also be easily damaged so care must be taken on moving patients to avoid abrasions.

The metabolic rate drops by 1% per decade after the age of 20 [43]. A reduced basal metabolic rate and reduced body mass can affect thermoregulation. Hypothermia can alter coagulation cascades, increase recovery time by altering drug metabolism and increase oxygen demand [44]. Active warming such as a forced hot air blanket and measurement of core temperature should be employed.

Analgesia

Postoperative analgesia should not be overlooked, especially for patients who may have challenges in self-reporting pain. A combination of local anaesthesia and simple analgesics is used to achieve multimodal analgesia. Often paracetamol will suffice, and non-steroidal anti-inflammatory drugs (NSAIDs) such as diclofenac should be used cautiously due to the increased risk of cardiovascular complications and renal impairment in older patients.

Postoperative Cognition Disorders

Postoperative delirium is a fluctuating disturbance in attention and awareness that occurs more frequently in the older population. Some patients may experience a brief period of delirium when emerging from anaesthesia which clears fully after a few minutes. However, persistent postoperative delirium is seen more commonly, in up to 65% [45], of those with advanced age or pre-existing cognitive impairment. It causes an increase in hospitalisations, increased mortality and morbidity and can be distressing to both family members, staff and other patients. Risk factors that can be modified to reduce the risk of developing delirium include avoidance of prolonged periods of low BIS values, fluctuations in blood pressure, hypothermia, anticholinergic drugs, opioids and benzodiazepines, and avoidance of metabolic and electrolyte disturbances, e.g., hypoglycaemia [46–50].

Non-pharmacological methods for treating delirium should be employed in the first instance [47]. These include:

- Presence of a familiar person
- Orientating the patient to time, place and person
- Regular communication and explanations
- Ensure communication aids are present, e.g., hearing aid, glasses
- Normalising postoperative care, e.g., regular meal times and rest times
- Low background noise, well-lit rooms

Older patients are at risk of increased morbidity and mortality in relation to surgery and anaesthesia. This risk can be mitigated with careful pre-operative assessment and preparation of the patient, careful intraoperative management of coexisting disease and attentive postoperative care.

Impact of Emergency Life Support Legislation on Dental Care

Medically compromised and those patients coming towards the end of life may have a pre-existing do not attempt resuscitation (DNAR) or Recommended Summary Plan for Emergency Care and Treatment (ReSPECT) [51] form in place.

A DNAR order may be in place when

- A patient has made an informed decision to decline cardiopulmonary resuscitation (CPR).
- CPR would be ineffective.
- The patient (or advocate if the patient does not have capacity) feels the risk of CPR would outweigh the benefits.

ReSPECT was introduced in the UK in 2017 and creates a summary of personalised recommendations for a person's clinical care in a future emergency in which they do not have the capacity to make or express choices (Fig. 9.7). It allows more discussion about all aspects of intervention rather than CPR alone, for example, whether the individual wants life-sustaining treatment like antibiotic therapy.

When a DNAR or ReSPECT form is in place, a discussion should be had with the patient undergoing dental treatment or their advocate. As anaesthesia or surgical intervention may increase the risk of a medical complication, a discussion about whether to suspend, modify or maintain emergency life support care should be undertaken at the assessment appointment.

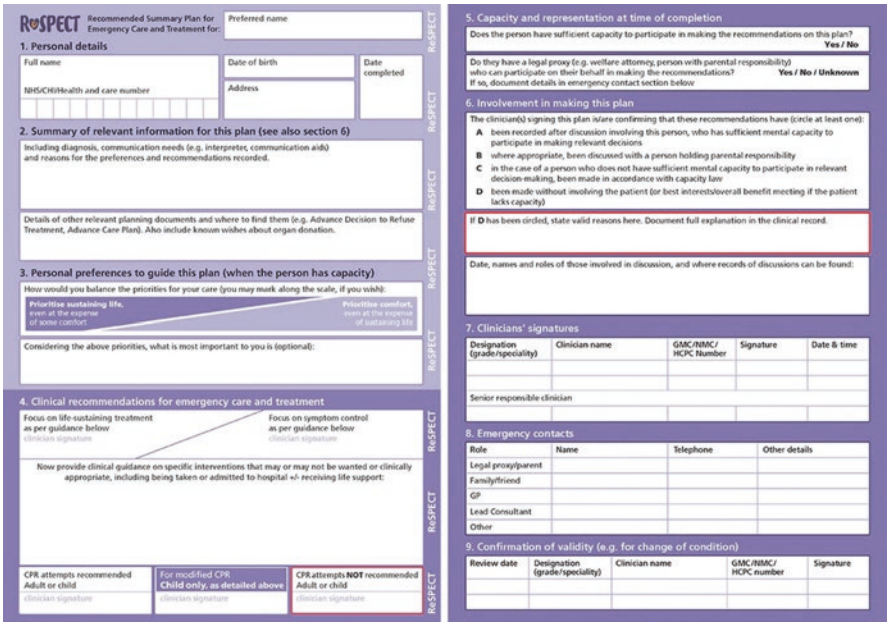

Fig. 9.7 Example of the ReSPECT document

Conclusion

Age itself should not be a barrier to providing appropriate pain and anxiety control for dental care for older people. The physiological impact of ageing and the presence of multimorbidity will impact on an individual's reserves and resilience to dental interventions. The least restrictive method that enables the safe delivery of care should always be used. A comprehensive patient assessment is very important, including a full medical, dental and social history when planning sedation or general anaesthesia for the older person.

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Oral Health and Healthcare for People Living with Dementia and Other Cognitive Impairments

10

Charlotte Curl, Kathryn Kerr, and Andrew Geddis-Regan

Learning Outcomes
This chapter will describe:

- Dementia, and the prevalence, types and impact of dementia
- How dementia affects oral health and dental care provision and how to support people living with dementia to receive care
- The challenges in oro-facial pain identification for people living with dementia
- Assessment of mental capacity and management of situations where a person cannot consent for their treatment.

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Introduction

Dementia is an overall term for diseases and conditions that typically present with a progressive clinical syndrome of deteriorating mental function significant enough to interfere with everyday life [1]. Specific diagnoses falling under the umbrella of dementia are shown in Fig. 10.1. The International Classification of Diseases (ICD) classifies it as 'a syndrome due to disease of the brain, usually of a chronic or progressive nature, in which there is disturbance of multiple higher cortical functions, including memory, thinking, orientation, comprehension, calculation, learning capacity, language, and judgement' [2]. The impairments of cognitive function are commonly accompanied and occasionally preceded by deterioration in emotional control, social behaviour or motivation. This syndrome occurs in Alzheimer's disease, in cerebrovascular disease and in other conditions primarily or secondarily affecting the brain [2]. A person's symptoms will depend on the type of dementia, the area of the brain affected, the stage of the disease and the underlying cause of the decline in cognitive function. Symptoms may vary in intensity and presentation on a daily basis and are widely variable between individuals. In most cases, however, the process of neurodegeneration is ongoing and a general progression of the disease is expected, with worsening symptoms.

In the United Kingdom (UK), dementia is a growing health concern, particularly in the ageing population. In 2015, there were an estimated 850,000 living with dementia and this is projected to rise to over two million by 2051 [3]. Older people

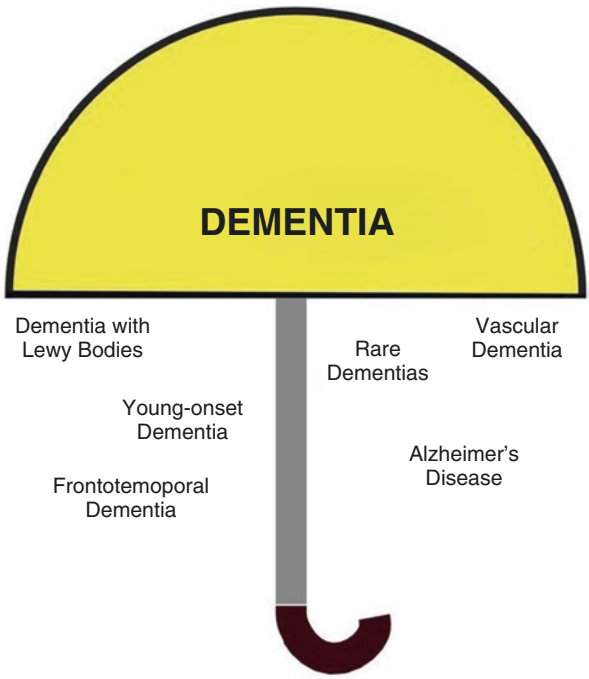

Fig. 10.1 Dementia is an umbrella term encompassing multiple separate diagnoses

are most at risk for dementia, hence, the largest increases in the number of people with dementia are expected to occur in the oldest age groups [4]. The most significant change in demographics is that there will be a substantial growth in the number of people living with more advanced dementia [5] which is expected to place a significant burden on healthcare services.

Types of Dementia

There are over 200 subtypes of dementia; however, the most common types are described in Table 10.1.

Table 10.1 Key types of dementia

Type of dementia	Comments
Dementia in Alzheimer's disease	The commonest form of dementia accounting for approximately 65% of cases [6]. Primary degenerative cerebral disease of unknown aetiology. The hippocampus (the centre of learning and memory in the brain) is the first area to be damaged, subsequently, a loss of memory is often one of the earliest symptoms
Dementia in Alzheimer's disease with early onset	An example is dementia in Down's syndrome or when diagnosed under the age of 65
Vascular dementia	This is caused by reduced cerebral blood flow secondary to small vessel disease, a cerebrovascular accident or multiple transient ischaemic attacks (multi-infarct dementia), accounting for 15–20% of dementias [6]
Dementia in Pick's disease (fronto-temporal dementia)	Dementia caused by the degeneration of the fronto-temporal lobes of the brain possibly due to a protein disorder. This is characterised by early, slowly progressing changes of character and social deterioration, followed by impairment of intellect, memory and language functions, with apathy, euphoria and, occasionally, extrapyramidal phenomena. Accounts for up to 5% of dementias [6]
Dementia in Creutzfeldt-Jakob disease	Progressive dementia with extensive neurological signs. Onset is usually in middle or later life, but may be at any adult age. The course is subacute, leading to death within one to 2 years
Dementia in Huntington's disease	A dementia occurring as part of a widespread degeneration of the brain. The disorder is transmitted by a single autosomal dominant gene. Symptoms typically emerge in the third and fourth decade. Progression is slow, leading to death usually within 10 to 15 years
Dementia in Parkinson's disease	Develops in the course of established Parkinson's disease. Visual hallucinations may occur, particularly seeing 'little people'. Auditory and olfactory hallucinations may occur
Dementia in human immunodeficiency virus	Dementia developing in the course of HIV disease, in the absence of a concurrent illness or condition other than HIV infection that could explain the clinical features
Dementia secondary to B1 (thiamine) deficiency	Otherwise known as Korsakoff's syndrome and frequently due to alcohol misuse. This may also arise due to nutritional deficiencies, disseminating cancer and chronic infection

(continued)

Table 10.1 (continued)

Type of dementia	Comments
Lewy body dementia	Similar to the dementia of Parkinson's disease. Definitive diagnosis can only be made post-mortem histologically when 'Lewy bodies' are found to be present microscopically. Thought to be due to underlying problems with brain processing of the protein alpha-synuclein. People display physical disabilities early in the course of the disease, often prior to cognitive impairment. This accounts for around 9% of dementia [6]
Mixed dementia	Where various pathologies contribute to a person's symptoms. The most common combination is when the abnormal protein deposits associated with Alzheimer's disease coexist with blood vessel problems linked to vascular dementia. Alzheimer's brain changes also often coexist with Lewy bodies. In some cases, brain changes may be linked to vascular dementia, Alzheimer's and Lewy body dementia or in combination with separate pathologies [7, 8]

The Diagnosis of Dementia

Though its prevalence increases with age, dementia is not a part of normal or healthy ageing. The pathophysiological processes leading to dementia can also lead to less substantial cognitive impairment which does not fill the diagnostic criteria of dementia. Those living with a more subtle cognitive impairment may be diagnosed with mild cognitive impairment (MCI) [9]. This is an early form of cognitive impairment that does not impact on activities of daily living. MCI can progress to dementia but does not do so in all instances. An appropriate diagnosis of any impairment is crucial to allow the correct support to be established for each person.

The diagnosis of dementia can be complex, yet a diagnosis is a key step in accessing appropriate support [10]. Memory clinics were set up in the UK in the early 1980s, based on models from the USA. They are secondary care centres where diagnoses of dementia are usually made following a concern raised by a primary care medical practitioner. The assessments and investigations used are based on clinical history and presentation. Physicians (often with the help of specialists such as neurologists, neuropsychologists, geriatricians and geriatric psychiatrists) use a variety of approaches and tools to help make a diagnosis. Although physicians can almost always determine if a person has dementia, it is not always possible to identify the exact cause. The pathway outlined by NICE (2014) [10] describes the ideal route to diagnosis. This starts with a patient attending their general medical practitioner, who then takes a detailed history and examinations as necessary alongside a cognitive assessment. Patients in this pathway are then referred to memory clinics for further investigations and to rule or identify other factors contributing to the symptoms a patient experiences. A specialist dementia service ultimately provides a diagnosis if appropriate.

Mental status tests are invaluable for the diagnosis of dementia and there are many available for use in both a primary and secondary care setting [11]. The Mini Mental State Examination (MMSE) is a structured 10-min test of mental status

which consists of a series of questions designed to test a range of everyday mental skills. It is the most used cognition test in secondary care settings in the UK. The maximum MMSE score is 30 points: a score of 20 to 24 suggests mild dementia, 13 to 20 suggests moderate dementia and less than 12 indicates severe dementia. It is useful for assessing cognitive decline and may be used to assess the effectiveness of dementia treatments at slowing its progression.

The Mini-Cog test is a brief test, often used by GPs, which assesses short-term recall and clock drawing. First, the person is asked to repeat three unrelated words, to test immediate recall. Then, they are asked to do the clock drawing test. The clock drawing test assesses multiple factors, but its ability to screen for executive functioning is especially helpful in identifying dementia. Finally, the person is asked to remember the three words, testing their memory after the distracting task of drawing the clock. Scoring of the Mini-Cog is simple; a person is scored as likely to have dementia if they recall none of the three words, or if they recall one or two of the three words and draw an abnormal clock. Similarly, a person is scored as unlikely to have dementia if they recall all three words or if they recall one or two of the three words but draw a normal clock. A more detailed official scoring is available in which a low score indicates a concern over cognitive functioning (a mild cognitive impairment). The main disadvantage of the Mini-Cog test is that it cannot be used with people with visual impairments or those who have difficulty in using a pen or pencil to write with. The Mini-Cog test is an excellent free screening tool for identifying dementia but is of no value in measuring the progression and extent of the disease.

Prognosis and Progression of Dementia

All types of dementia feature ongoing cognitive decline but there can be substantial variation in both the rate of progression and the time between diagnosis and death [12]. As a general indication of longer-term prognosis, the Alzheimer's society describes how, on average, somebody with Alzheimer's disease or vascular dementia will live for 5 or 8–10 years following a diagnosis, respectively [13]. With time, both the number and severity of symptoms can increase leading to the need for further adjustments in accommodation, care provision and to support communication. Despite medications such as rivastigmine or memantine aiming to slow the progression of dementia, a general greater degree of dependence is expected with time. Reisberg et al. [14] describe the wide range of scales which can be used to categorise dementia such as the Global Deterioration Scale [15] which contains 7 stages. Stage 1 is 'no cognitive impairment' and all activities of daily living can be undertaken. Stage 7 is severe dementia where few useful words or verbal expressions are possible and the ability to walk, sit and hold up one's head is progressively lost. Between these two extremes are several defined stages. Though patients or carers are unlikely to know or describe the stage a person is at with a number, the scale highlights how a person living with dementia may present and the nature of progression that may occur.

Looking at dementia with a biomedical lens offers only some insight into a person's experience of dementia [16]. An alternate perspective is to view the individual living with the condition as a person, as opposed to a deteriorating physical being; doing so recognises the uniqueness of each individual [17]. The concept of personhood has been extensively described in relation to dementia: Kitwood defines this as 'the standing or status that is bestowed upon one human being, by others, in the context of relationship and social being' [17]. When a person is considered as an individual the interplay between neuropathology, the person's life history and the person's wider social circumstances are all said to impact how dementia and its progression are experienced. Berghmans [18] describes the philosophical possibility of a person with dementia undergoing such a significant neurological and psychological change that they are no longer the same person they once were. An alternative view supported in policy is that 'the person with dementia remains the same, equally valued, person throughout the course of their illness, regardless of the extent of the changes in their cognitive and other functions.' [19] On this basis, the person's history, values, preferences and ideals remain equally important as dementia progresses and should continue to inform how the person is cared for and supported (as detailed in Chap. 3).

Impact of Dementia on Oral Health and Dental Care

Dementia presents additional challenges which can impact on the status of the mouth. For example, though some older people may have altered dexterity which may affect levels of plaque, a person living with dementia may have excellent intentions for brushing but occasionally forget. A range of competing priorities and a highly variable impact of dementia can make oral health a lesser priority. Reflecting this, comprehensive reviews have demonstrated that people with dementia have poorer oral health than those of similar ages without any cognitive impairment. Through reviewing a multitude or relevant studies, Foley et al. [20] identified that people living with dementia had fewer teeth, more carious teeth, higher plaque levels and a worse periodontal state than similarly aged individuals without dementia. A review with a slightly different focus [21] specifically found a great number of retained roots as well as higher levels of coronal and root surface caries for people living with dementia.

This disease presentation in addition to an anticipated progression of cognitive decline means that regular dental assessment becomes increasingly important for people living with dementia. Specifically, this could support professional oral hygiene instruction and plaque or calculus removal where necessary. Unfortunately, additional research has shown that people who are diagnosed with dementia access dental care far less frequently after a diagnosis [22]. This was particularly marked for people with mixed dementia, dementia with parkinsonism and for people who were experiencing a more rapid decline in cognition. Those who may benefit from dental preventative support or symptom management are therefore accessing care less than the ideal, leading to the potential progression of dental disease from a range of risk factors.

Studies have sought to understand how dental diseases impact oral health related quality of life (OHR-QoL) for older people. Though people with cognitive impairment are included in some of these studies, none specifically focus on this patient group. A 2019 review [23] identified that neither dental caries or periodontal disease had a clear adverse impact on quality of life for older people. In contrast, xerostomia and orofacial pain were determinantal to quality of life. Considering the higher caries prevalence in people living with dementia [21] it is noteworthy that caries presence alone, prior to causing pain, does not seem to have a direct impact on day-to-day living. Though dental disease may be asymptomatic and not affect OHR-QoL, the impact is felt when pain arises [23]. Though it is important to aim to prevent dental disease and its sequalae, the need to identify pain in order to manage it is paramount to optimise the OHR-QoL for older people, including those with cognitive impairments. The specific impact of oral health problems specifically for people living with dementia is less well known and individual assessment of the impact of dental diseases is crucial.

Identifying Orofacial Pain

Dementia commonly affects communication and people living with dementia may have difficulties in understanding and expressing themselves verbally. It therefore may be difficult to identify when a person with dementia may be experiencing oral pain or discomfort and it is thought that oral pain and discomfort may be underdiagnosed in people living with dementia [24]. In one study in the USA, up to 60% of a sample of people living with dementia had an oral condition which was likely to cause pain or discomfort, yet they were unable to communicate their pain verbally [25]. The concern is that if verbal communication is not possible, then the presence of pain may lead to challenging behaviour in this group. One major challenge is that as dementia progresses, the patients' pain experiences may change in parallel with declining cognitive function. Their ability to report pain may be further reduced, thus orofacial pain can be further underdetected in those who cannot verbally self-report [26].

To address this challenge, several attempts have been made at developing diagnostic pain assessment tools for dental professionals to identify pain in those who live with dementia who may not be able to verbally self-report pain [27–29]. Though tools exist, the most useful source of information about patient's pain experience can be those closely involved in their care. Carers are considered best placed to identify orofacial pain in people with dementia as they may notice subtle differences such as behavioural changes (particularly the expression of challenging behaviour that others would not notice) [30]. It is thought that challenging behaviour is seen as an attempt to express or meet psychological or physical needs or to express will [31].

Considering the potential prevalence of oral pain in those living with dementia, it is important that the clinician is aware of factors that may indicate dental pain (such as those shown in Fig. 10.2) so that appropriate care can be delivered, or a

Fig. 10.2 Holding of the face or refusal of medication may indicate a person is experiencing pain

Table 10.2 Signs that may suggest a person with dementia may be experiencing pain

Changes in day-to-day behaviour noted by carers such as wincing when eating/brushing teeth
Changes in appetite, refusing food with possible loss of weight
Holding face and different facial expressions such as grimacing/frowning/tensing
Trouble in sleeping and relaxing/restlessness
Sleeping more than normal
Drooling
Anger/agitation/striking out/repetitive movements such as twitching or rubbing or persistent sucking
Sudden problems with wearing dentures
Halitosis
Obvious facial swelling with no separate identifiable cause
Periods of relief following administration of analgesia

referral be made to specialist services if necessary. Though dental care delivery may deviate from a conventional comprehensive restorative approach in those with substantial medical or dental complexities, the need to address pain is crucial and a moral obligation when symptoms arise from dental problems. Table 10.2 illustrates signs that may indicate a person living with dementia may be experiencing orofacial pain and they may be used to guide a practitioner when taking a history from a carer.

Accounting for the Impact of Dementia on Oral Health Care

Surgery Design

The practice environment is an important factor in making the patient feel more at ease and this will aid communication and facilitate treatment [32]. Within the confines of 'reasonable adjustments' outlined in the Equality Act (2010) [33], services

should aim to create a calm and secure treatment environment. Insight on design has come from research in hospital and general medical practice and can be usefully translated into the dental environment. The use of unobtrusive safety measures, varying the ambience, reviewing the size and shape of the spaces, maximising visual access and controlling levels of stimulation can all be helpful [34]. The use of a separate room or space, if available, is useful; it affords a place for the person and their carer to wait with fewer distractions, meet with the clinician prior to treatment and for rest periods if needed, during treatment.

Improvements can be made to the environment of the practice to increase the accessibility to older patients in general and particularly to patients living with dementia. It has been noted that by designing an environment for people with dementia it will result in a well-designed environment for all [35]. All environments should be designed to compensate for decreasing orientation skills [36]. It may be difficult to make large modifications to the design or layout of the practice, but some changes can be simpler to achieve. It may be helpful to undertake a practice audit or ask staff or a patient group to walk around the public spaces in the practice to gain insight into what may need to be changed.

It is useful to review the whole patient journey through the surrounding environment; clinicians must consider the patient journey and their ability to access a dental setting. This includes considering the building itself and transport to it, including parking and the availability of disabled parking spaces if required. Entry into the building should be straightforward via a clearly visible entrance, which should have wheelchair access, ramps, a door of a suitable width and handrails. The journey to the reception should consider how the easiest floor plans are straight circulation systems, with no changes in direction, such as an L-shape, as this leads to less disorientation [37]. Finally dental teams should review access into the dental chair and facilitate easy transfer from a wheelchair, if needed. Drop-leg chairs can support this. It is most helpful if there is place in the surgery for a relative or carer to sit during the appointment. Furthermore, good non-glare lighting should be utilised whilst also making good use of natural daylight. Sudden changes in light contrast should be avoided whilst maintaining good colour definition [38, 39]. Flooring with noise reduction is also desirable and it should be a solid matt colour with no patterns. Signs should be prominent and easy to read, and toilets should be clearly marked and include grab rails. In addition, there is even a benefit in having a toilet seat and toilet paper in distinct colours. These seemingly specific factors can go a long way into supporting people with dementia to enter and feel at ease in the dental setting and can potentially contribute to reduction of pre-treatment anxiety.

Supporting the Individual

To meet the needs of patients with dementia will require some adaption to both the practice environment and service delivery. Dental care needs to be carefully planned throughout the progression of the disease to avoid crisis management in the later stages when intervention becomes much more problematic. Continuity of

care is a fundamental part of supporting an individual living with dementia. This enables the person to build a trusting relationship with their dentist and for the clinician to monitor their dental and general health and document any changes over time [40]. It also allows the practitioner to develop long term care plans and have a full understanding of what treatment may be acceptable for that individual. If a patient requires referral to a specialist service for an episode of care in the future, it may be appropriate for the patient to return to a familiar setting after this, or for care to be shared between generalist and specialist settings. Recognising that some people have good days and bad days, by knowing the individual it may be possible to plan dental care to be delivered at their best time of day. Dental appointments should be kept within the individual's ability to cope. This can vary, with some who have short attention spans, or who are particularly anxious being less able to cooperate [40, 41]. The aspects of dental care to consider mainly centre around the themes of consent, communication, dental care planning and clinical dental management.

Being person-centred is about focusing care on the needs of the individual, ensuring that people's preferences, needs and values guide decisions, and providing care that is respectful of and responsive to them [42]. Every effort should be made to involve the individual in planning their mouth care with support from family or friends who know the person. Brennan and Strauss [43] highlight the importance of a thorough medical and dental history in designing an appropriate dental care plan for each patient. It can be difficult for a person with dementia to complete this in the surgery and they may not have all the relevant information with them. Dentist should consider if a medical history form could be sent to the patient or their carers for completion before the dental appointment. A supporting welcome letter is also useful with details of the appointment procedure and a request to bring a list of any queries or concerns to the visit, as this is shown to improve communication and enhance oral health literacy.

A detailed social history is also invaluable to ascertain the wishes of the patient and the mouth care training needs of family and caregivers [44]. A discussion with carers before the appointment can be helpful with respect to the appointment time, transport issues, necessary modification of stressful stimuli (noise, mirrors, etc.). In addition, this may be an opportunity for the carer and patient to become familiar with members of the dental team. Many people living with early dementia may proactively wish to bring a family member or friend with them to an appointment; there is no reason to discourage this form of support for any patient. The support of such individuals will be increasingly valuable as a person's dementia symptoms progress.

The appointment system should allow for all the practice staff to be alerted that a person with dementia will be on the premises so that they can share the responsibility of ensuring that person has a positive experience whilst in the practice. It also means that everyone can be vigilant to make sure that the individual's safety is maintained, particularly if they attend independently. Safeguarding is important and under the Care Act (2014) [45], all practices should have an 'Adult Safeguarding Policy' and a

'Did Not Attend' or 'Was Not Brought' policy so any concerns can be raised, as appropriate, if patients with dementia fail to attend repeatedly without a valid reason.

Adapting Treatment to the Stage of Dementia

The signs and symptoms of some types of dementia can be subtle in the early stages meaning regular dental attenders may still attend for examinations and treatment either before or after a diagnosis of dementia [46]. All types of dementia have variable and potentially unpredictable trajectories [47], therefore being seen soon after a dementia diagnosis affords the opportunity to discuss dental care for the future. In the early stages, the patient should still have capacity to consent and can cooperate. The level of oral hygiene and periodontal status needs to be carefully assessed and a preventive regime put in place. A proactive approach to restorative treatment should be taken whilst keeping restorations simple and easily maintained. Teeth with a doubtful prognosis should be extracted whilst those with a good prognosis particularly canines and first molars should be restored if possible. Occluding pairs should be identified and it is important to ascertain what level of restorative dentistry can be provided [48]. Removable prostheses may be preferable if there is a concern about deterioration in oral hygiene occurring over time. If used, prosthesis should be labelled. Denture loss is common and a significant issue for patients and care teams especially as replacement of dentures in the future can be increasingly difficult and the process of producing and wearing dentures may be less well tolerated. Copy dentures have their place for older people, including people living with dementia, to reduce the issues that arise if dentures are lost.

In the middle stages the dental team may notice a previously compliant patient exhibits signs of confusion and agitation. Friedlander et al. [49] found that impaired cognition, apathy and apraxia in this stage lead to a lack of interest and diminished ability to carry out basic oral hygiene measures, hence maintenance and prevention of further disease become the focus of treatment at this point [40, 50]. More frequent recalls on a three-monthly basis may be required to maintain the focus on prevention. As the dementia progresses, the appropriateness of complex treatment should be continually reviewed. It may be suitable for some, based on a person-centred patient assessment, yet typically where maintenance is lacking it is less appropriate to place complex restorative dentistry which requires extensive maintenance. It is particularly relevant at this stage that the dental team support and encourage family members and carers to assist with or carry out oral hygiene measures. However, as the disease progresses it becomes more difficult for carers and family members to undertake oral hygiene due to an increase in care resistant behaviour and the overall care burden [51].

The neurological changes in the brain for patients with dementia mean that they may have a heightened threat perception so they may perceive mouth care as threatening and respond with care resistant behaviour [52]. Disruptive behaviour is usually preceded by feelings of fear and confusion and is a coping mechanism for the patient. Many of these problems can be prevented by decreasing environmental

stresses, meeting basic needs of comfort and improving the quality and quantity of social interaction [39, 53]. The members of the dental team need to be prepared to stop procedures and set a new appointment if the patient's behaviour indicates a need to withdraw or to leave the dental surgery.

In the later stages of dementia, the patient may have difficulty eating, speaking and swallowing. Muscle loss can make it more difficult to wear removable dentures and this in addition to a reduction in neuromuscular coordination can further impact on a person's ability to communicate and eat. Here, the focus of dental care should be to ensure that the mouth is comfortable and that there is no further deterioration of oral function. Carers should be supported to carry out a regular oral hygiene regime to disrupt the biofilm that can accumulate (as described in Chap. 5). If dental treatment is necessary, there may be challenges with how well a person can tolerate dental care delivery. Though some patients can receive treatment under local anaesthetic despite varying degrees of cognitive impairment, it may become necessary for treatment to be provided under intravenous sedation or under general anaesthetic in some cases. This should only be considered where the benefit of the proposed treatment outweighs the risk of these more complex approaches [41, 54]. In advanced stages of dementia, a conservative and palliative approach is typically more appropriate as generally, the risks of delivering complex treatment outweigh its benefit unless there are oral symptoms. Preventative care centred around the individual remains essential for all patients.

Mental Capacity and Decision Making

Dementia can affect memory, understanding and communication so can drastically impact on a person's ability to consent for dental treatment. It is important to note that a diagnosis of dementia alone does not mean a person cannot consent for their treatment; in fact, many people living with dementia are able to make their own decisions even if may not be as simple for them as it may have been historically. The person for whom a decision relates and their values and preferences must be considered comprehensively whether or not they are able to consent for their own treatment.

Legislation

The law regarding mental capacity varies between the nations of the UK and abroad. UK legislation is typically consistent though subtle differences arise. The Mental Capacity Act 2005 [55] (applying to England and Wales) has a great deal of commonality with the Mental Capacity Act Northern Ireland (2016) [56] whilst there are more significant differences in the Adults with Incapacity Act (2000) [57] applicable in Scotland. Importantly, in each of these pieces of legislation, a person is presumed to retain capacity to make decisions unless an inability to do so is formally identified. In addition, there is a focus on specific decisions and capacity assessment should be time and decision specific. The Mental Capacity Act (2005)

Table 10.3 The key principles of the Mental Capacity Act [55]

A person must be assumed to have capacity unless it is established that he lacks capacity
A person is not to be treated as unable to make a decision unless all practicable steps to help him to do so have been taken without success
A person is not to be treated as unable to make a decision merely because he makes an unwise decision
An act done, or decision made…for or on behalf of a person who lacks capacity must be done, or made, in his best interests
Before the act is done, or the decision is made, regard must be had to whether the purpose for which it is needed can be as effectively achieved in a way that is less restrictive of the person's rights and freedom of action

[55] describes how mental capacity should be assessed and decisions made where there is a disturbance in functioning of the mind or brain such as in dementia. This act is based on five key principles (Table 10.3) which broadly aligns other legislation used across the UK.

For healthy adults, including those with earlier dementia, the expectation is that they will retain mental capacity (Principle 1) and that they will be supported to make their own decisions (Principle 2). The Mental Capacity Act promotes autonomy and ensures a decision made is based on what is right for the person if they are assessed to lack capacity. The formal assessment of capacity detailed in the Mental Capacity Act is a two-stage test:

Stage 1 asks whether there is an impairment in functioning of the mind or brain, be it temporary or permanent. If there is no known reason for impairment, there can be no progression to Stage 2. It is therefore crucial to establish if a diagnosis has been given to a person if capacity is being questioned yet no diagnosis is formally declared. If a dentist suspects there may be symptoms of an underlying cognitive disorder this can be investigated and a treatment decision for elective care can be postponed under further information is gathered.

Stages 2 is based upon the person's ability to:

1. Understand the information given
2. Retain this information (long enough to make a decision)
3. Weigh up the available options
4. Communicate a preference (by any means)

If any of the four components cannot be met individually, then the person is assessed to lack capacity. Capacity assessment can be straightforward where somebody clearly has capacity or obviously cannot meet the above criteria. What becomes more challenging, however, is when there is ambiguity. The nature of 'understanding' can be difficult to assess, as this is based on how much information is given to a person for them to understand. A reasonable adjustment to support a person to make their own decision is to simplify the way in which information given or the nature of such information itself or to give them additional time to process this. How much information is given to a person will depend on what is perceived to be relevant for the person, and what material risks may apply [58].

Where capacity is present, shared decision making is an accepted model for clinical practice [59]. Here, a patient's values and preferences are established in relation to the available options. These options are explored and the clinician supports the patient to choose an option that is aligned with their values and preferences. Where capacity is assessed to be lacking, the patient is no longer the decision-maker about their own care. This sharp divide between capacity and not has been criticised, [60] yet remains the basis of legislation and there is a necessity in an alternative decision-maker acting to agree to or undertake a plan.

It is often assumed that family members of a patient become decision-makers when the patient is assessed to lack capacity [61]. Family members can act as formal decision-makers in two instances: (1) when a Lasting Power of Attorney for Health and Welfare was established for the person prior to the loss of capacity or (2) when this was not done, when the Court of Protection has allocated a family member as a 'Deputy' in a formal manner. Many people diagnosed with dementia wish to plan ahead and legally establish a Lasting Power of Attorney for both welfare and for finances yet this does not always occur. In the absence of these two formal roles, the role of the family member (in England and Wales) is to support the clinician to establish what is felt to be in the patient's best interests. This process reflects the concept of personhood in that the person's life experiences and values are essential to inform an approach which suits them as an individual.

Best Interests Decision Making

Scottish legislation stresses that any act made in relation to a person lacking capacity must benefit the person [57]. This differs from the MCA whose fourth principle details how a decision should be made in a person's best interests. The term is not defined in either the Mental Capacity Act or the associated Code of Practice [62]. There are varying perspectives on what best interests entails, even if the same outcome may arise. One approach described in the broader literature is that of Substituted Judgement, doing what the person would have wanted or chosen for themselves if they were still able to express this. If this approach to decision making is employed, the decision-maker uses the information provided by those close to the patient to put themselves in the position of the patient to the best of their ability to figure out what they would have done. Though it is important to consider what the person would have done (substituted judgement), this is only part of the puzzle in determining what is in their best interests *after* capacity is lost, a circumstance for which they could only somewhat prepare. The person can never know how they would feel and what they would wish for with a cognitive impairment as they could not know what this future may entail [63, 64]. On this basis, the spirit of best interests was clarified in the Court of Protection, where Lady Hale stated:

> in considering the best interests of [a] particular patient at [a] particular time, decision-makers must look at his welfare in the widest sense, not just medical but social and psychological; they must consider the nature of the medical treatment in question, what it involves and its prospects of success; they must consider the outcome of the treatment is or would be

> likely to be: and they must consult others who are looking after him or interested in his welfare, in particular for their view of what his attitude would be. [65]

This gives useful insight into what factors should be considered and what types of knowledge about the person, procedure and risk need to be considered in best interest decision making. The need to consider a treatment's outcome may sound straightforward, yet it may be difficult to estimate or establish the chance of success of a treatment, or whether an adverse outcome will arise. In the context of treatment for a person living with dementia, there are also short-term impacts (such as a post-operative infection) and longer-term impacts (altered function) that need to be simultaneously considered alongside a neurodegenerative progression. Though the formal clarification of best interests can appear theoretically and medicolegally complex, it is often more straightforward, at least when capacity is clearly permanently lacking. Here, a simple discussion with a family member, for example, may be adequate to identify what course of action is in a particular patient's best interests. Where treatment or a decision regarding it are particularly simple, if a patient cannot consent for the simpler option, the discussion with a family member may be brief. For example, a mobile posterior tooth causing bother clearly in best interest to remove if able and safe to do so.

Situations can be more complex than this of course and in these instances the key, as detailed in the above quote, is to consider the patient's attitude and views alongside the wider circumstantial considerations and to consider these together with the support of those who have an unpaid role in the life of the person. As difficult as this can be, working with other dental colleagues and seeking further support about the person, their best interests at that point in time can be ascertained. It may be that these interests change, such as if health deteriorated or symptoms arose, so the nature of best interests should be reassessed where appropriate. Dental guidelines do exist [40, 46, 50] to support the care of people living with dementia yet these are simply guides and cannot account for each individual person and their unique preferences which should be the primary factor supporting decisions made.

Conclusion

Dementia clearly impacts both individuals, their families and healthcare providers and society in multiple ways. Though some types of dementia are more common, each individual and their experience of the condition differs. In the dental setting, this variation has significant implications. Each individual's experience and attitude towards oral hygiene may differ as may their attitudes or understanding of dental care and how they may be impacted by dental care being either unavailable or being actively provided. People may express pain differently or have differing points at which this is expressed both before being diagnosed with dementia and as the condition progresses. Understanding the person holistically including their life-long experiences of dental care, health care, can support the delivery of high-quality person-centred care to optimise quality of life.

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Palliative and End-of-Life Oral Care and Oral Care Planning

11

Richard Fitzgerald and Andrew Geddis-Regan

Aims

To understand the considerations of planning dental treatment for patients receiving palliative care and to be able to support them with a clean and comfortable mouth right up to end-of-life (EOL).

Learning Objectives

1. Know the importance of oral health for patients approaching EOL.
2. List common considerations when creating an oral care plan for EOL patients.
3. Understand when and how to involve those supporting the patient such as the patient's family, carers and other healthcare staff.
4. Apply strategies to treatment planning for these patients.

Introduction

Definitions of Palliative Care and End of Life Care

From the onset, it is important to discuss what exactly we mean by the terms 'end-of-life' (EOL) and 'palliative' care to avoid confusion. Although clearly intertwined

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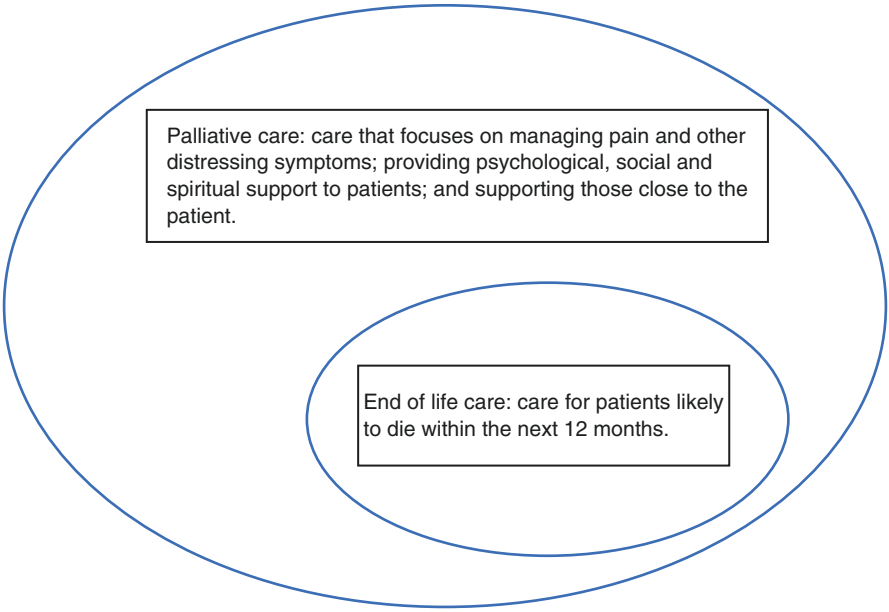

Fig. 11.1 An illustration of the relationship between palliative care and end of life care

(Fig. 11.1), there is an important distinction. Both NICE [1] and the General Medical Council define end of life as when a patient is likely to die within the next 12 months but also includes patients with:

- advanced, progressive, incurable conditions
- general frailty and coexisting conditions that mean they are at increased risk of dying within the next 12 months
- existing conditions if they are at risk of dying from a sudden acute crisis in their condition
- life-threatening acute conditions caused by sudden catastrophic events [2].

Palliative care, however, is defined as 'care that focuses on managing pain and other distressing symptoms; providing psychological, social and spiritual support to patients; and supporting those close to the patient' [2]. It forms an important part of end of life care but can also be an important part of care before end of life is approached. The UK's end of life charity, Marie-Curie, describes end of life care as a subset of palliative care [3].

Although palliative care can be needed by anyone with chronic conditions, several authors report the following conditions as the most common [4, 5]:

- cancer
- heart disease, including heart failure
- cerebrovascular disease (stroke)
- renal disease (chronic renal failure)

- liver disease
- respiratory disease (chronic respiratory disease and respiratory failure)
- neurodegenerative diseases
- dementia, Alzheimer's disease and senility
- HIV/AIDS.

However, the majority (60–80%) of patients accessing specialist palliative care services have a diagnosis of cancer [6].

Epidemiology of End-of-Life Care for the Older Person

The above conditions can affect patients of any age and therefore end of life care is not limited to the older person alone and the principles discussed in this chapter can generally be applied to a patient at any age approaching end of life. That said, most people who are approaching end of life will be older. This is reflected by adults over the age of 60 accounting for 69% of palliative care needs at the end of life according to the World Health Organisation [7]. As well as requiring more end of life care, the patterns of conditions of those in end of life care is different for adults above the age of 60 [7].

The most common conditions at end of life (cancer and cardiovascular disease) are more common in patients over the age of 60 than those below. Conditions such as dementia and neurodegenerative diseases are much more commonly seen in older adults, whilst the prevalence of HIV/AIDS is much lower. Conditions such as liver disease and multiple sclerosis are seen in all age groups.

Over 600,000 people die in the UK every year [9] and there are estimates that roughly 75% of deaths will need palliative care input [4, 10]. The number of older persons living in the UK has consistently increased over the previous decades and is forecast to continue to increase [11]. In addition, people will approach end of life at older ages and increasingly at home or in care homes rather than in hospital [12, 13]. Drawing from these trends the number of older persons receiving end-of-life care in the community, and therefore at potential need for community dental care, is likely to increase. In summary, older persons comprise the majority (but not totality) of those at end of life, and the pattern of conditions leading to end of life is different for the older population.

Palliative Care Dentistry

There is no widely accepted definition for 'palliative dental care' but there are some examples in the literature. Wiseman proposed a definition as 'the management of patients with progressive, far-advanced disease for whom the oral cavity has been compromised by either the disease directly or indirectly as a result of treatments received and the focus of care is on the immediate quality of life' [14, 15]. A weakness of this definition, however, is that it may exclude dental care in the earlier stages of terminal diseases (not end of life, or 'far-advanced') as well as in those whose oral health has not yet been compromised but is likely to in the future.

A distinction should also be made between 'the dental care of patients receiving palliative medical care' (which can include usual, comprehensive dental care, especially if the patient is not receiving end of life medical care) and 'dental treatment with a goal of addressing symptoms and improving/maintaining (oral health related) quality of life insofar as possible rather than comprehensively restoring oral health'. For the purposes of this chapter, we will use the latter to refer to palliative dental care. This point is returned to later in the chapter (see 'Approaches to Dental Care or Treatment' below).

The End of Life

Although patients in end of life are defined as above, the real-world practice of identifying patients at end of life can be difficult. Indeed, research suggests dentists may not adequately identify patients at end of life [16], based upon the provision of comprehensive and often invasive dental treatments in the last year of life. Establishing an end of life prognosis can be difficult even for medical professionals [17, 18], especially for patients following the 'frailty' end of life pattern (see Fig. 11.2) [19] and so perhaps it is not surprising that dentists with less (and sometimes no) training in this area find it challenging.

However, despite its challenges, identifying patients at end of life can have direct implications for dental treatment planning and so dental professionals working with this cohort need to equip themselves with an awareness of end-of-life trajectories, (shown in Fig. 11.2) as well as the common end of life conditions mentioned above. Thankfully, tools and tips exist to help identify those at risk of end of life.

A common and simple question used in medicine to identify EOL patients is the 'surprise question': would you be surprised if the patient died within the next 12 months? This crude, but useful, question will help guide dentists also as they consider treatment planning.

An example of a more formalised tool is the Supportive and Palliative Care Indicators Tool (SPICT™) [18, 20]. SPICT™ is an accessible, one-page tool that lists both the general indicators and condition-specific indicators of deterioration in health and therefore at risk of EOL.

The general indicators are:

- Unplanned hospital admission(s)
- Performance status is poor or deteriorating, with limited reversibility (e.g., the person stays in bed or in a chair for more than half the day)
- Depends on others for care due to increasing physical and/or mental health problems
- The person's carer needs more help and support
- Progressive weight loss; remains underweight; low muscle mass
- Persistent symptoms despite optimal treatment of underlying condition(s)
- The person (or family) asks for palliative care; chooses to reduce, stop or not have treatment; or wishes to focus on quality of life [20].

The specific conditions listed in SPICT™ are:

- Cancer
- Dementia/frailty
- Neurological disease
- Heart/vascular disease
- Respiratory disease
- Kidney disease
- Liver disease
- Other

A similar tool is the Gold Standards Framework Proactive Identification Guidance [21]. This tool is more detailed but slightly longer.

End of Life Trajectories

End of life trajectories refers to the rate of decline of function with everyday tasks as patients approach death. The term 'function' here refers to ability to carry activities of daily living such as preparing food, dressing oneself, transferring into/out of bed, etc. This is useful as it can be assessed clinically through a history such as those taken in a dental practice (e.g., do you need help cooking at home or getting in/out of bed?) and can be used to identify end of life patients. However, even those with a low 'function' may not be in end of life (see frailty below) and so it is important to be aware of the trajectories.

There are four common trajectories based upon the cause of death [8], as illustrated in Fig. 11.2.

The first illustrated here is 'sudden death' where there is no loss of function as death was unexpected, for example, a fatal road traffic accident. It is not possible to identify these patients as death is unexpected. They will not receive any palliative care and there are no associated effects on dental treatment planning for this group, so it is described here only for completeness.

The second trajectory, terminal illness, is perhaps the simplest to identify as it applies to patients with a condition that is expected to lead to death in the short term, e.g., malignancies not responding to treatments. These patients can be identified through their medical history and by contacting their wider medical team.

The third trajectory is organ failure. This is variably defined but usually refers to progressive deterioration of major organs including the heart, lungs, liver and kidney. Here, the patient's ability to complete activities of daily living may fluctuate as time passes: the patient can cope well after treatments but during acute phases of organ failure may not be able to complete everyday tasks. The function does deteriorate over time, even after recovery of an acute phase, however. Identifying these patients in a dental setting is possible through a detailed medical history, but how close they are to death can be more challenging as those in low function may be experiencing an acute deterioration in their condition, which may recover, or be approaching the end of life, where it will not recover. Asking about activities of daily living and consulting the patient's medical team will help.

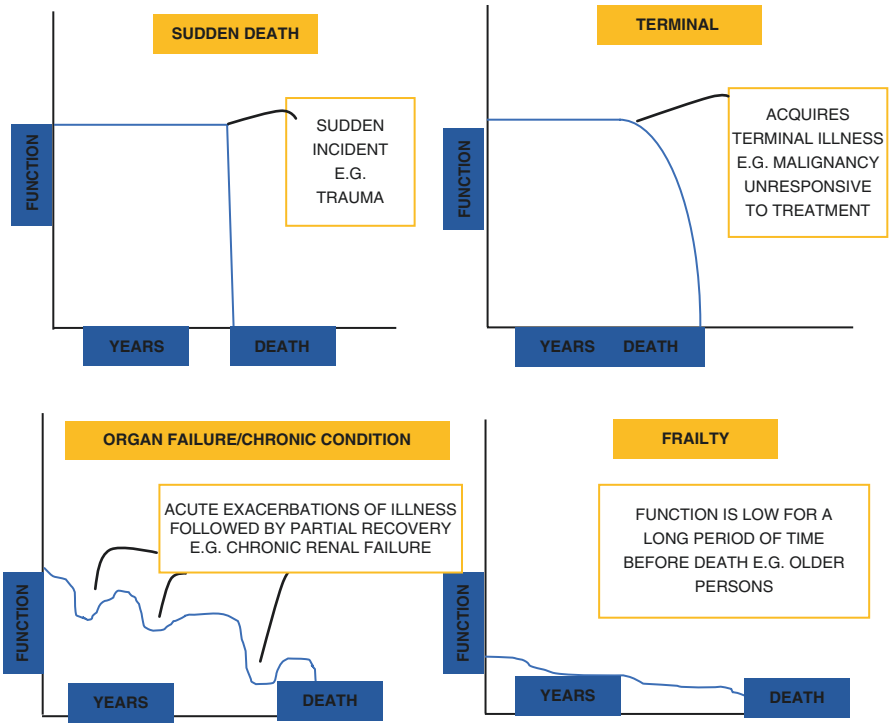

Fig. 11.2 The four common trajectories to end of life [8]

The fourth and last is frailty. Here, function is low and often has been low for some time. This is a common trajectory in the older person where their age and likelihood of comorbidities have been increasing leading to the loss of function long before end of life is approached. These patients present a challenge in identifying end of life patients: those with low function could live for many years. Consulting the wider medical team will certainly help but without specific life-threatening diagnoses such as malignancies or organ failure, there may be less certainty as to the life-expectancy. It should be mentioned that although several studies support these four distinct trajectories, other studies found that function decrease in older persons was not as predictable [22].

Oral Health at the End of Life

Oral health can change quite dramatically at EOL. It is a time of often rapid change in both a person's health and ability to carry out activities of daily living. Comorbidities and polypharmacy are common and so will affect oral health. In addition, the treatments of the patient's life-threatening condition can bring side effects that directly affect the mouth, e.g., radiotherapy and chemotherapy for malignancies. There are limited studies examining the oral health of EOL patients [23].

Caries is common with a prevalence of 10–50% [24, 25]. Two studies involving 197 and 1216 patients, respectively, from the USA found that almost 40% of EOL patients' remaining dentitions had carious or retained roots, the mean number of carious teeth was 6.3–6.4, and that there were significantly more carious teeth in EOL patients compared with other long-term care residents [2, 3]. There are several reasons for this high rate of carious teeth. As previously mentioned, a decline in function is common in EOL which will of course affect the ability to self-provide adequate oral hygiene measures. In fact, studies suggest that as high as 50–82% EOL patients require assistance [24, 26, 27]. In addition, access to professional dental services may have been challenging for some time in progressing systemic disease, advancing malignancy, increasing frailty; even before EOL is approaching. This in turn means reduced professional exposure and associated prevention. The debris-cleansing and carious preventive effects of salivation are lost as hyposalivation increases (see below). However, an important consideration is that treating the caries in itself may not be a priority for EOL patients; the symptomatic sequelae such as pain, sharp edges of cavities, fistula/abscess may well be as quality of life becomes paramount. This is revisited below in the treatment planning section.

Although studies examining periodontal conditions in EOL are lacking, factors such as hyposalivation, barriers preventing optimal oral hygiene, problems accessing professional dental care, and the accumulative nature of bone loss in periodontitis means periodontal disease is commonly encountered in EOL patients. Again, it is the effects on quality of life that may be more relevant—for example, the loose tooth/teeth causing discomfort or a reduced retention of a prosthesis. Prosthesis use in EOL patients is common (estimates 14–54.8% [25, 26] with 34–35.7% being edentulous [16]. Unfortunately, reports of denture problems are common [28] which has a potentially large impact on quality of life as oral intake and social confidence are critical in end of life [29].

Hyposalivation (the objective lack of normal oral saliva, differentiated from xerostomia: a subjective patient symptom of dry mouth) is common in EOL, present in up to 98% of patients and usually progresses as death is approached [24, 25, 30, 31]. Not only is the prevalence of hyposalivation high, but it is also its extent: 20–64.8% of EOL patients had moderate to severe hyposalivation from two studies, based on oral dryness or hyposalivation scales [30, 31]. It comes as no surprise then that xerostomia is also very common (64–92% of EOL patients) [25, 30, 32] with its associated effects on oral comfort and function (see next section).

Mucositis (chronic inflammation of the mucosal membranes, such as oral mucosa) is a common side-effect of cancer therapies such as chemotherapy and radiotherapy that contains the mouth in the radiotherapy field. It could therefore be present in EOL with advanced cancer and is an important condition to manage. Radiotherapy to the jaw region could also cause varying degrees of trismus, with associated effects on oral intake, prosthesis use and speech. Ulceration of the mucosa is also reported in EOL patients with cancer [30, 32]. Candidiasis is a specific oral concern in EOL of patients with prevalence estimates of 6.6–44% and one study found that this increased in both prevalence and rate of complications with reduced oral intake when approaching death [24, 25, 30–33].

Symptoms and Oral Health Related Quality of Life

Figure 11.3 details the process of patient assessment, for people at EOL and other patient groups. As alluded to previously, and explained further below, it is the effects of oral conditions on quality of life, and not merely the presence of the conditions, that are the primary concern in end-of-life patients. Perhaps the most concerning finding of EOL research is that 48–67% of EOL patients report oral pain or discomfort [25, 32]. Both taste disturbance and dysphagia are common in EOL patients and both are likely to increase within a month of death [28, 30, 32]. Fischer et al. [30] found that the prevalence of functional impacts of oral morbidity was high: difficulties with swallowing (61%), speaking (57%) and eating (55%) were common, as were problems such as food restriction (50%), oral dryness (66%) and oral pain (44%). Patients also reported being worried or bothered because of their oral health (51%), not wanting people around them (22%) and life being less satisfying (36%). Certain oral conditions were more associated with functional or social affects, namely: hyposalivation, taste disturbance, pain and ulceration.

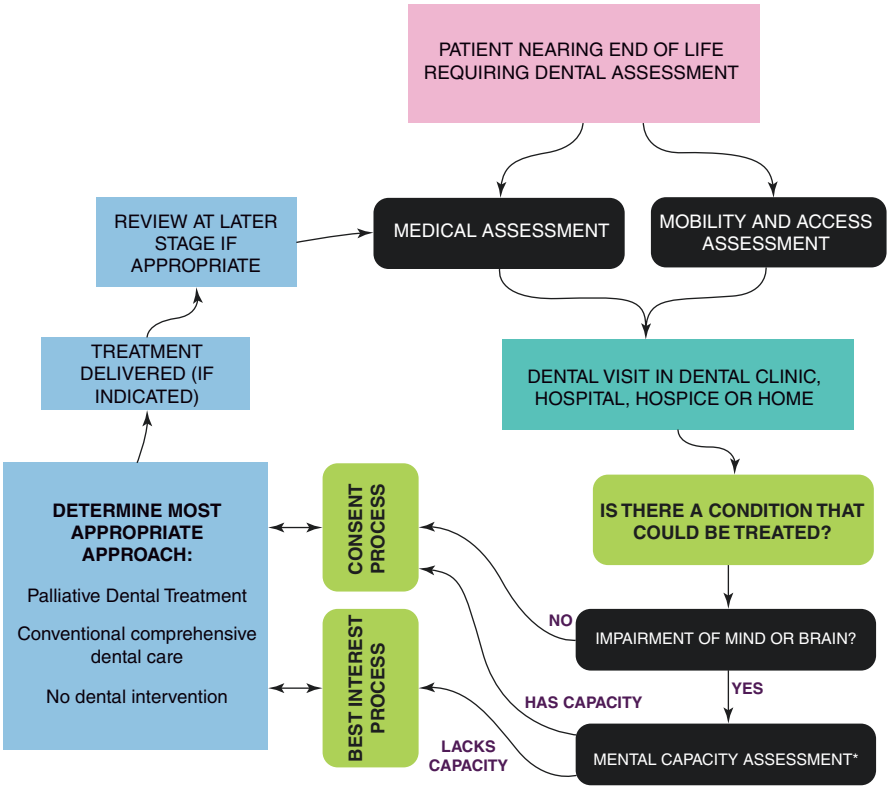

Fig. 11.3 The process of assessment and care planning at the end of life

These symptoms in turn affect the day-to-day life of EOL patients, reducing the quality of life. Patients with severe oral conditions (oral pain, dysphagia, severe mucositis, etc.) may not be able to eat— not only risking accelerating deterioration due to malnutrition, but also losing an inate human source of joy. The dentition also serves many social functions: patients who have missing or broken teeth or dentures may be embarrassed to smile, to get close to loved ones (perhaps due to halitosis) or to share a meal with family or friends. This, in addition to an often-new inability to self-perform personal hygiene including oral hygiene, can exacerbate mental health conditions and low mood at a difficult time. Encouraging autonomy and preserving oral health as much as possible therefore remains important, and oral health professionals play a role in ensuring this is not ignored. Due to a low or rapidly decreasing function, access to dental services may be impaired. Therefore, support in terms of reasonable adjustments may be required. Often dental examinations for EOL patients take place on a domiciliary basis, where the dental team travels to the patient's home, long-term care institution (hospice, care home) or even hospital. The community dental service often plays a crucial role in these cases. Other times the patient may be well enough to attend the dental clinic, with or without ambulance transport. Sometimes, due to practical or other reasons, a remote video or telephone dental consultation may be carried out where the goal is to screen for any dental/oral symptoms, educate about the importance of oral health and regular oral hygiene (to patient, family and/or care staff) and ensure a plan is in place if any symptoms arise in the future.

Thankfully, although the above challenges exist, there is usually a good level of support from both personal and professional healthcare services. Family and friends not only provide invaluable personal, emotional, social and spiritual support, but even so with practical support such as arranging dental appointments or being a point of contact or being involved in best interest decisions. Due to a high care need, there is often a wide healthcare team who know the patient well and are an excellent source of further information or recommendations. Oral healthcare professionals have an important role in this wider team, as evidenced by the high rate of oral conditions, symptoms and effects on quality of life mentioned above. The final stages of life may coincide with the most substantial determinate effects of oral conditions meaning the dental team and caregivers should work together to ensure oral comfort in the end-of-life setting.

Care Planning and Decision Making

The term *treatment* planning is widely used in dentistry. This term, however, actively suggests that intervention will be undertaken whilst this may often be inappropriate due to patient wishes or the balance of risk and benefit. We propose the term 'care planning' as a more holistic approach to determining the nature of dental care that may be appropriate (preventative, interventive or both, for example). Treatment planning and decision making are closely intertwined but not fully synonymous. A treatment plan is produced by a dentist. This may be based on previous patient

examinations and discussions or may be produced by the dentist, then presented to a patient to inform a discussion, leading to further examination or diagnostic assessments. Decision making relates to the choice between a range of options. Whilst treatment plans are produced by dentists, the decision to proceed with a chosen option—or not—should be made by the patient where they are able to do so. A care plan is a collaborative agreed approach to care provision.

Though a dentist must understand a patient's wishes through history taking which should precede treatment planning, the patient's wishes in respect to particular treatment options or approaches need to be understood before they are actually delivered [34, 35]. The challenge for dentists is how much of a discussion to have at each point of the patient's journey. In reality, the combination of clinical findings, medical suitability and patient wishes should all contribute to a joint decision made for dental care and the process of decision making is longitudinal [36].

Chapter 10 details how a person's ability to consent for treatment is determined through a formal assessment aligned with legislation. As described, the patient must be assumed to have mental capacity and decision-making ability unless it is identified that capacity is impaired due to a relevant mental impairment that affects their ability to make a specific decision at a specific time. Here we focus on patients with capacity and the factors that should feed into discussions about how, if and when dental care is planned and delivered. For older people, the burden of oral diseases can be significant leading to a range of approaches being possible to restore or maintain specific teeth or prosthesis or an entire functioning dentition. Alternatively, a patient may decide not to pursue dental treatment in the absence of symptoms. For many patients, this could be an acceptable approach to dental care, especially if it aligns with their known preferences. Regardless of how much treatment is delivered, preventative regimes should be implemented to minimise the risk of oral diseases progressing and symptoms arising. Patients who decide to avoid active interventive care should still be able to access appropriate urgent dental care if this becomes necessary.

Autonomy and Shared Decision Making

Before any elective or emergency dental care is delivered, a decision has to be made to deliver it. A range of approaches can be taken when planning any healthcare intervention—including dental care—and when establishing what the correct course of action is for any given patient. Approaches can vary in both the extent to which a patient is involved in decisions about their care and about how clinical and logistical factors are considered [37]. Historically, a paternalistic approach has been employed where 'doctor knows best' [38] and patient autonomy was essentially absent [39]. Here is an assumed imbalance in knowledge resulting in the clinician using their professional knowledge to make decisions for a person. The person themselves is minimally involved, if at all. With this approach to care, two patients with similar dental problems would receive the same management, regardless of their attitudes,

anxiety, preferences or financial circumstances. With time there has been a growing emphasis on patient-centred care [40] and this view, though it may prevail in some contexts, is no longer deemed appropriate or ethically acceptable, not reflecting the standards of informed consent expected in clinical practice [41, 42].

Reflecting a greater emphasis on patients as partners in healthcare as opposed to recipients of care, the dynamic of clinical decision making has transitioned and become increasingly complex. Despite there being a greater number of variables, the incorporation of patients as proactive healthcare partners is welcome and reflects the imperative nature of autonomy [34]. With patients having the right to choose their own path, autonomy is a key principle of medical ethics [39]. As this has become increasingly recognised, the role of clinical staff in allowing patients to make their own informed choices has become increasingly discussed. An approach that contrasts paternalism is that of 'Informed Choice' [41]. Here, a patient, provided with information, makes their own decision entirely, without any deliberation or discussion with a physician. This reflects patient's autonomy in choosing their own care. Though this approach may seem beneficial, patients may not be able to utilise the knowledge they are given when considering their own preferences [43].

Reflecting the limitations of both paternalistic decision making and of informed choice, the model of shared decision making (SDM) has been proposed [34, 44, 45]. In this model the clinician and patient are equal partners both with roles and responsibilities. The clinician must discuss available approaches to care whilst the patient should be supported to express their perspective to enable to clinician to tailor the information given to their circumstances. Here the patient retains their autonomy but uses this to make an informed decision from options presented to them. The decision making responsibility is shared between the parties, with the patient ultimately choosing from the options they are given [34]. All suitable treatment options should be presented as part of legally valid informed consent. Where somebody is advocating for a patient in a best interests discussion, such as a family member or independent mental capacity advocate, they must be aware of the options and their merits in relation to the person whose care is being considered. The principles described (Fig. 11.4) all need to be considered when determining what treatment, or if a decision not to provide treatment, is in somebody's best interests [46].

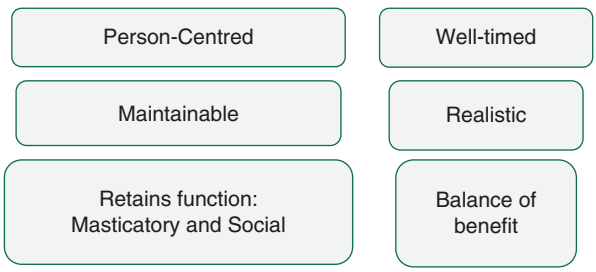

Fig. 11.4 Ideal aims of dental care towards the end of life: it may well not be possible to each of these for each individual especially where function has to be impacted to manage symptoms

Approaches to Dental Care or Treatment

As discussed, patients should be actively involved in decisions made regarding their care. Patients cannot, however, demand whatever treatment they may desire as not all approaches are suitable or appropriate for all patients and all dentitions. The challenge for the dental team is to present feasible options to a patient as part of the shared decision-making process. In all patients, but specifically in older people, a range of options and approaches may be suitable and some information regarding the person's preferences is required to guide the presentation of available options [36].

With heavily restored dentitions, potential cognitive decline, physiological changes, frailty or a combination of these factors the options presented may need to be modified. Professional guidelines offer some insight into the types of care that may be appropriate though these do not replace the need for person-centred care discussions. Regardless of specific services or patient wishes there are three key approaches to care provision that can be proposed alongside comprehensive preventative care: conventional comprehensive care, palliative dental care (see definition above) or no care. Examples detailing these options are presented in Cases 1, 2 and 3 (shown in Figs. 11.5 – 11.9). A combination of approaches can be taken, such as conventionally restoring an anterior tooth but leaving an asymptomatic posterior tooth which is damaged but asymptomatic.

In reality, a combination of approaches may be needed to align with the principles specified in Fig. 11.4 and to help a patient achieve their goals of care. A consensus statement, the Seattle Care Pathway was published in 2014 [47]. This considers the manner in which a person's health and degree of dependence on others to support care may impact upon suitable dental treatment options. It considers the issues of patient assessment, preventative care, communication needs as well as the approach to dental treatment. The process described here is that of a pathway, through which a person may progress as their level of dependence increases. This is highly logical as a patient's wishes and preferences are likely to change as their dependence changes. The pathway presented by these authors does not overrule patient's autonomy and decision-making ability yet simply proposes a planned and considered approach to the current and longer-term oral health needs and care delivery.

When considering conventional dental care, if a patient is motivated, and able to accept conventional comprehensive treatment there is no contraindication to doing so just based on somebody's age. Indeed, as part of informed consent it is crucial to offer these approaches and allow a patient to express their priorities (as discussed below). Comprehensive care also aims to 'future-proof' a dentition to minimise the risk of its deterioration in later stages where symptomatic management may be more challenging to deliver. Future-proofing may include extracting poor prognosis teeth at an earlier stage of illness where this may be better tolerated.

'Palliative' approaches to dental care share principles with palliative care overall. The approach aims to avoid or minimise pain and discomfort and avoid complex or traumatic interventions and the potential sequelae of these. Here, complex treatment is not specifically defined and the threshold is based on a person's own circumstances. For one patient an extraction may be complex even if it was clinically

simple to deliver. Generally, 'palliative dental care' would consist of basic treatment such as prescription of analgesia, smoothing of sharp restorations or glass ionomer temporary cement restorations. Pulp extirpations or simple treatments may be appropriate but more complex care would involve visits to a dental clinic. This might may not be feasible for all patients. A risk arises here that compromised teeth may become symptomatic for a person even closer to the end of life or more medically or cognitively impaired: this risk can often not be entirely eliminated, and patients should be aware of the potential for problems to arise if this track is chosen jointly by patients and clinicians.

There are instances where it may be the correct approach to avoid active treatment altogether. If a patient has no symptoms, despite the presence of dental diseases, they may wish to avoid dental care in all forms. Many patients have experience of living with dental diseases but without being directly impacted by these; a classic example is retained roots which can be asymptomatic for years. Though some patients develop problems with such conditions, there can be significant uncertainty about if or when such conditions will cause symptoms or infection for each person. For both problematic and asymptotic conditions, patients' priorities can vary significantly and not everyone places such importance on oral health that they would wish to receive care in the final stages of their life. Clinicians may be uncomfortable about leaving dental disease untreated, yet if a patient is fully informed about the risks of doing so, it is entirely their choice to make.

What Are We Aiming to Achieve?

Reflecting the changes in patients' lives and circumstances, their desired outcomes for dental treatment may differ. It is hard to imagine a patient with dental symptoms who would not desire to have these symptoms managed; this is therefore a cornerstone of any dental care plan. Beyond this, patients may have specific goals or desired outcomes from treatment both in the present moment or in the future.

Patients may simply desire a pain-free state, whilst others may place a greater value on aesthetics or function. Where these aims cannot all be achieved, the extent to which patients may accept poorer aesthetics, a reduction in function or low-grade symptoms will vary significantly based on the individual. It is important to directly ask patients what they hope to achieve from their care and not to make any assumptions about what they may want based on any pre-assumed factors. Establishing patients' goals is a key element of shared decision-making (detailed below). Patients' goals for treatment have to be proactively sought from the patient themselves or from an appropriate advocate to support a best-interest process that incorporates their values and what they may have wished for from their care. Deviation from a patient's goals may sometimes be possible, or their goals may not be realistic; goals must still be established to navigate any agreed deviation from these goals or compromises in the nature of the care delivered.

Towards the end of life, goals typically become simpler and involve management of symptoms. This aside, there can be a significant value placed on a person's

appearance and demand for dentures can increase, sometimes driven by family members in the final stages of an end-of-life journey. The period towards the end of life may see an increase in social interactions and patients may have a new perspective on how they wish to appear to those they may see. For such individuals, the benefits of denture wearing should not be underestimated.

Principles of Dental Care Planning

Prevention of dental care is clearly crucial, detailed in Chap. 5. Preventative care underpins any dental care plan. The options discussed here are discussed on the basis that this element of care is ongoing for all patients. When considering what options to present to any patient, some key principles are useful. A proposed list of key principles is presented in Fig. 11.4. First and foremost, any treatment should be suitable for the person for whom it is proposed. By person here we mean an individual with their own attitudes, preferences, fears, concerns or expectations. In addition to considering what treatment to propose the timing of treatment must not be ignored. It may be that patients wish to delay treatment or that they need more time to figure out their preferences.

Considering the challenges in provision of oral care for oneself or for another person, any dental treatment placed in a mouth should have a predictable outcome, which is generally only the case when treatment is well maintained. Consequently, it must be made possible that any appliances or restorations can be cleansed with ease, with this ease being based on the person's own abilities, circumstances and motivation. On a similar note, realistic options should be presented. For example, a poorly motivated patient or someone who is anxious and reluctant to receive dental care may not be a candidate for endodontic re-treatment.

A dentition has a key function, and a functional dentition contributes to quality of life. Wherever possible a dental care plan should aim to preserve some degree of dental function. It may, in some instances, be necessary to render somebody edentulous even if they cannot tolerate prosthodontic rehabilitation yet this option has significant implications for many patients and drastic deprivation of function should be a last resort. Over-riding all the principles detailed and highlighting the essential nature of urgent care and symptomatic management, treatment must provide a greater benefit to a person than harm. The nature of any benefit is subjective yet the importance of certain outcomes for individual patients cannot be underestimated and must be appropriately established.

Evolving Plans

When dental care or treatment is considered and planned it is important that the clinical team, including the patient, remain flexible. At all stages of life, dental care planning should be a dynamic as opposed to a static concept. It should be iterative, incorporating information from the patient's evolving health and social care

circumstances. Informed consent is a process and agreeing to a course of action does not legally or ethically commit a person to continue to accept a previously agreed upon plan. Similarly, the dental team may feel that an option planned may no longer be suitable if they feel there is a risk of harm to a person, they then have a duty to discontinue treatment.

Treatment delivery can be logistically complex for people at end of life, especially if specific ambulance transfer to dental clinics is required or if it is felt appropriate to deliver care in a domiciliary setting (see Chap. 12). In addition, patients may have other health problems requiring management that take priority of dental care delivery. The issues may lead to significant time passing between scheduled episodes of dental care during which dental status or symptoms may alter as may the person's general medical status or their attitudes towards dental care.

Another factor that can arise is an unanticipated difficulty accessing or tolerating dental treatment. For example, treatment under local anaesthesia may be planned and a patient may consent to this approach to care. If they then found treatment highly distressing it would be necessary for the patient and clinical team to consider how to progress with care delivery. A new discussion, based on an adverse clinical outcome may lead patients reconsidering their preferences, declining future treatment or request an alternative approach to care. For patients lacking capacity, either their advocates or the clinical team (or both) may re-assess what is felt to be in a person's best interests based on similar factors.

Figure 11.3 demonstrates the need to continually reassess a patient's situation and how their care may be best delivered. It is imperative to check any changes to a patient's health or well-being between dental visits especially as patients themselves may not be aware of the significance of certain changes. The responsibility for delivery of care remains with clinicians who must continually evaluate the balance of risk and benefit in dental care delivery.

Planning for the Future

When a course of dental treatment is completed, or a patient is free of dental disease or symptoms it can be sensible to consider how future care is best approached by considering a form of advance care planning (ACP). This approach to planning future care has been widely studied outside of the dental context, specifically in relation to life-sustaining or altering treatments such as enteral feeding. ACP has been defined as 'A voluntary process of discussion and review to help an individual who has capacity to anticipate how their condition may affect them in the future and, if they wish, set on record: choices about their care and treatment and/or an advance decision to refuse a treatment in specific circumstances, so that these can be referred to by those responsible for their care or treatment (whether professional staff or family carers) in the event that they lose capacity to decide once their illness progresses' [48].

The process aims to retain a person's autonomy in the future; the documentation of such a plan can be highly valuable in determining what may be in somebody's

best interests. Under the Mental Capacity Act (2005) [46] there are three main routes by which somebody may express their wishes for the future:

1. **An advanced decision to refuse treatment can be prepared**: This is legally binding if it is relevant to the situation that is being faced by decision-makers. A patient can only refuse an approach, they cannot demand a specific approach be used.
2. **An advanced statement of wishes can be prepared**: This is not legally binding though can directly support best interest decision making.
3. **Appointment of a lasting power of attorney (LPA) for health and welfare**: A patient can inform the person assigned to this role of their wishes so that they can be legally decided upon on their behalf if capacity is assessed to be lacking in the future.

Through these routes, a person can make their wishes known formally. Unless in relation to a decision to refuse treatment, those involved in a person's care are not obligated to comply with their wishes though would have to justify deviating from any specific approaches a patient had documented. The person's best wishes, aligning with the principles described in Chap. 10 must be the key consideration and, in some instances, it may be necessary to progress with care in a manner that does not align with the wishes expressed. That said if the wishes had not been expressed this knowledge could not have even been discussed.

ACP in dental settings is a fairly new concept and there is little in the wider literature about how and when this should be used. As patients retain their teeth into later age, potentially having spent considering time and energy to do so, a formal plan for future care may be very sensible. This is especially worthwhile when a person with a neurodegenerative condition such as dementia anticipates having a lesser contribution to decision making in the future. Simply by recording discussing preferences for future care and documenting this in a dental clinical record, a person's preferences would be known to guide future care. Though the effectiveness of such an approach is unknown, it may simplify the process of decision-making for those advising on a patient's best wishes or acting as an LPA as has been shown to occur for health care decision making in other contexts.

Cases

Case 1: Comprehensive Treatment Despite a Limited Long-Term Prognosis

Background: This 69-year-old patient had stage 3 metastatic lung cancer, with metastases in his spine. He was awaiting palliative chemotherapy for symptom control but was advised to seek dental treatment before this. He was concerned that his denture barely fitted and that he has had pain with the upper right canine. The patient felt he has lots of people to see in the coming months and wanted to be able to interact with them without worrying about his teeth.

Fig. 11.5 Pre-treatment photograph of case 1

Dental Concern: The patient had many missing teeth and was not able to easily wear his dentures. The upper right canine root was grossly carious and the lower anterior teeth were associated with significant periodontal attachment loss. None of the teeth was symptomatic. The lower teeth had also been sore from time to time and were becoming loose, see Fig. 11.5.

Treatment Discussed: There was a need to manage significant sources of infection before the patient commenced chemotherapy, so despite the patient's long-term health conditions, treatment had to be delivered to manage infection. The patient was not anxious about dental treatment but did have a concern that loss of further teeth may make new dentures tricky to adjust to. The way chemotherapy could affect the general health of his mouth was discussed, particularly in relation to adjusting to new dentures. It was explained that dentures would take a period of adaptation and that they may not be able to be comfortably worn during chemotherapy. In agreement with the patient, the lower right 6, upper right 3 root and upper left 2 were extracted first, then the lower incisors were removed at the same visit as the fitting of both dentures.

Outcome: The dental treatment described was completed alongside preventative advice. The patient coped with the treatment though struggled with pain in his spine sitting through appointments. After a two-week period of post-operative healing, palliative chemotherapy was started. The dentures (Fig. 11.6) were not well tolerated initially and the patient found adjustment to new dentures frustrating whilst experiencing pain related to his cancer and the side-effects of chemotherapy.

Learning Points:

- Treatment planning has to consider a range of factors. Even when the lower anterior teeth could have been left, as they may be for other patients nearing the end of life, these teeth had to be removed due to the systemic infection risk associated with chemotherapy.

Fig. 11.6 Post-treatment photograph of Case 1

- Even when patients are not dentally anxious, treatment delivery can be uncomfortable where conditions affecting a person's lifespan affect their day-to-day comfort and ability to sit comfortably.
- Denture adaptation can be challenging in all instances, but this can be especially difficult when chemotherapy can affect mucosal health.
- The use of prosthesis and their benefit to patients' social interaction have to be balanced against the challenges of their construction and their impact on the health of oral mucosa when this is affected by medical intervention.

Case 2: Terminal Illness and Symptomatic Treatment

Background: A 74-year-old lady diagnosed with a type of motor neurone disease (progressive bulbar palsy) was referred for a dental assessment by the neurology team to a special care dentistry team within a dental hospital setting. Motor neuron disease is a progressive, life-limiting neurological condition with an average life expectancy of two–three years after diagnosis [49] and progressive bulbar palsy is a subtype that has the worst prognosis.

This patient had no dental pain but reported that food gets stuck in a hole in a lower left tooth. The patient has recently experienced deterioration of speech, and swallowing, with PEG feeding being considered for the future. She retains the capacity to consent through supported communication.

Dental Concerns: Poor oral hygiene on left hand side with visible plaque and associated gingival inflammation. Some mild calculus deposits. Cavitated caries LL8, LL7, LR6, LR7, LR8. LR6 of poor prognosis. LR6 extensive caries sub-crestally. No teeth were tender to percussion. The clinical and radiographic presentation is shown in Figs. 11.7 and 11.8.

Discussions about Treatment: The patient is anxious about dental procedures and is especially worried about her swallow. After a discussion about the risks and benefits of dental treatments, a joint decision was reached between the patient and the dental team to pursue a symptomatic or 'palliative dental treatment' approach. The LR6 was therefore not extracted as there had

Fig. 11.7 Radiographic presentation of case 2

Fig. 11.8 Clinical presentation of case 2

never been any symptoms. The only treatment received was a hand excavation of caries and placement of a glass-ionomer restoration on the LL7 to stop food trapping and cleaning of teeth with careful suctioning in the upright position. Personalised oral hygiene instruction was given with emphasis on the left-hand side.

Outcome: 6-month update: The patient's condition deteriorated, and swallow assessment revealed an unsafe swallow. The patient had a radiologically inserted gastrostomy (RIG) tube placed for nutrition and was nil by mouth feeding. There were no further dental complaints.

Learning Points:

- Whilst appearing quite well at initial appointment, knowledge of the patient's condition and contact with the relevant healthcare professionals enabled this patient to be identified on the 'terminal illness' trajectory (see above).
- Therefore, in the joint decision-making process with the patient (who had capacity), it was agreed to follow a symptomatic or 'palliative dental treatment' approach. In this case, this led to avoiding extraction of a tooth of poor prognosis (the LR6).
- Disadvantages of this route should be carefully discussed with the patient including the possibility of dental pain/infection which may be more

difficult to treat when the condition has progressed. Similarly, the likelihood of this pain/infection occurring within the patient's expected life course given the lack of symptoms over the previous years following pulpal necrosis of the LR6 needs to be discussed.

Case 3: A Decision to Avoid Complex Intervention

Background: An 84-year-old lady was referred by her care home staff due to concerns about toothache. The patient had advanced dementia, chronic heart failure and COPD and was no longer able to communicate verbally, though expressed pain with verbal sounds. She had regular visits from her son who was supportive with her care both in the care home and the dental setting. The care team had found toothbrushing increasingly challenging and her teeth had not been properly cleaned for a number of months. After the initial referral, the care team were no longer concerned that pain was present and explained that the patient would eat and drink normally.

Dental Concern: The patient had a lower denture that the care team did not feel comfortable to insert or remove. The patient's son explained this has been made a number of years ago and that the patient used to proactively attend for dental treatment. He did not believe his mother was experiencing any dental pain. Dental examination was challenging as the patient was initially combative when attempts were made to look in her mouth. At a return visit the patient was willing to sit still for dental imaging (as shown below) and was far less distressed.

Discussions about Treatment: The patient was assessed to lack capacity to consent for dental treatment. The OPG shown (Fig. 11.9) demonstrates a heavily restored dentition, with areas of infection (LLQ) and caries (UR7) and retained roots UR2, UL6); these findings were discussed with the patient's son. A discussion was had to establish whether active intervention was felt to be in her best interests or if this may cause more distress than benefit. The patient's son said that though she sought dental treatment she did this begrudgingly, despite a despite to retain teeth. It was explained that the lower left tooth, if removed, would likely mean the lower denture could not be worn and may affect eating.

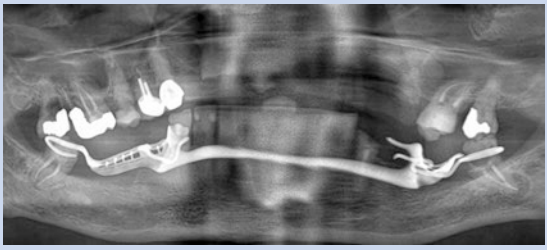

Fig. 11.9 The radiographic presentation of Case 3

Outcome: A best interests discussion established that not providing treatment was felt to be in the patient's best interests meaning no active dental intervention beyond preventative advice was given. The patient was reluctant to allow a dental examination and treatment was not expected to be feasible using local anaesthesia alone. The risks of sedation, such as on her cardiac or respiratory systems, and the risk of post-operative delirium were felt to be too significant to justify managing dental conditions that were not causing any bother. The paint remained under follow-up of the Community Dental Services. The care team and dental team believed she was free of dental symptoms until her death 2 years after the image was taken.

Learning Points:

- Though treatment might address symptoms in some instances, the impact of treatment delivery also has to be considered. This is especially true when specific teeth that may be removed could compromise a person's ability to wear a denture.
- When treatment is not tolerated under local anaesthesia, the risks can be significant, particularly when comorbidities or cognitive impairment are factored into care planning.
- Some patients for whom treatment is not delivered can remain symptom-free, and this cannot always be said when a decision is made to intervene for asymptomatic conditions.
- When a decision is made to avoid treatment, preventative advice and long-term monitoring are important to identify any changes in symptoms and to re-assess was felt to be best for a person as time and illnesses progress.

Conclusion

The period towards the end of life may be a period when patients' interest in their dental health changes. The general expectation is that people may be less bothered about their teeth but, as demonstrated in Case 1 above, this is not always the case. It is crucial to identify what patients' hopes and expectations of dental treatment are to support a person-centred and safe plan to deliver their care if any is to be delivered. Conditions impacting a person's long-term health do not have to mean that comprehensive dental treatment is not possible or suitable even though some patients may wish not to receive such comprehensive care. Regardless of the approach taken, care must be made to ensure that dental symptoms are safely managed. The avoidance of dental pain and infection in the last stages of life is crucial and both preventative care and appropriate treatments determined for each person can help to avoid such problems.

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Domiciliary Dental Care and Supporting Access to Dental Services

12

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Learning Outcomes

- To consider the advantages and disadvantages of domiciliary dental care for both the dental team and the patient.
- To discuss the barriers to the provision of domiciliary dental care, including institutional and organisational barriers.
- To make recommendations to improve training in the provision of domiciliary dental care for all the dental team to improve access to dental care for older people confined to home.

Introduction

Domiciliary dental care (DDC) is defined as the 'provision of dental care in an environment where a person is resident either permanently or temporarily, as opposed to dental care delivered in a fixed dental clinic or a mobile dental unit'. [1] Many patients can benefit from DDC, including people with profound disability, advanced frailty and confinement to bed or home, complex or progressive medical conditions, severe mental health problems such as agoraphobia, or dementia causing disorientation and confusion in unfamiliar environments. It is generally more convenient and cost-effective to treat patients in a dental surgery, but for some, the physical, emotional or psychological trauma of being transported to a dental clinic and the

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reliance on the availability of a carer will eclipse any benefits provided by the surgery environment. Domiciliary dental care is not exclusively provided for older people; however, this chapter will focus on DDC for the older population.

The demand for DDC will rise with the fast-growing ageing population with increasingly complex medical conditions who are also remaining dentate. These individuals often struggle to access conventional health and social services, including dentistry. Oral health problems can lead to pain and infection, impacting on eating, general well-being and quality of life [2]. Providing DDC to maintain good oral health for this vulnerable group is an essential part of their overall healthcare needs.

The objective of DDC is to deliver high-quality oral healthcare in a person-centred way, which respects the dignity of the individual receiving it. Providing dental care in people's place of residence involves a significant amount of preparation by the dental team before any visit to ensure the safe and effective delivery of care whilst aiming to use resources efficiently. Appropriate training for the dental team in providing DDC and care for older people is essential, and awareness of DDC should start at an undergraduate level and continue after graduating. Dental care professionals (DCPs) can play an important part in delivering DDC, as demonstrated in some parts of the UK, for example, in Wales with direct access for dental hygienists and therapists. In the UK, most DDC is provided by Community/Public Dental Services, but there is acknowledgement this is not sustainable considering the future ageing demographic changes whose needs are unlikely to be met by the already stretched salaried dental services [3].

Future commissioning of DDC will need to include dentists from a range of settings and include DCPs. General dental practitioners (GDPs) can currently deliver domiciliary care on a private basis if necessary; however, few GDPs undertake DDC due to a lack of training opportunities and adequate remuneration [4].

There are legal factors that need to be considered as part of DDC. In particular, patients may lack the capacity to consent for a domiciliary visit. Those involved in decision-making for clinical interventions can include relatives, close friends, formal carers, advocates and Independent Mental Capacity Advisors.[1] These individuals may not necessarily be present at the domiciliary dental visit. NHS dental charges apply for DDC in England, and professional or family carers may not know whether the patient is exempt from NHS dental charges. Responsibility for their financial affairs and health may lie with a lasting power of attorney (LPA).[2]

Access to DDC depends on local commissioning and availability of services rather than need, and there is no significant association between the volume of DDC provision and the social demographics in a given region [5]. Changes to the NHS dental contract in 2006 in England led to a reduction in the provision of DDC by

[1] Or other appropriate individuals in the devolved nations.

[2] There are two types of LPA: An LPA for Property and Financial Affairs covers decisions about money and property. An LPA for Health and Welfare covers decisions about health and personal welfare. Clinicians need to clarify whether or which type is present and contact the named LPA as appropriate.

General Dental Practitioners, which has negatively impacted access and increased waiting times. Before 2006, dentists were able to claim a 'call-out' fee for providing home visits, but the introduction of the new contract meant that post-2006, General Dental Practitioners must be specially commissioned to provide DDC. Due to these changes, DDC is often carried out for urgent dental care rather than for dental examinations and preventive care and demonstrates unequitable oral health care for this group compared with the general population.

Advantages and Disadvantages of DDC

Advantages for the Patient

The advantages of DDC for the patient include better access to dental services and increased independence as they are not reliant on a carer or transport service. They may feel safe, less anxious and more involved in their dental care when provided within a familiar environment. An individual may feel more able or inclined to disclose personal information to the dental team or to ask them questions, as confidentiality is increased. A visitor may be a welcome contact, and the fact that the dental team are guests can give a service user more control and confidence. The person does not have to tolerate a long journey which may be uncomfortable for them or spend time waiting for transport services and be away from home for many hours. This will especially impact those with medical needs such as diabetes, where they need access to medication and food and drink at certain times. Many older people struggle with continence and worry about access to toilets and may be reluctant to drink before or during a long trip away from home, which can contribute to dehydration. Some people are fitted with catheters that can become uncomfortable and unsafe if not emptied regularly.

Disadvantages for the Patient

The disadvantages of DDC from a service user's viewpoint are that there can be a longer wait for treatment and a limited choice of service provider. There is also less flexibility in times and days for dental appointments. A domiciliary visit can disrupt the patient/carer's routine. There may be a feeling of embarrassment about their social circumstances or environment. The range of treatment provided safely in a patient's home environment is more limited than in a dental surgery and is discussed later in this chapter. Face masks can create an additional communication barrier for older people who may have a hearing impairment or dementia.

Advantages for the Dental Team

There are also several advantages for service providers. It allows the dental team to learn about the patient in their own environment and provide more holistic care.

The patient is usually more comfortable and relaxed in their surroundings, mutual rapport can be improved, and there may be more compliance with treatment and preventive regimes. The dental team can access medication details and patient retained medical records and learn more about their eating habits. It allows an assessment of the person's ability to comply with oral hygiene advice and to consider, for example, if they have access to a toothbrush, toothpaste and a sink, and how do they or carers manage toothbrushing. They may also take in information more easily when in familiar surroundings, especially if it is followed up with written information or leaflets about prevention or treatment left in their home. DDC may also allow the dental team to meet family and carers who may not have accompanied the patient to the surgery. It may also be an opportunity to identify any safeguarding concerns. Abuse of the older adult is more common, especially when the person is not able to look after themselves [6]. As the patient may not receive many visitors, the dental team could be one of the few health and social care professionals to visit the patient at home to recognise and escalate any concerns. Finally, taking a service to the patient reduces the frustrations of failed appointments for both parties and waiting for transport services to collect and drop the patient home.

Disadvantages for the Dental Team

There are also disadvantages for service providers, who often feel a lack of control when working outside the conventional dental setting. There may be compromise with lighting and positioning, making it harder to diagnose oral conditions. There is a lack of emergency backup and potentially increased vulnerability to personal safety. Domiciliary visits can be time-consuming, leaving less time for patient care, and it is difficult not to become involved with problems in the patient's personal life. The delivery of dental care in people's residences may be compromised compared to the delivery of similar care in a dental clinic, for example, where it is not possible to take radiographs to aid diagnosis. There are environmental risks within a person's residence, which potentially place dental staff in physical danger during the delivery of dental care. Operator/assistant positioning can be compromised, and dental equipment often needs to be set up in cramped spaces. The distance and travel time from a dental clinic to peoples' places of residence may be significant and unless planned carefully, may not be a productive use of resources.

Factors That Impact on Access to Domiciliary Dental Care

The literature both from the UK and internationally cites many common barriers to the provision of DDC relating to the dental service and the patient.

Factors Relating to the Dentist/Service

Barriers within existing dental services can prevent access to the dental clinic for the older patient. Domiciliary patients may be able to access clinics but require aids such as wheelchair access, stretcher or ambulance transport [7]. Once in the clinic, these patients may require specialist equipment to receive dental care, such as a wheelchair recliner or a hoist.

Dentists may have a negative attitude or be unwilling to provide domiciliary care [4]. Reasons for this include feeling inadequately prepared, fear of litigation and lack of knowledge, experience or training in dentistry for older people. Dentists have reported that they feel inadequately educated in this field of practice due to a lack of training at university or during their foundation training [8]. This results in dentists feeling insecure about making treatment decisions [9] or lacking in confidence [10]. There is a perception from dentists that patients would be too difficult to manage in the home environment [11] and that the quality of domiciliary care they could provide would be inadequate [12] leaving dentists feeling their input was pointless [8]. Othman et al. [13] found that younger dentists below the age of 30 and those with confidence in providing this service were the most willing to undertake domiciliary care for older patients. However, younger dentists have been found to have concerns regarding the risk of professional litigation, mainly whether their indemnity would cover them should a medical emergency occur [8]. A further barrier reported by dentists was personal safety concerns of providing care in an unfamiliar environment [12] and leaving the dental practice to undertake DDC was perceived by some dentists as being inconvenient [14]. Once in the home setting, there can be concerns about infection control [12], poor working conditions and a lack of suitable facilities for treatment provision [15]. A lack of guidance and consensus surrounding which medical emergency equipment and drugs should be within the DDC kit is a cause of concern for many [12].

Remuneration is a significant barrier for dentists undertaking DDC, and it is considered too low to be economically sustainable [8, 12]. The lack of adequate financial reimbursement for DDC and loss of time from private practice [16] mean many GDPs consider DDC as a form of charity work. One study reported that most GDPs felt that the salaried Community Dental Services should entirely provide DDC due to a lack of proper reimbursement [9].

Patient Factors

Older people can face particular challenges in accessing dental services. The cost of dental treatment is a significant barrier [17]. The older person may be retired with a reduced income [18], they may have the burden of paying for their residential care costs [19], or they may be unemployed due to their disability [20]. These financial barriers may mean the patient requiring DDC may feel they cannot afford their treatment.

A lack of empathy and poor communication from the dental team has been found to contribute to patient anxiety [21, 22]. A lack of perceived need or inability to express need and a negative attitude from healthcare providers are barriers from a patient perspective [23].

There is often a lack of awareness of DDC services amongst patients, carers and non-dental health care professionals and DDC is often only sought when there are acute dental needs. After referral to a DDC service, patients often face long waiting times due to a lack of availability within their area [17, 24]. Public Health England research [25] has found that care home managers find it challenging to access DDC for their residents.

Institutional Factors

There has been a reported shortage of skilled oral health care professionals in gerodontology [17, 23] and unsupportive care systems for individuals confined at home or living in residential care [23, 26]. Dentists have found that understaffing in care homes can lead to poor communication, finding that staff were often unaware of the DDC appointment and that the patient was not ready when they arrived [8].

Barriers that impact on the dental team's willingness or ability to provide DDC include a lack of training in gerodontology and DDC at both an undergraduate and postgraduate level [27]. In their paper on Older Patients' Views of Oral Health Care, Legge et al. [27] recommended that the perceptions of dental professionals require adaptation to accommodate the needs of adults as they age.

From a financial perspective, care providers will incur costs if they send a staff member to support clients attending an external appointment, but domiciliary visits are more expensive for dentists than delivering treatment in a dental surgery. There are questions over how to fund improved access and whether this should be subsidised. The Faculty of Dental Surgery of the Royal College of Surgeons [28] urges all the key stakeholders in this area, including government, health services, local authorities, care providers, regulators and the oral health profession, to work together to develop a strategy for improving access to dental services for older people.

The barriers faced by dental professionals, patients and others involved with their care warrant investigation to inform planning for future service delivery to meet the current and future needs of the older population [15].

Referral Pathways for Domiciliary Dental Care

Due to the limited capacity for DDC, it is essential that these services are provided only for those individuals who truly cannot access dental care in a clinic. Therefore, a robust triage process for DDC referrals is important.

The following questions can help determine whether a domiciliary visit is indicated:

- Is the patient confined to bed or their home?
- Is the patient able to attend their doctors'surgery?
- Is the patient able to leave the house for social visits or other activities like attending their hairdresser?
- Is the patient able to attend the dental clinic if appropriate transport is available?

If the answer to any of the last three questions is 'yes', then consideration should be given as to whether, with reasonable adjustments, the patient should be attending the dental clinic with appropriate transport and support. The situation may arise that after accepting the referral and visiting the patient, they do not meet these criteria, in which case arrangements should be made to continue their treatment in a dental setting.

Domiciliary dental professionals routinely work closely with other multidisciplinary team members responsible for the patient's overall care, including doctors, social services, district nurses, specialist nurses, speech and language therapists, dieticians and residential care home staff. This includes sharing information with the right person, including oral health concerns. Often, non-dental professionals will identify a dental issue that requires investigation and need to be aware of local referral pathways for urgent and routine care. Referrals for DDC should be facilitated by any multidisciplinary team member or a carer or family member. In this way, oral healthcare and dental treatment become part of any package of healthcare measures for older people who are confined to home [29].

The pathway in Fig. 12.1 was developed in the UK by the Wessex domiciliary clinical network in 2006 and remains an appropriate pathway for DDC.

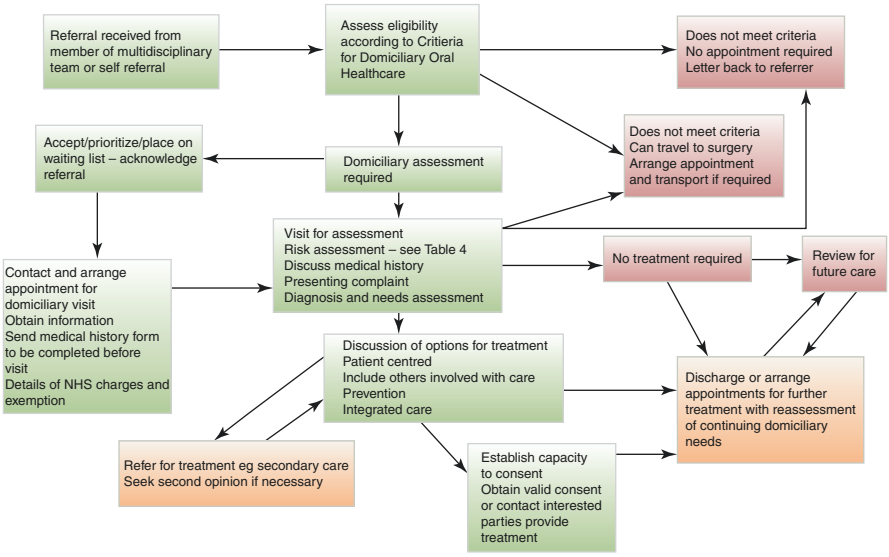

Fig. 12.1 Example referral pathway for DDC developed in Wessex (permission given by Denise Mattin and Verna Easterby-Smith)

To create holistic person-centred services, varying levels of prevention and care need to be available as part of the same care pathway. This may mean a service provides DDC for routine prevention and simple treatments, with access to dental surgeries with appropriate facilities for more complex treatments. A range of clinical settings and skills are required for those requiring DDC and care should be person-centred [30].

Risk Assessments for Domiciliary Dental Care

Domiciliary dental care carries risks that must be assessed and reviewed at each visit to optimise safety both for patients and the dental team. The DDC risk assessment includes patient factors such as behavioural, medical or cognitive impairment, and operator risks such as fire hazards, space limitations, internal and external access and lighting, slip, trip or fall hazards, electrical safety and other hazards such as animals [31].

Together with an expert panel Zaidman et al. in 2021 [32] developed a risk assessment for DDC that can be used to train dentists to risk assess their domiciliary practice (Figs. 12.2 and 12.3).

Patient Title	
Patient Name	
Date of Birth	
Gender	
Patient number	
NHS number (if available)	
COVID status	Vulnerable/shielded patient
	Displaying symptoms of COVID
	Member of household symptomatic
	No symptoms within household
Dentist Name	
Name of Assessor	
Job title	
Date of initial assessment	

Mobility (circle as appropriate)	In bed/Wheelchair/Armchair/ Upright chair/Other
	Patient able to vacate room for 1 hr following procedure* Y N
Type of premises	Care home/House/Flat/School/ Hospital/Secure Unit/Other
Stairs required to access patient	Yes/No
Lift available	Yes/No
Power points available for equipment	Yes/No
Smoker(s) within the property	Yes/No
Others who use premises	Family/Carers/Other
Specific access details	Via back or side door/key safe/door code/ring once arrived/Other Please specify details (ie key safe number)……
Preferred time/day for visit	

Fig. 12.2 Example of information gathered to inform risk assessment and domiciliary care delivery

Hazards	Hazards identified	Risk Identified (Y/N)	Person at risk	Risk limitation/Action if hazard noted			Risk limiting action completed (Y/N)
External access / parking							
Access inside building							
Dental team safety							
Domiciliary Equipment							
				Carer aware of aerosol risk	Y	N	
				Carer willing to accept aerosol risk to provide personal care following AGP	Y	N	
				Carer has appropriate PPE for carrying out patient care following AGP	Y	N	
Fire and electrical hazards							
Infection Control							
Manual handling of patient							
Environmental conditions inside premises							
Patient: medical/ dental/ behavioural							
Other							

This is an overall measure of the assessment itself. The assessor is required to categorise the assessment by ticking a single box"

Green (low risk)	Assessment did not highlight any significant problems	
Amber (medium risk)	Assessment includes additional comments which must be read by any individual visiting premises or patient	
Red (high risk)	Anyone visiting premises must contact assessor or appropriate person to discuss hazards before visiting premises or patient	

Fig. 12.3 A specific risk assessment form for DCC

Essential and Desirable Equipment for DDC

There is an increasing range of dental materials and equipment available for use in DDC, the availability of which will partly depend on the resources available to purchase them.

Factors to consider when procuring equipment for DDC include

- Frequency of use.
- Types of treatment being provided.
- Ease of decontamination.
- Weight of equipment and ease of transporting.

Routine checks of the emergency drugs and equipment should be carried out before leaving for domiciliary visits. Table 12.1 lists all the equipment that should be available when carrying out DDC (Figs. 12.4 and 12.5).

Table 12.1 Equipment that a standard DDC dental kit should include

Examination kit	Mirror Probe Periodontal probe Tweezers Finger guard
Means of drying teeth	Gauze Cotton wool rolls and pledgets Dry guard
A light source	Loupes Head torch Torch
Personal protective equipment	Gloves Aprons Gowns Masks Visors Alcohol gel Disinfectant wipes Plastic sheaths Paper towels
Restorative kit	Right angled portable handpiece and burs (Fig. 12.4) Hand instruments L-pop and composite Adhesive restorative material Handmix glass ionomer cement Luting cement Pulpal medication Temporary filling material Matrix bands Mixing pad Microbrushes

Table 12.1 (continued)

Topical and local anaesthetic	Syringes LA cartridges Needles
Prosthetic kit	Impression trays and handles Impression materials/compound Mixing bowl Water measure Spatula Lab bag Mirror Shade guide Fix Wax knife Safe air heater Straight portable handpiece Acrylic burs Pink wax Greenstick Articulating paper Vaseline Occlusal rim trimmer Bite gauge Bite registration material Pressure relief paste
Surgical kit	Extraction forceps Elevators Luxators Suture kit Bite packs Dry socket medicament Haemostatic agent
Periodontal kit	Scalers Portable scaler Toothbrushes Chlorhexidine gel Interdental brushes and floss
Preventive kit	Fluoride varnish Dry mouth products
Portable suction	Yanker suction tips
Infectious waste	Sharps disposal box, infectious waste bags, clinical waste transfer box (Fig. 12.5)
Dirty instrument carrying receptacle	
Emergency drugs kit	Adrenaline, β2 bronchodilator (e.g., salbutamol) inhaler, glyceryl trinitrate spray, dispersible aspirin, glucose (quick acting), glucagon, midazolam oromucosal solution [33]
Oxygen	
AED	
Mobile phone	
Admin items	Prescription pad, post-op instructions, consent forms, FP17s, risk assessment forms, pens, patient information leaflets
ID badge	

Fig. 12.4 Portable handpiece

Fig. 12.5 Clinical Waste transfer box

A convenient method of housing the equipment is a compartmentalised trolley box (see Fig. 12.6) that is regularly restocked and ready to use. Domiciliary dental units vary in performance and weight, with modern units having a 3 in 1 handpiece and suction, portable scalers are also available. A portable suction system is also an essential item of equipment. Portable kits with emergency drugs, oxygen and a defibrillator should be available to manage any medical emergency. A charged mobile phone is another essential item to keep in touch with a clinic base, patients and carers, and for emergencies. A lone worker buddy system should be in place so that the dental team has a dedicated contact to inform them of their movements. The buddy system will be aware of the safe return of the domiciliary team to base.

Provision of a service owned domiciliary vehicle which houses all the equipment is an advantage and avoids dental teams using their own car and needing to transfer equipment into and out of their boot every time they make a domiciliary visit (Figs. 12.6 and 12.7).

Fig. 12.6 A portable domiciliary kit with emergency drugs and a lightweight wheelable trolley

Fig. 12.7 Domiciliary kit in car boot

If members of the dental team are using their own vehicle, they should confirm with their car insurance provider that they are covered for travel to and from domiciliary visits, including transporting and securing medical gases in the vehicle whilst travelling, along with any requirements to display a warning sign in the car.

Planning and Time Management

Forward planning is paramount to the success of a domiciliary visit and may involve liaison with other members of the multidisciplinary team, family members and carers to gather information, including:

- Clarification of any dental problems,
- A comprehensive medical history including medication and allergies,
- Check the address and parking facilities,
- Establishing if NHS charges apply, exemption status and discussion of payment methods. It is recommended that the patient is invoiced following the visit to avoid the domiciliary team taking payments from vulnerable adults,
- Special requirements, such as the need for a carer or an interpreter present, collection of a key from a neighbour, entry access or safe key code.

The pre-visit information gathering can be carried out by a trained dental nurse as shown in Fig. 12.8.

On the day, patients/carers must be made aware of the dental visit in advance, especially for vulnerable people living alone where there could be potential anxiety with unexpected visitors.

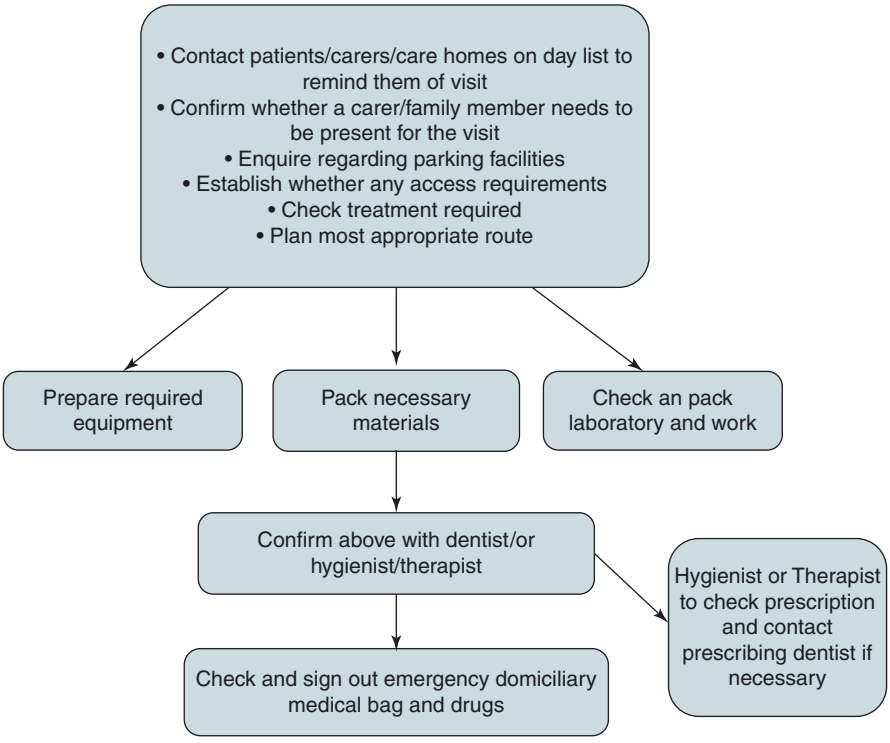

Fig. 12.8 Pre-visit information gathering

Virtual consultations can be of value as part of the DDC pathway. They can help to prioritise those with the greatest need, including those whose general health may be compromised if their oral health deteriorates and those with complex medical conditions, disabilities and communication difficulties. Virtual consultations can form part of a screening process so that the dental team are aware of the dental problem before the visit, which can help plan the care needed. It can also help reinforce preventive care and identify oral lesions that require urgent referral. Virtual consultations have proved very useful during the COVID-19 pandemic and will continue to do so [33].

Infection Control in DDC

The same principles apply to infection control in the domiciliary setting as those that are applied in the surgery, including:

- Identify the most appropriate working area—ensuring a clear pathway from this area to the sink
- Use the principle of zoning for identification of clean and working areas
- Cover work surfaces with clinical sheets, or similar, and confine clinical work to the covered area, disposing of covers at the end of treatment
- Most surfaces may be wiped with disinfectant wipes
- Wash hands if access to a sink, if not use alcohol gel
- Use appropriate personal protection equipment
- Clinical waste needs to be placed in yellow bags—make use of yellow bags in hospitals and care homes
- Other non-clinical waste can be placed in the patient's waste bin
- Dirty instruments should be transported in sealed, rigid, plastic containers.
- Sharps should be disposed of in puncture-resistant sharps boxes

A request should be made prior to the visit during the planning stage for a clear surface to be available, where possible, close to the patient. Any personal items that needed to be removed from the surface should be replaced in the same position after completing treatment.

Personal protective equipment should be donned on entry to the home and then doffed and placed in a clinical waste bag on exit.

Manual Handling

Patients seen in their residences are often unwell and confined to bed with limited space for the DDC team (Fig. 12.9). This poses access difficulties and the risk of medical emergencies or exacerbation of a condition during treatment in suboptimal conditions. Musculoskeletal injuries may be more common in dental professionals providing DDC, so it is important to address manual handling risks as much as possible within a domiciliary environment.

Adjustments may need to be made before treatment is safe to carry out, e.g., the use of reclining chairs, foam boards to kneel on to enable the dental team to work at

Fig. 12.9 An older lady being treated in her recliner chair with limited space for both dentist and dental nurse

Fig. 12.10 Dentist kneeling in order to work at correct height

a comfortable height (Fig. 12.10) or finding a less cluttered area with fewer trip hazards to encounter. Bariatric patients may also become confined to bed or home as their mobility reduces. There are additional challenges to the provision of safe DDC as access to the mouth may be difficult due to patient size.

Table 12.2 Treatment that is appropriate and not appropriate within a DDC setting

Items of treatment appropriate on a domiciliary basis	Items of treatment not appropriate or to avoid, if possible, in domiciliary setting
Scaling of teeth	Advanced restorative care such as crown and bridge preparation
Simple restoration of teeth	Complex extractions[a]
Dressing of teeth	Implant placement or other surgical procedures
Smoothing of teeth	Conscious sedation
Denture construction	Definitive endodontic treatment
Extractions[a]	

[a]Extractions may or may not be suitable based on a range of factors which require patient-by-patient risk assessment such as tooth and periodontal status, medical history, access to radiographs

Determining Treatment that Can Be Carried Out as Part of DDC

The availability of increasingly sophisticated portable dental equipment and range of dental materials enables more treatment to be carried out to a better standard as part of DDC. The development of portable X-ray machine such as the Nomad described by Jogezai et al. [34] enables the dental team to take radiographs in a patient's home or care home. However, not all medical physics departments will endorse this piece of equipment for use outside a clinical setting and it should be discussed with the radiation protection advisor.

Minimum intervention dentistry [35, 36] is an appropriate approach to providing restorative care on a domiciliary basis and the use of fluoride varnish and silver diamine fluoride for arresting and preventing root caries [37].

Some procedures may not be advisable or possible to undertake safely on a domiciliary basis as indicated in Table 12.2.

Skills Mix

It is important that the correct skill mix is available to meet patients need with an emphasis on prevention which can be provided by dental therapists and dental nurses with oral health promotion and fluoride varnish training. In Wales, for example, where dental therapists practice direct access, they can provide dental care on a domiciliary basis and refer on to a dentist if the care required is beyond their clinical competencies. Clinical dental technicians should also be included in the provision of DDC to provide dental care for edentulous older people and can carry out examinations of edentulous patients and fabricate dentures. Health Education England's Advancing Dental Care (ADC) Review Report [38] aims to develop a future dental education and training infrastructure that provides a skilled multi-professional oral healthcare workforce, which can best support patient and population needs within the NHS with a focus on older people which will include DDC and is very much needed.

Training Needs for the Dental Team

Training in DDC is required to develop the knowledge and skills necessary to perform such care. It requires the dental team to transfer their skills from the dental surgery to the kitchen, sitting room or the bedroom whilst respecting the individual's culture, wishes and home [1]. Training in the planning and delivery of domiciliary dental care should be provided for the whole team according to local requirements and based on professional guidance.

Whilst the deterrents to providing domiciliary care are very real, they are not insurmountable. Most dentists are capable of delivering DDC, although some people will adapt more easily than others to work outside the traditional surgery/practice environment. These issues can be addressed through training. There is a necessity for improved training programmes both pre-and post-qualification for all dental team members [1, 39]. If experience of DDC is gained early on in an individual's career, it is likely to lead to an increase in confidence and willingness to provide such care. One of the best ways of developing the knowledge and skills required is to observe an already established DDC team at work. Many services will welcome job shadowing, and the host team may have a range of domiciliary equipment that can be tried out. Alternatively, manufacturing companies may be prepared to allow 'road testing' of their portable units.

There should also be the opportunity for dental teams who work on a domiciliary basis to discuss cases with their peers and allow for shared decision-making regarding planning appropriate care that is person-centred. This will include clinical supervision of domiciliary cases, which will enable support with complex planning. This could include, for example, when to plan active intervention that may involve sedation/general anaesthesia for an older patient with multimorbidity and frailty or when to actively monitor the patient.

Commissioning Domiciliary Dental Care

The BDA report 20–20 Vision (2012) [40] predicted that domiciliary services would be essential to provide professional advice and treatment to residents of nursing and care homes, as well as to the increasing numbers of frailer people living at home or in sheltered housing. It suggested that each dental practice could be contracted by its local health commissioning body to provide domiciliary care to a small number of local care homes. This would share public responsibility and result in virtually all care homes having a relationship with a nearby dental practice. This has been achieved by the Residential Oral Care Sheffield (ROCS) project [41], a comprehensive dental service for adults in care homes. Local General Dental Services (GDS) work in partnership with Community Dental Services (CDS) to provide an oral health needs assessment screening and any necessary dental treatment for all adults in each care home. They also provide oral healthcare training for staff to increase knowledge and skills to improve the mouth care of the residents. The training is provided by the Community Dental Services Oral Health Promotion Team in

conjunction with the Programme in Dental Hygiene and Therapy at the University of Sheffield. Dental hygiene therapy students deliver oral healthcare training for staff in care homes. Similarly, the Scottish Oral Health Improvement Plan [31] involves accredited GDPs providing domiciliary care. Shared care is provided in parts of Wales where the CDS triages referrals for domiciliary dental care, and the less complex patients are referred onto dental domiciliary GDS teams and the more complex to the CDS. The ROCS project is in line with the recommendations 1.2 and 1.4 in the NICE Guidance for Oral Health for Adults in Care Homes (NG48) [42], covering oral health assessment and the knowledge and skills of care staff. Opportunities for partnership working in England may also arise in the future working with primary care networks (PCNs), sustainability and transformation partnerships (STPs) and integrated care systems (ICSs) to address this vital need. Innovative initiatives such as this should be initiated in other areas, and partnership working is the key to meeting the oral health needs of older people confined to home.

There should be provision within the NHS dental contract to allow dentists to provide continuity of care for their older patients as their circumstances change, for example, if they can no longer access the surgery and require domiciliary care. It is often the case that when an individual is becoming less able, more dependent and frail and confined to home, familiar health care professionals become less accessible. This is when well-established relationships with dental teams should ideally be maintained, especially if the individual has dementia. It is also beneficial if the clinician has been managing a patient's dentition for many years to continue to do so in an alternative setting. This is far preferable to a referral from General Dental Services to Community Dental Services when an individual, carers and/or family has to establish a new relationship at a time in their lives when it is more difficult to do so. However, in reality, these patients are often referred to domiciliary services, and GDPs should provide as much information about their dental history, including previous radiographs.

Mobility Aids and Supporting Access to Care in a Clinical Setting

There are situations when even the most mobility-limited patients need to attend dental clinics for essential care that is inappropriate to provide on a domiciliary basis. Prior planning is necessary to assess if the patient can be transferred to a dental chair or if they need to be seen on a bed or treated in their wheelchair.

Some individuals who can access a dental clinic in a wheelchair may not be able to transfer to the dental chair without transfer aids or a hoist. Ideally, the dental surgery should be arranged so that there is room for a wheelchair to be positioned alongside the dental chair to aid easier transfer by the patient into the dental chair. This layout also allows for treating the patient in their own wheelchair using a variety of headrest attachments (Fig. 12.11) [43]. Positioning of both parties may be improved by reclining the back of the patient's wheelchair, as is possible with many current larger models [44]. Some patients with physical disabilities can transfer to

Fig. 12.11 Headrest attachment for wheelchairs

the dental chair independently. As a general rule, the dental team should ask the patient how much support they require and not assume that they need help.

Furthermore, it is important to remember that some people have conditions such as rheumatoid arthritis whereby being touched can be painful, and they may prefer to transfer without help [45]. When the transfer is not straightforward, because the patient cannot stand or weight bear, 'transfer' or 'banana boards' can be used. This method requires that the dental chair has a knee break design and is lifted or lowered to the same level as the wheelchair. After the sidearm is raised or removed, the smooth curved board (hence the name 'banana board') is placed between the seats to allow the person to slide from the wheelchair to the dental chair or vice versa. Patients can usually transfer themselves or have a carer present to assist them if required. Many patients who use this transfer method have their own boards at home, which can be brought to appointments. However, it is helpful for the service provider to have this facility, and transfer boards can be cheaply purchased from disability suppliers and are easy to store. It is not advisable for dental staff to manually transfer or lift patients from their wheelchairs.

A hoist is the best option for safe and efficient transfer of patients unable to do so independently, to the dental chair. Folding hoists or ceiling mounted models aid storage within the practice and are readily available.

An alternative to transferring patients is to use a wheelchair platform that allows patients to remain in their wheelchair and tilts them into a reclined position (Fig. 12.12). These have become much more popular in recent years.

Manual handling training of the appropriate level should be undertaken and updated regularly, according to local recommendations, by all dental staff who may need to assist patients with transfers.

Patients who are confined to a bed and cannot sit in a wheelchair may require dental treatment in a clinic, for example, if they require a more challenging extraction. For these patients, ambulance transfer should be arranged for their attendance via a stretcher ambulance, they are then transferred with a PAT slide to a

Fig. 12.12 A 94-year-old patient with a high risk of falls being treated in a wheelchair recliner

theatre-style trolley. Treatment can then be provided with the patient in a reclined position on the trolley [46]. Not all dental clinics will be able to accommodate a stretcher, and often these patients need to be seen in a theatre setting [47].

Future Demand for DDC

Demand for DDC will increase as a result of a growing population of older people who are more likely to become functionally dependent and who are increasingly dentate, as well as through legislative pressure.

One of the main challenges in providing NHS DDC is the lack of commissioning and reliance on the Community/Public Dental Services. The British Dental Association suggests levels of commissioning are low and falling, equivalent to providing coverage to less than 1.3% of the population whose activity is significantly limited by disability or ill health [48].

Access to DDC must improve in line with the PHE report (2018) [47] which recommended that care home managers must create local partnerships or links with General Dental Practice and Community Dental Services including special care

dentistry. Local authority public health teams and dental public health leads should be informed about gaps in services, so they can advocate for accessible oral and dental health services on behalf of residents of care homes. This should also apply to the increasing number of housebound older people living in their own homes.

The following two cases describe DDC for patients at different stages of life and the importance of dental interventions as part of holistic care.

Case 1

A 65-year-old male patient living in a nursing home complained of sharp front teeth, causing tongue ulcers and pain on eating leading to reduced food intake. His medical health included chronic lymphoid leukaemia (receiving palliative care), a mild learning disability and dementia. Arrangements were made for an urgent domiciliary visit to his nursing home. On the first visit, the dentist assessed the ulcers (see Fig. 12.13) to be of traumatic origin from the fractured teeth (Fig. 12.14) that had been exacerbated by his dry mouth. The patient was in the lounge in an armchair in a hunched head-down posture at this visit. The dentist attempted to wake the patient and encourage co-operation for treatment. The patient asked the dentist to leave and get away from him, due to issues with access to the oral cavity and safety concerns of attempting treatment with the patient's movements, a decision was made to visit on another day when the patient was in his bed and able to recline comfortably. The carers also suggested that his sister be present as they had a good relationship and could enhance his co-operation. A soft diet was recommended, a mouth care plan was delivered and analgesia advice was given. Dry mouth gel was prescribed with instructions on its use.

On the second visit, patient co-operation, safety and access improved. The patient allowed for smoothing of sharp tooth edges with the portable slow

Fig. 12.13 Traumatic ulceration of the tongue

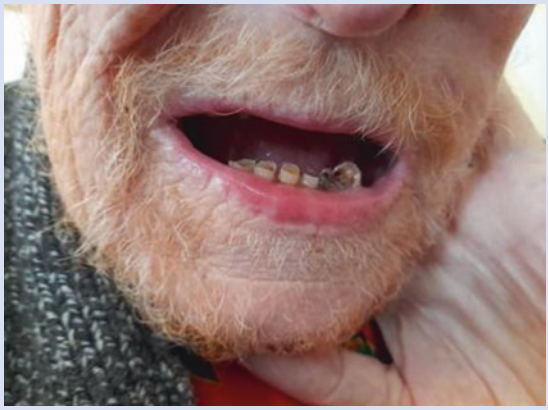

Fig. 12.14 Sharp teeth that were causing the ulceration

handpiece. Glass ionomer cement was placed to further smooth and seal. A beclometasone dipropionate inhaler was prescribed as a topical spray for oral ulceration.

A phone review in the days following, which included photos taken by the clinical nurse specialist, showed resolution of the ulcers.

Case 2

The dental team were contacted by the wife of a 78-year-old male patient. The wife visits her husband at the care home daily and is very involved in his care. On a recent visit, the wife had noted that a front tooth appeared loose and at an unusual angle.

The patient's medical health included late-stage Parkinson's disease, he was on an end-of-life pathway with one-to-one care and PEG fed due to dysphagia. Regular medication included fentanyl, midazolam and morphine.

Advice was given over the phone to take care when providing oral care due to the risk of aspiration, and an urgent domiciliary visit was arranged.

The care home nurse advised the dental team that the bedroom was the best area for a dental examination as the patient was confined to his bed. The wife and nurse were present during the consultation.

On examination, a crown on an upper incisor was found to be very loose (Fig. 12.15), close to debonding and high risk of aspiration. The patient was assessed as not having the capacity to consent for removal of the crown. A best interest's decision was made in agreement with the wife and nurse to remove the crown at this visit. It was decided that it was not in the patient's best interest to extract the root which would be a more invasive procedure.

Fig. 12.15 Patient with two upper crowns

Fig. 12.16 Glass ionomer seal on root after removing crown

The patient had an open mouth posture, so the tooth was accessible. The loose crown was removed with forceps, and glass ionomer cement was used to seal the root surface (Fig. 12.16).

Conclusion

DDC is an essential service for older people unable to leave their residence for the reasons discussed in this chapter. Barriers to DDC include attitudes of the dental team, their perceptions of DDC and workforce shortages within domiciliary dentistry. Many barriers can be addressed by improving the teaching of Special Care

Dentistry, including DDC, both at undergraduate and postgraduate level. Remuneration for dental teams should reflect the additional time both in the administration and provision of DDC and addressing this will help improve access to dental care. Commissioning of shared care between General Dental and Community Dental Services and closer partnership working with other health and social care services involved with the care of an older person will allow for a more joined up approach to the increasing number of people who rely on support from multiple different services.

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