Demography and Aging

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Abstract

The aging of the population may be defined as a concept of shifts in age distribution. The study and research of this aging population is mainly driven by a concern for the burdening of social retirement programs. The aging of the population is mainly measured by increases in the percentage of elderly people reaching retirement age. Therefore, the definition of retirement age may vary, depending on the country.

1.1 Introduction

The aging of the population may be defined as a concept of shifts in age distribution. The study and research of this aging population is mainly driven by a concern for the burdening of social retirement programs. The aging of the population is mainly measured by increases in the percentage of elderly people reaching retirement age. Therefore, the definition of retirement age may vary, depending on the country. For example, in Europe, it was decided that 65 is to be considered the retirement age [1].

1.2 The Age Concept

This standard is usually utilized for the definition of elderly persons. Another important reference is the elderly dependence ratio (EDR). This index evaluates the retirement age of individuals compared with the working age. A patient may be retired but still working. The old age dependency ratio defines the ratio of the elderly who

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A. Mersel (ed.), *Oral Rehabilitation for Compromised and Elderly Patients*,
https://doi.org/10.1007/978-3-319-76129-9_1

are dependent with those who are financially active. Currently, it is often utilized as the aging index indicator, which looks at the ratio of the number of individuals aged 65 and over, per 100 youths under age 15. For example, in Germany, Italy, Bulgaria, and Japan, the index is above 100, and by 2030 this index is projected to exceed 200. For administrative facilities, the head count ratio simply relates the number of persons in broad age categories. In the same way, the median age system indicates the age at which half the population is younger and a half is older. In the United States, the finding was 36 years. Unfortunately, these indexes do not take into consideration several factors and consequences of the aging process.

1.2.1 The Aging Population: A Global Phenomenon

With the beginning of the twenty-first century, the aging population has emerged as a major worldwide phenomenon. The global world population increased from approximately 2.526 billion in 1950 to 7.62 billion in 2015 and is projected to reach 8.083 billion in 2025 and 9.551 in 2050. Most will live in the developing countries. From a historical perspective, it was noted that the average life expectancy was around 40 years in the eighteenth century. The life expectancy reached 50 years in the twentieth century and then rose further to 80 years from the middle of the twenty-first century. In particular, the percentage of persons aged 65 years and over increased from 7.7 to 16.1% in the developed countries in comparison with an increase from 3.8 to 5.8% in developing countries. By 2050, China and India will have the largest older population. Japan, which has the largest share of the world's elderly, who are 60 years and over, will reach 44% in 2050. In the USA, 44 million citizens are aged 65 or over, and the number is expected to reach 89 million, that is double, by 2050 [2].

1.2.2 The Aging Population: Three Main Factors Increasing Life Expectancy

1.2.2.1 Age Dynamics

Between 2015 and 2030, the number of people living in the world aged 60 years and over is expected to grow by 56%; from 901 million to 1.4 billion. By 2050, the population of older people will double in size compared with 2016, reaching nearly 2.1 billion. At the same time, the cohort of "**oldest-old**" aged 75 and over will increase faster than the number of older persons. The projections indicate that the number, which was 125 million in 2015, will triple by 2050 to 435 million (Fig. 1.1).

Another important fact is that from 2010 to 2015, women outlived men by an average of 4.5 years. Consequently, women represent 54% of the global population aged 60 years old or over. Women constitute 61% of the "**oldest-old**" group. Nevertheless, in the coming period, the survival of men is expected to increase reaching 42% of the elderly population by 2050. The older population is increasing faster in urban districts than in the rural regions. As a comparison, on a global level, from 2000 to 2015, the number of people aged 60 years and over has increased by 68% in urban districts versus 25% in rural regions.

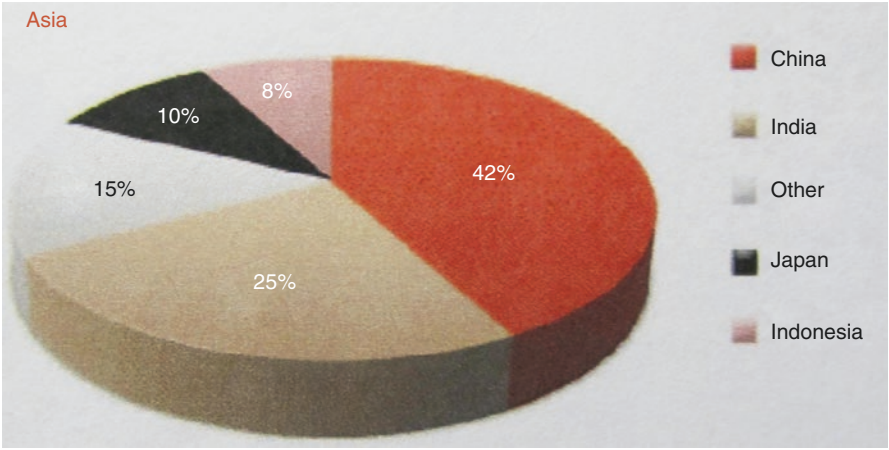

Fig. 1.1 Aging and edentulism—a projection

Consequently, elderly people are living concentrated in the urban cities. In particular, the **"oldest-old"** persons aged 80 years and over are living in the urban districts, which is an increase from 56 to 63% between 2000 and 2015.

1.2.2.2 Fertility Rates and Longevity Increase

The growing phenomenon of the elderly is a direct function of the levels of fertility from 60 years ago. The immediate reason for the population aging is the decline in fertility, but the increase in longevity contributes as well. In 2050, the life expectancy is evaluated to surpass 80 years in Europe, America, and Asia, and 70 years in Africa. In conclusion, the global proportion of older persons is estimated to increase from 14% in 2015 to more than 20% in 2050 (Fig. 1.2).

1.2.2.3 Factors of Life Expectancy

The reasons for this trend are the consequences of several factors: the amelioration of health conditions, the rise in health services, the increase in education, better nutrition in quality and in quantity, the instauration of psychological support, wide promotion of oral hygiene, and better housing conditions, with increased possibilities for dependent or handicapped people.

Medical Conditions

General health conditions or involvement may define oral rehabilitation. Systemic diseases are frequent, needing special care and prohibiting an invasive procedure. The most common diseases and the major causes of mortality are: heart diseases, cancers, cerebrovascular problems, arteriosclerosis diabetes, impaired lung diseases, and the neuro-psychological conditions, such as Parkinson's and Alzheimer's [3].

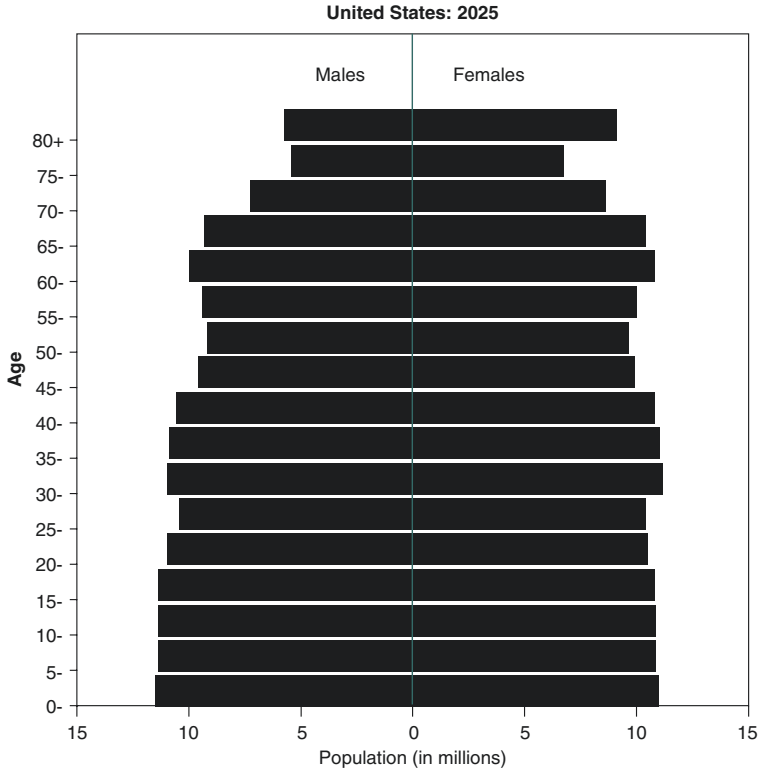

Fig. 1.2 Demographic situation in the USA by 2025

Mental Status Evaluation

During the first examination of the patient and before starting any diagnosis, prognosis or treatment, it is essential to carry out basic mental status testing. Dementia is the main brain illness of elderly patients. The practitioner must understand that elderly people who appear to have dementia may be suffering from pseudo-senility syndromes and may in fact have communication disorders.

Often, ageism contributes to an over-diagnosis of dementia. Therefore, it is crucial to have a good knowledge of the cognitive status (speech, hearing, and language difficulties), and to know how to evaluate a patient who is suspected of suffering from dementia. Aside from these factors, it was proved that "fatigue" is a clinical sign of biological aging. Frailty is described as a phase of acceleration in the aging process. Therefore, the identification of fatigue is an interesting parameter for knowledge about patients with increased vulnerability to stress conditions [4].

Oral Status of the Elderly

Aging is characterized by important changes in the human organs. The combination of these changes with age-related pathological conditions leads to the need for multiple medications to maintain their quality of life. There is a danger that taking a large number of medications could also provoke undesirable side-effects in the elderly, for example, mouth dryness [5].

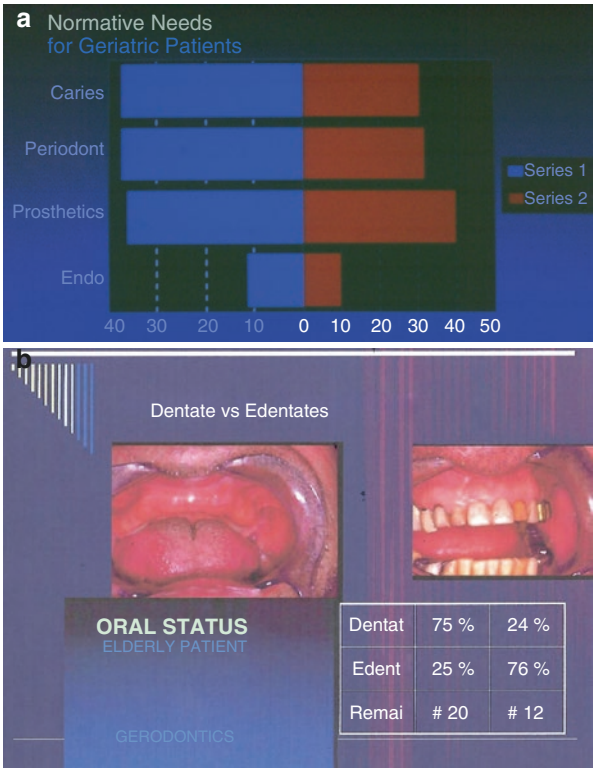

Fig. 1.3 (**a**) Normative needs for an elder population. (**b**) Dental status number of edentulous elderly

Edentulism

Edentulism is most common in the oldest cohort of the population. In the main European countries, there is a decline in the remaining natural teeth with increasing age. In Denmark, France, and Germany, the number of teeth is decreasing more rapidly between the ages of 60 and 70. In general, 25% of aged patients suffer from edentulism before the age of 80 years and 50% by the age of 90. Prosthodontic replacement of the missing teeth differed between countries. The WHO goal for the next decade is evaluated as having 20 remaining teeth at the age of 80 years. This target has been achieved by 25% of the population in most European countries (Fig. 1.3).

Aging and Sexuality

With the aging process, common stereotypes define the elderly as asexual. Nevertheless, many aged individuals continue to be active in a range of patterns of sexual activity, often shifting to other forms of sexual expression and intimacy in later life [6].

As the physiological changes in the oral sphere are clear indicators of patient aging, the silent patient's request is to overrule this handicap. Older adults are looking for a form of sexual activity to desire or be desirable. This emphasizes the importance of

Fig. 1.4 Vertical dimension at rest

the esthetic factor when planning orofacial rehabilitation. This is not only a matter of the color of the teeth, but a correct evaluation of the patient aspiration.

From this perspective, the dentist has the obligation to involve the patient's partner in the strategic decision about the esthetic target. Over the past few years, there has been an increase in sex education for senior patients, providing them with sound information about their problems. In fact, by developing this approach for harmonious dialogue is a matter of basic continuing education for the practitioner. An example is the relationship between the vertical dimension of the face and the facial aspect, and the shape of the lips (Figs. 1.4 and 1.5).

Old age refers to ages nearing the life expectancy of human beings, and thus the end of the human life cycle. In 2016, scientists identified the maximum lifespan to be an average of 115 years, with an upper limit of 125 years (en.wikipedia.org/wiki/old age).

Terms and euphemisms for the aged include: old people, seniors, senior citizens, older adults, the elderly, and elders. Old people often have limited regenerative abilities and are more susceptible to diseases and sickness than younger adults. The organic process of ageing is called **senescence**, medical study is called **gerontology**, and in the oral sphere **gerodontology.** The study of diseases that afflict the elderly is called **geriatrics**. The elderly also face other social issues around

Fig. 1.5 Vertical dimension of occlusion

retirement, loneliness, and ageism. Chronological age, denoted as old age, varies culturally and historically. Consequently, old age is a social concept rather than a biological stage.

1.2.3 The Necessity of a Bioethical Attempt

Despite the fact that the dentist applies the rules he/she was taught, he/she is very disappointed with the results. Unfortunately, there are dogmas that dragged down the prosthetic restoration to a pitfall for senior patients [7].

As gerodontology is not a priority in the basic educational syllabus, the profession is not able to deal with a growing minority of persons with atypical or unusual requirements looking for prosthodontic treatment who present outstanding features or variations from normality. Therefore, these handicapped patients are described as "denture cripples" and are unable to receive a conventional treatment or often cannot wear the dentures as completed by the dentists. The classical approach is devoted to the treatment of typical or normal patients, but for the old-old or typical patients, special diagnoses and solutions are recommended (Fig. 1.6) [8].

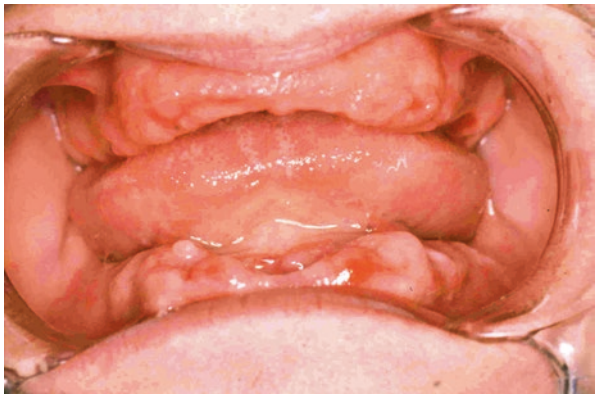

Fig. 1.6 Maxilla and mandible edentulous patient

A typical or conventional patient can be categorized as one concerned with the following characteristics:

1. A patient who comes to the dental office for prosthodontic treatment after or about losing his natural teeth.
2. His expectation of the dental care is that he will be provided with a set of removable dentures to partly replace the functions fulfilled by the natural teeth.
3. He agrees to the treatment and collaborates with the dentist during the clinical procedures and the necessary adjustments that follow the delivery of the dentures.
4. He does not present any severe systemic or physical limitation for the treatment and for the home self-care.
5. The masticatory muscles and the temporo-mandibular joints are reasonably healthy and have no functional limitations.
6. The residual ridges and their adjacent structures are of normal size and form, and able to provide a stable functional foundation for the dentures.
7. The soft and hard oral tissues are healthy and properly lubricated by the salivary flow.
8. The tongue and the tongue attachments are of normal size and position to allow the insertion and proper function of the mandibular prosthesis.
9. There is a minimal or non-existent gagging reflex at the posterior region of the maxilla during the treatment and after upper denture insertion. On a physiological vertical dimension on occlusion there is adequate denture space for the construction of the denture base and the artificial teeth.
10. Some special occlusal relations between the edentulous ridges permit the setting of the artificial teeth on top of or close to the residual crests and allow harmonious arrangements.
11. The patient shows a reasonable and positive attitude, acceptance and ability to adapt following delivery of the dentures.
12. *Last but not least: there are NO symmetrical patients, as learned in the conventional text-books.* Because the left and right sides are not symmetrical, this means that the teeth arrangements do not respect the patient's physiology.

In conclusion, with aging, there is no ideal patient who presents all the criteria described.

1.2.4 Physiological Design in Complete Dentures

The most frequent features are described:

1. Systemic diseases.

Most patients present one or two systemic diseases. The most common are hypertension, diabetes, and cardio-vascular problems [9]. Aside from these, there are also neurological systemic critical situations such as Parkinson's, Alzheimer's, and various types of depression. Various forms of cancer are also frequent.

2. Psychological behaviors.

One of the most difficult obstacles to successful treatment is a psycho-geriatric attitude and behavioral disorder [10]. *Aside from the classic organic brain syndromes, there are also paranoid states and affective disorders. These factors will barely compromise treatment planning.*

3. Economic limitations.

With the increase in life span and difficulties in the economic situation, an economic gap appears and consequently a diminution of financial possibilities [11].

4. Physiological evolution with aging.

There is a change in the elderly patient physiology with aging, such as a change in the supporting structures, the muscles, and the natural or acquired reflexes. In particular, bone resorption was studied, that is, the significant differences between the maxilla and the mandible. A growing difference between the right and left sides is noted.

Therefore, taking into consideration the major dogmas present in old text-books and articles, a new approach has to be introduced. For example, very few studies on the fundamental asymmetry in most individuals were found.

Usually, one side is shorter than the other. Often, the middle of the maxilla does not correspond to the middle of the face.

This is in contradiction with what was written in the traditional text-books.

In the same way, the condylar process is different on both sides, providing an unequal occlusal position. In general, the ridge resorption is centripetal in the maxilla and centrifugal in the mandible, causing a problematic cross-bite situation [12].

Dentists were taught to set up the artificial teeth on the residual ridges. As this anatomical landmark disappears, it is recommended to take advantage of the neutral zone and place the teeth between the tongue and the peripheral structures. *Phonetic impressions are of paramount importance for registration of the prosthetic design of the dentures* (Figs. 1.7, 1.8, 1.9, 1.10 and 1.11) [13].

Numerous statements of research have pointed out the asymmetry of the chewing cycles, inducing in this way a special occlusal balance system.

Another important factor is acquired para-function caused by poor prosthetic restorations and this creates a serious obstacle for the stability of the new dentures. When considering an adapted treatment planned for the old-old patient, this asymmetric factor must be taken into account.

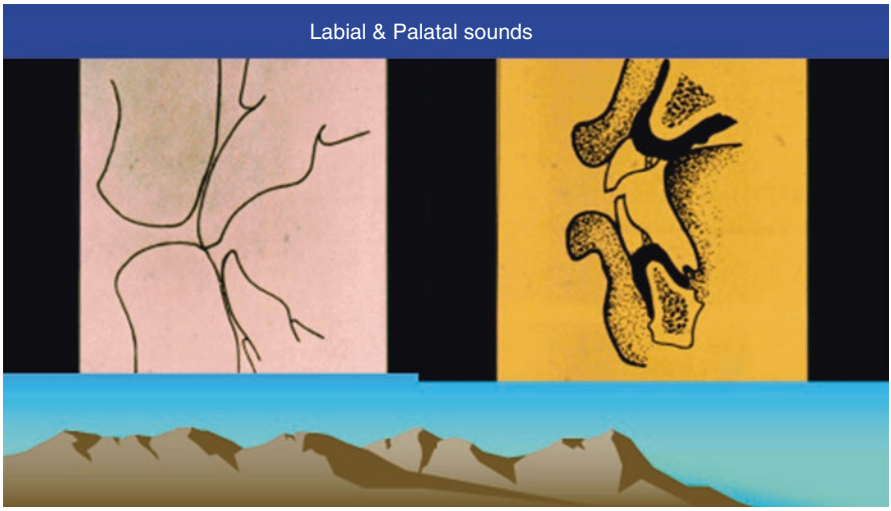

Fig. 1.7 Anterior piezo registration

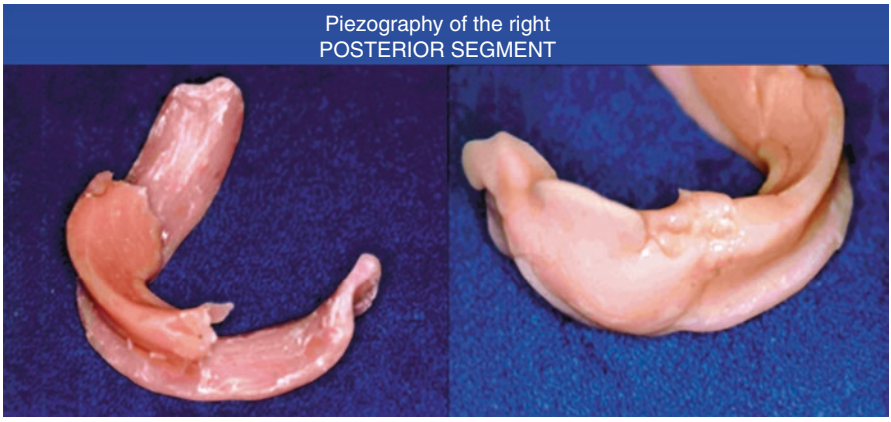

Fig. 1.8 Posterior piezo registration

1.2.5 Satisfaction with Complete Dentures

The elderly cohort is an important group who constantly has great difficulty in adjusting and wearing dentures. Therefore, they have a reduced quality of life and are dissatisfied, causing considerable problems to dentists. Identifying these patients before treatment gives the practitioner the possibility of modifying the approach and helping the patient to adopt more realistic expectations. There are many varied factors involved in dissatisfaction [14].

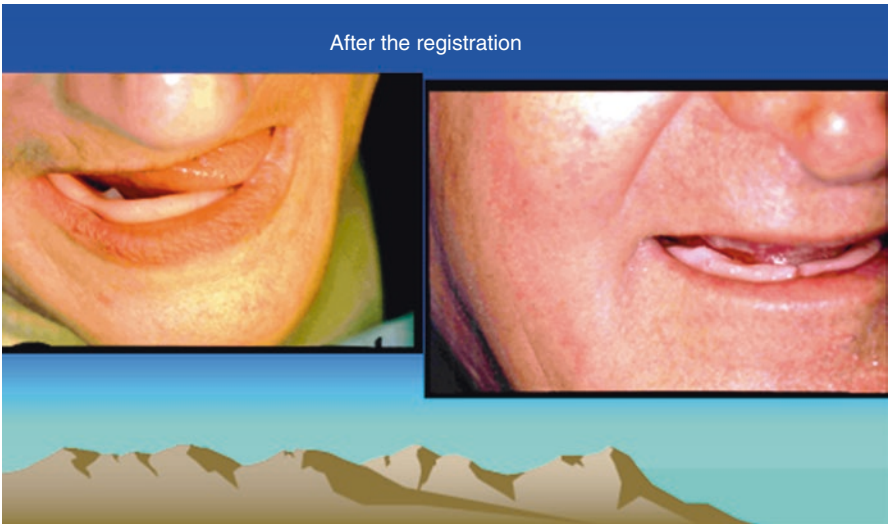

Fig. 1.9 Posterior piezo registration

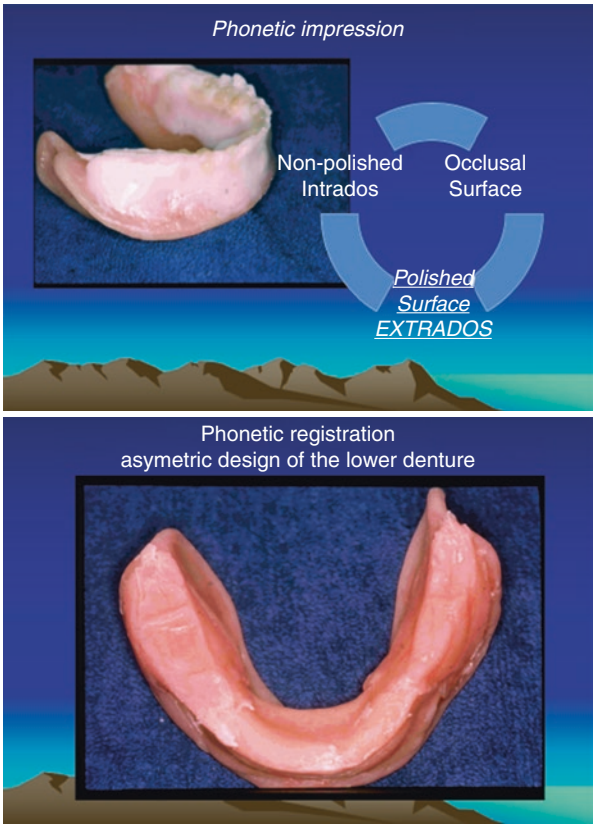

Fig. 1.10 Phonetic registration asymmetric design of the lower denture

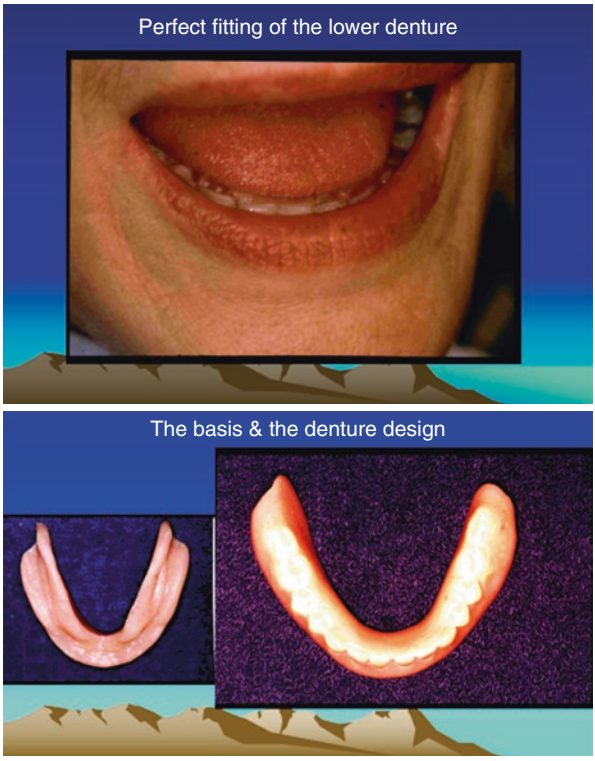

Fig. 1.11 Perfect fitting of the denture between the tongue and the buccal face of the cheek

1. Past denture experience is better related to denture satisfaction than to age.
2. Comfort is a decisive factor, because the patient is always comparing the new dentures with the old ones, in term of the denture design, the occlusal system, the freeway space, and phonetics.
3. Usually, the criteria for conventional dentures are: accepted esthetics, good retention and stability, ability to chew properly, and acceptable phonetics. A failure in one of these conditions leads to a deterioration of all oral rehabilitation.
4. Switching abruptly from an old to a new denture is often the reason for the destabilization of the geriatric patient. In this situation, the patient will never accept the new restoration.
5. This underlines the importance of the psychological aspects of the treatment of elderly patients. In the same way, the influence of systemic conditions and medication has an impact on the tolerance of dentures.
6. Only a step-by-step treatment plan with evaluation is recommended. These transitional steps are the *conditio sine qua non* for comprehensive and tolerated changes.

1.2.5.1 Immediate Dentures

An important challenge, both for the dentist and the patient, is the transition from the dentate to the edentulous status. For the geriatric patient, the loss of their remaining teeth causes a psychological and functional stress. The main problems arising concern function, because the patient cannot accept waiting a long healing period before the insertion of the definitive dentures and the esthetics, as there may be differences between the dentist's and the patient's esthetic perception. The use of conventional immediate dentures may not be an acceptable solution, because it presents difficulties concerning appearance and the psychological and emotional state, because a wax setup trial is not able to predict the final stage. Nevertheless, multiple extraction surgery can be very stressful even though the procedures are simple. Because of these factors, interim dentures are recommended. Usually, we can help the patient with this transition by converting his partial removable dentures or by providing him with provisional ones [15].

1.2.5.2 Overdentures

Epidemiological studies indicate that more patients will become edentulous in their old age when they are especially less able to adapt themselves to the limitations of complete dentures. One of the main problems is the lack of retention. Therefore, the overdenture approach is attractive. Two types of overdentures are currently in use (Figs. 1.12 and 1.13):

1. The type that rests on doomed, endodontically treated tooth roots with or without attachments. A conservation of the root is a valid and a practical measure in complete denture prosthodontics. Bone maintenance is the most significant advantage of a tooth-supported denture, providing a bone with volume and height that increases retention and stability and moreover allows the patient a better function and control by conserving intact proprioception.
2. The type that rests on an implant, supporting the denture with a large variety of mechanical devices. The Toronto Study states that this solution is of paramount importance for a complete lower denture (Fig. 1.14) [16]. Nevertheless, there are important factors limiting the use of implants in elderly patients:

– Bad anatomical conditions, acute bone resorption.
– Severe systemic diseases, or psychological problems.
– Anxious patients or dentists' perceived stress.

3. Benefits and risks perception. Recent studies indicate the extreme importance of psychological aspects of satisfaction with the complete denture treatment. The patient may be frustrated by his unrealistic expectations of prosthetic and implantology therapy [17].
4. Undergoing the surgical implant procedure, which is often traumatic, experimenting with the insertion of a similar prosthetic device can led to a pitfall.
5. Sometimes the expense and the long delay increase the negative behavior of patients.

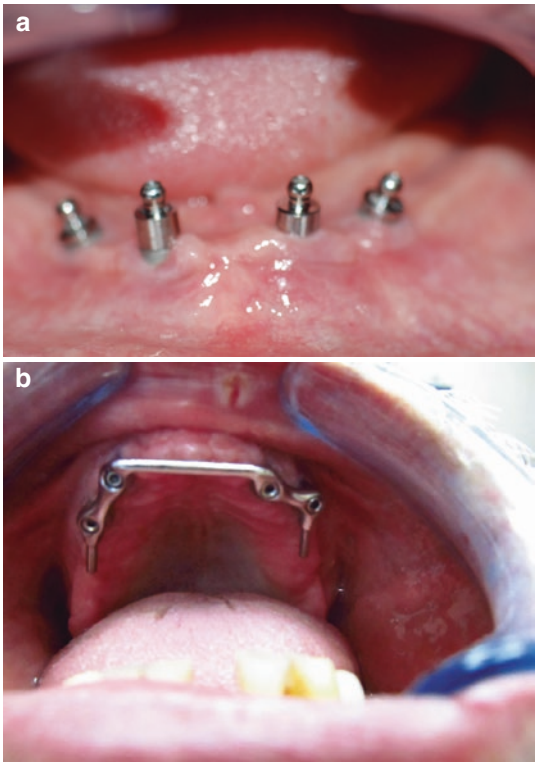

Fig. 1.12 (**a**) Implant overdenture (IOVD) with ball attachment. (**b**) Implant bar overdenture

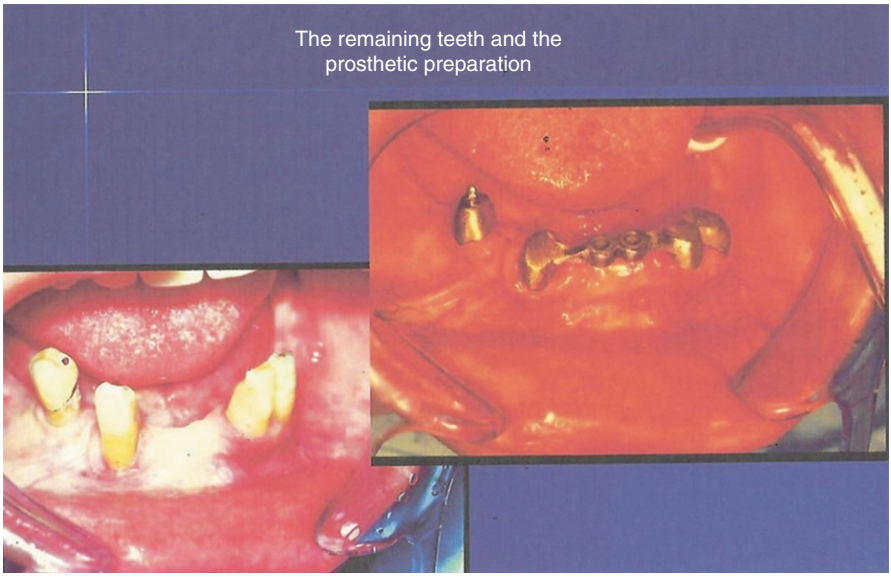

Fig. 1.13 Overdentures on natural teeth

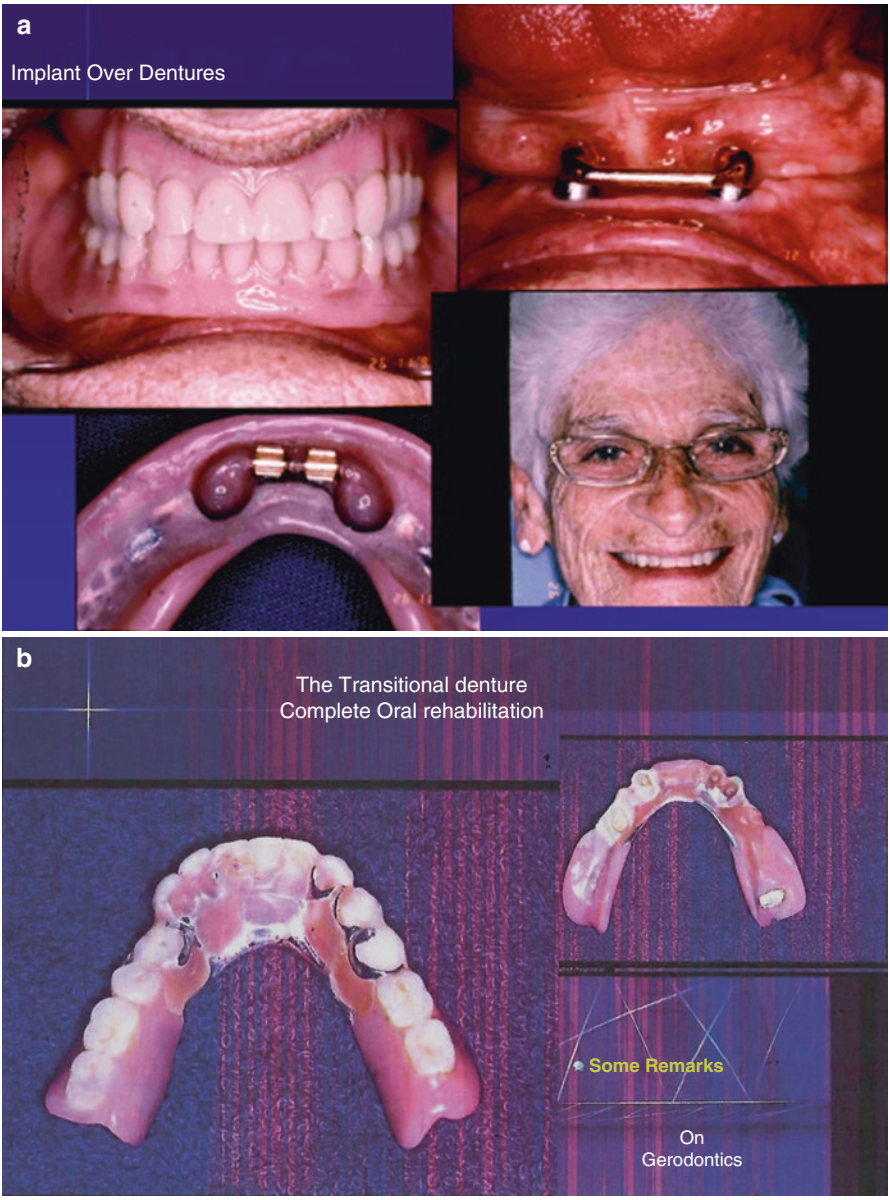

Fig. 1.14 (**a**) Bar overdenture. (**b**) Transitional overdenture on natural teeth

1.3 Rationale

All the above descriptions take a specific approach to the elderly/frail patient. It is a fact that ageing is a process that affects each patient differently. Chronological age is not the only indicator of geriatric status. There is a tremendous variability in the biological and psychological aspects between patients. Consequently, there should be a specific approach to each individual. Treatment of these patients requires a realistic risk benefit evaluation. One of the most significant challenges is adapted management. To avoid unhelpful and stressful situations and a large financial burden, it is recommended to proceed with a step-by-step schedule, thus enabling constant revaluation. This requires first palliative treatment and then transitional or intermediary restorations (Fig. 1.4).

When considering the permanent or final stage, it is essential to act from a preventive perspective, always giving the possibility of a repair or a transformation of the prosthetic devices [18].

To summarize this non-conventional approach, *minimally invasive management is highly recommended* [19].

1.3.1 Ethical Rules

There are ethical rules that must be imperatively respected by the practitioner:

- Adapting carefully the standard of care in geriatric dentistry to the patient's functional and cognitive impairment, his medical condition, and his socio-economic situation and motivation.
- Avoiding creating irreversible traumatic situations: "primum non nocere".
- Providing immediate pain- and infection-free comfort.
- Reaching a transitional oral function in addition to a more esthetic appearance.
- Accomplishing subjective personal satisfaction and increasing motivation.
- Taking into consideration the time factor. This should be an important and decisive guideline for treatment planning.
- Finally, achieving oral rehabilitation is key to oral quality of life.

1.3.2 Remarks

The age concept*: how old are you*? (Fig. 1.15)

Usually, this is one of the first questions that the dentist asks.

Often, there is confusion between the patient's answer and his medical psychological status. In fact, there are various approaches to this problem:

Fig. 1.15 Overdenture with ball attachment

1. Chronological age

The birth date is the main point determining the correct age.
Since the German Chancellor Bismarck, and for economic reasons, 65 years old is the landmark between active and retired people.
Certainly, this criterion is obsolete when considering actual evolution.

2. Psychological evaluation

Various tests help the practitioner to set up an evaluation of the patient's behavior. This is a key reference for adapted treatment planning.

3. Medical anamnesis

This is an essential indicator of the medical condition. Drug intake is sometimes difficult to obtain, owing to loss of memory or hesitation of the patient. It is recommended to establish contact with the relevant physician to receive a clear opinion on the medical status.

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