1 Current Status on Partial Edentulism and Removable Partial Dentures

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Oral health, without a doubt, plays a vital part in both general health and quality of life. In 2010, it was reported that nearly 3.9 billion people have varying levels of oral disease. Among the reviewed 291 diseases and injuries, the leading problem was found to be the caries of permanent dentition. Severe periodontitis ranked 6th, caries of primary dentition came up 10th, and severe tooth loss, referring to less than 9 remaining permanent teeth, 36th. The term "disability-adjusted life years" refers to the sum of lost potential years due to early death and productive years accompanied with disabilities. Severe tooth loss comes out as the main cause of disability-adjusted life years for people over the age of 60. Therefore, tooth loss will continue to be, as it always has been, a major factor affecting individuals' oral and systemic conditions along with their quality of life.

According to the World Health Organization's (WHO) 2012 report, 60–90 % of school children and almost 100 % of the adult population have caries. The ratio of severe periodontitis in middle-aged people between 35 and 44 is 15–20 %. Almost three out of every ten people all over the world between the ages of 65 and 74 are totally edentulous. Furthermore, almost 60 % of tooth loss was found to be due to dental caries that are left untreated, followed by periodontal involvement that led to extraction by 30 %.

As the average life span of the global population is increasing rapidly, the oral health of elderly people is becoming more important.

This elderly population, particularly of more developed countries, is expected to have an annual increase of 1.0 % until 2050 and 0.11 % between 2050 and 2100, which indicates an increase of 45 % by the middle of the century. The number of elderly people, which is currently 287 million people, will increase to 417 million from 2013 to 2050, and by 2100, the elderly population over the age of 60 will be 440 million. The underdeveloped parts of the world show even more vivid dynamic. The 3.7 % yearly rise from 2010 to 2015, which is the highest rate of all times, is expected to be followed by a 2.9 % rise until 2050 and 0.9 % in the next 50 years. 554 million in 2013 will rise to 1.6 billion by 2050 and to 2.5 billion by the end of the century.

The average life span worldwide, which was 69 years between 2005 and 2010, is expected to rise to 76 years from 2045 to 2050 and to 82 years by the end of the century. The scenario is much faster in developed countries. The expected increase for corresponding time intervals is 77–83 years until the middle of the century and to 89 years by 2095–2100.

The rate of total and partial edentulous people in a population and relevant types of prosthetic

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restorations vary from one country to another. However, these parameters change even in a constant population over time. Socioeconomic status, smoking habits, attitude to dental care, and dental anxiety may be mentioned among many possible causes of these variations in both domestic and international populations.

Total edentulism is in global decline, and WHO declared a number of at least 20 teeth to be functional dentition, but it is a pity that even in Europe, where the rate of edentulism is known to be the least, this goal of functional dentition has not yet been achieved for many dentate subjects over the age of 60 (Table 1.1).

The evident increasing elderly population versus decreasing total edentulism tendency indicates that we will be dealing with an escalating number of partial edentulism in the following years. It is not hard to guess that this population will seek less complicated and more affordable treatment options when compared to young people who have higher incomes and motivation to cope with the exhausting, time-consuming, and expensive treatment alternatives.

It should not be ignored that even if a removable partial denture (RPD) is accepted as an economic treatment option for some parts of the world, the simplest basic applications of dentistry are still unaffordable for other less wealthy regions, because poverty is still the major issue which should urgently be addressed. The world is said to be enjoying its most wealthy period since the middle of the twentieth century; however, almost 2.5 billion people live with an income of less than 2 USD per day, which is declared as the poverty line by the World Bank. Furthermore, 1.2 billion people live under 1 USD and that is the hunger line.

Another issue regarding the attainability of health-care services is the ratio of elderly people who need, by various means, the care of the younger generation; this is called "the old age dependency ratio." The increase in this ratio indicates fewer working people taking care of more elderly dependent persons, which in turn complicates the availability of health-care services socioeconomically (Table 1.2).

The type of treatment for partially edentulous patients varies according to local factors like the condition of remaining hard and soft tissues, systemic condition of the patient, socioeconomic status, and patient preferences.

Implant-assisted prostheses for totally and partially edentulous patients have been a choice of treatment for a while. The growing popularity of dental implants also attracted the attention of scientific research, which led them to become a major subject of scientific meetings and events. Being fed by the media with the current innovations in dentistry and dental implants led people to demand these treatment alternatives from their dentists. However, despite this focus on implant dentistry, it is estimated that the number of totally or partially edentulous patients who could receive a treatment involving dental implants covers merely 1.7 % of the relevant population globally. The common cause for this limited availability is the high expense of implants. The idea of com-

Table 1.1 In various countries, the percentages of total edentulism and the people with functional dentition in subjects 60 years old and over

Author (First name)	Publication Date	Country	Sample (*n*)	Age (years)	Prevalence of total edentulism (%)	People with functional dentition (%)
Peltola	2004	Finland	260	≥ 60	42	18 ** #
Petersen	2004	Denmark	1612	65–74	27	40 *
Tramini	2007	France	321	≥ 65	26.9	33.6 *
Madlena	2008	Hungary	612	65–74	19.8	22.6 **
Ribeiro	2011	Brazil	5349	65–74	54.7	10 *
Doğan	2012	Turkey	1545	65–74	48	12.4 **
Urzua	2012	Chile	465	65–74	11.4	23.87 **

Min* 20 teeth, * Min* 21 teeth, #: This data was obtained only from the dentate subjects (n: 151).

Table 1.2 The old age dependency ratio is the ratio of the population aged 65 years or over to the population aged 15–64

Year	World	Sub-Saharan Africa	Africa	Asia	Europe	Latin America and the Caribbean	Northern America	Oceania
2000	11.0	5.6	6.1	9.1	21.8	9.1	18.6	15.3
2005	11.3	5.7	6.1	9.6	23.3	9.7	18.4	15.7
2010	11.7	5.8	6.2	10.1	23.9	10.4	19.6	16.4
2015	12.5	5.8	6.3	11.0	25.9	11.5	22.4	18.4
2020	14.2	5.8	6.5	12.9	29.0	13.3	25.9	20.4
2030	17.8	6.0	7.0	17.1	35.9	18.1	33.5	24.5
2050	24.7	8.0	9.5	27.0	46.6	30.5	36.2	29.0

They are presented as number of dependents per 100 people of working age (15–64)

bining all mandibular complete dentures with two implants has gained wide acceptance, but even this may be limited to the wealthiest countries, which leaves most edentulous patients out of range. As the global dynamics of economics are not likely to change soon, treatment options involving implants will continue to be restricted to a wealthy minority for a long time. On the other hand, a clinical study revealed that even when cost is ignored as a drawback, more than one-third of patients refused to have implants even free of charge to improve the comfort of their mandibular dentures. The main reason for refusal was the patients' concerns regarding surgery. These concerns included the thought of implants as unnecessary, drawbacks related to complications, negative feedbacks from unsatisfied people, and not having enough time for the length of overall treatment.

Recently the term "appropriatech," which is derived from the words "appropriate" and "technology," has been coined to describe a philosophy of treatment approach combining cheap yet effective materials and techniques to make the most cost-effective dentures without ignoring any basic principles of care. And it has been emphasized that innovations in materials and techniques add many advantages to dental practice but may sometimes cause dentists to forget their humanistic priorities.

As a conclusion, the RPD treatment comes out as a less complicated and cost-effective alternative to achieve functional and esthetic goals of prosthetic rehabilitation. Therefore, people who do not want their teeth to be prepared, systemic conditions that jeopardize surgery, and extensive treatment periods may indicate an RPD treatment. In addition, whenever teeth bound large edentulous spaces are present and flange support is inevitable due to extensively reduced alveolar ridge, an RPD is certainly the choice of treatment. Another indication is the maxillofacial defect patient, in whom an RPD can offer the fastest and satisfactory solution. When proper artificial teeth positions are hard to establish or implant positions turn the supra-structure design into a biomechanical challenge, an RPD can be the solution. Similarly, patients who need the reestablishment of occlusal vertical dimension and maximal intercuspal position are also candidates for both provisional and permanent overlay RPDs.

Despite the lack of adequate information about the percentage of patients using RPDs all over the world, limited recent studies from different countries, such as Kazakhstan 54.6 %, European countries 10–19 %, and Taiwan 15.4 %, have revealed that the RPD is still a common treatment alternative and emphasized its indispensable status.

RPDs have been proven to have satisfactory service time free from damaging influences over the remaining tissues if they are properly constructed and maintained. Recently, 90–96.4 % of properly designed RPDs have been found to be still in function after 5 years, 89.8 % after 10 years, and 50.4 % after 25 years.

Despite all these evidence-based advantages of RPDs, probably because of industrial pressure and

the commercial bombing of implant manufacturers, they are now pronounced as old fashioned, even among dental practitioners. Actually, the past 50 years introduced interesting novelties to RPDs like the shortened dental arch concept, nonmetal clasp dentures, implant-assisted RPDs, and the digital manufacturing of prosthesis. However, despite the fact that both conventional RPDs and RPDs equipped with these innovations can deliver premium service to patients, recent evaluation of denture services shows that clinicians not only seem reluctant to update their knowledge on RPDs, but they also neglect their conventional knowledge as well. For example, according to several studies, the U-shaped major connector, which is known to have questionable rigidity and therefore should not randomly be chosen, was found to be the most preferred connector for maxillary frameworks. Some other issues are major connectors being fabricated unnecessarily bulky and about rest seats. A wide variety of improper rest seat preparations among practitioners are frequently seen, furthermore in many cases rest seats are even not prepared. Another finding is the use of flexible thermoplastic major connectors lacking metal framework and rests.

While performing our mission as health-care professionals, we dentists should put great effort into preventive dentistry and avoid overtreatment. The priority of fixed prosthodontics, whenever possible, is surely out of the question, and one day genetic engineering may provide us with the technology to prevent or replace tooth and tissue loss. The indications for fixed prosthodontics are still limited to an appropriate group of patients, and, unfortunately, neither of these options is fully available today nor will they be in the near future. Therefore, despite all scientific and technologic advances, treatment of tooth loss will be continued by fixed prosthesis, occasionally RPDs, or even complete dentures in the upcoming years.

It is up to us to choose the most cost-effective treatment option that will serve the needs of the patient for the longest possible time. RPDs have been and probably are still the most favorable treatment option for most partially edentulous patients; therefore, the routine prosthodontic practice and knowledge should be kept updated and supported by the developments in the field. It should strongly be kept in mind that our capabilities are limited to our knowledge; we can only deliver what we know.

It was in our best interest while writing this book to provide a harvest of knowledge regarding the current, practical, scientific, and affordable ways to construct proper removable partial dentures. We hope to explore more scientific-based attention to RPDs in the near future, which will possibly make them a good and an easy choice of treatment.

Bibliography

Al-Dwairi ZN. Partial edentulism and removable denture construction: a frequency study in Jordanians. Eur J Prosthodont Restor Dent. 2006;14:13–7.

Arpacıoğlu Ö, Yıldırım M. An analysis of poverty on world and Turkey. Niğde Üniversitesi İİBF Dergisi. 2011;2:60–76.

Behr M, Zeman F, Passauer T, Koller M, Hahnel S, Buergers R, Lang R, Handel G, Kolbeck C. Clinical performance of cast clasp-retained removable partial dentures: a retrospective study. Int J Prosthodont. 2012;25:138–44.

Bohnenkamp DM. Removable partial dentures: clinical concepts. Dent Clin North Am. 2014;58:69–89.

British Society for the Study of Prosthetic Dentistry. The York consensus statement on implant-supported overdentures. Eur J Prosthodont Restor Dent. 2009;17:164–5.

Budtz-Jorgensen E, Bochet G. Alternate framework designs for removable partial dentures. J Prosthet Dent. 1998;80:58–66.

Bural C, Sülün T, Şakar O. What can be said about the future of complete edentulism and dentures? Dişhekimliğinde Klinik. 2008;25:148–51.

Carlsson GE. Some dogmas related to prosthodontics, temporomandibular disorders and occlusion. Acta Odontol Scand. 2010;68:313–22.

Carlsson GE, Omar R. Trends in prosthodontics. Med Princ Pract. 2006;15:167–79.

Carlsson GE, Omar R. The future of complete dentures in oral rehabilitation. A critical review. J Oral Rehabil. 2010;37:143–56.

Charyeva OO, Altynbekov KD, Nysanova BZ. Kennedy classification and treatment options: a study of

partially edentulous patients being treated in a specialized prosthetic clinic. J Prosthodont. 2012;21:177–80.
Chung SY, Song KB, Lee SG, Choi YH. The strength of age effect on tooth loss and periodontal condition in Korean elderly. Arch Gerontol Geriatr. 2011;53:243–8.
Curtis DA, Curtis TA, Wagnild GW, Finzen FC. Incidence of various classes of removable partial dentures. J Prosthet Dent. 1992;67:664–7.
Dogan BG, Gokalp S. Tooth loss and edentulism in the Turkish elderly. Arch Gerontol Geriatr. 2012;54:e162–6.
Douglass CW, Watson AJ. Future needs for fixed and removable partial dentures in the United States. J Prosthet Dent. 2002;87:9–14.
Ehikhamenor EE, Oboro HO, Onuora OI, Umanah AU, Chukwumah NM, Aivboraye IA. Types of removable prostheses requested by patients who were presented to the University of Benin Teaching Hospital Dental Clinic. J Dent Oral Hyg. 2010;2:15–8.
Feine JS, Carlsson GE, Awad MA, Chehade A, Duncan WJ, Gizani S, Head T, Heydecke G, Lund JP, MacEntee M, Mericske-Stern R, Mojon P, Morais JA, Naert I, Payne AG, Penrod J, Stoker GT, Tawse-Smith A, Taylor TD, Thomason JM, Thomson WM, Wismeijer D. The McGill consensus statement on overdentures. Mandibular two-implant overdentures as first choice standard of care for edentulous patients. Gerodontology. 2002;19:3–4.
Holm-Pedersen P, Lang NP, Müller F. What are the longevities of teeth and oral implants? Clin Oral Implants Res. 2007;18 Suppl 3:15–9.
Inukai M, Baba K, John MT, Igarashi Y. Does removable partial denture quality affect individuals' oral health? J Dent Res. 2008;87:736–9.
Jorge JH, Giampaolo ET, Vergani CE, Machado AL, Pavarina AC, Cardoso de Oliveira MR. Clinical evaluation of abutment teeth of removable partial denture by means of the Periotest method. J Oral Rehabil. 2007;34:222–7.
Kassebaum NJ, Bernabé E, Dahiya M, Bhandari B, Murray CJ, Marcenes W. Global burden of severe periodontitis in 1990–2010: a systematic review and meta-regression. J Dent Res. 2014a;93:1045–53.
Kassebaum NJ, Bernabé E, Dahiya M, Bhandari B, Murray CJ, Marcenes W. Global burden of severe tooth loss: a systematic review and meta-analysis. J Dent Res. 2014b;93(7 suppl):20S–8.
Keyf F. Frequency of the various classes of removable partial denture and selection of major connector and direct/indirect retainer. Turk J Med Sci. 2001;31:445–9.
Madléna M, Hermann P, Jáhn M, Fejérdy P. Caries prevalence and tooth loss in Hungarian adult population: results of a national survey. BMC Public Health. 2008;8:364.
Marcenes W, Kassebaum NJ, Bernabé E, Flaxman A, Naghavi M, Lopez A, Murray CJ. Global burden of oral conditions in 1990–2010: a systematic analysis. J Dent Res. 2013;92:592–7.
Mojon P, Thomason JM, Walls AW. The impact of falling rates of edentulism. Int J Prosthodont. 2004;17:434–40.
Müller F, Naharro M, Carlsson GE. What are the prevalence and incidence of tooth loss in the adult and elderly population in Europe? Clin Oral Implants Res. 2007;18:2–14.
Owen P. Appropriatech: prosthodontics for the many, not just for the few. Int J Prosthodont. 2004;17:261–2.
Pellizzer EP, Almeida DA, Falcón-Antenucci RM, Sánchez DM, Zuim PR, Verri FR. Prevalence of removable partial dentures users treated at the Aracatuba Dental School-UNESP. Gerodontology. 2012;29:140–4.
Peltola P, Vehkalahti MM, Wuolijoki-Saaristo K. Oral health and treatment needs of the long-term hospitalised elderly. Gerodontology. 2004;21:93–9.
Petersen PE, Kjøller M, Christensen LB, Krustrup U. Changing dentate status of adults, use of dental health services, and achievement of national dental health goals in Denmark by the year 2000. J Public Health Dent. 2004;64:127–35.
Polychronakis N, Sotitiou M, Zissis A. A survey of removable partial denture casts and major connector designs found in commercial laboratories, Athens. Greece J Prosthodont. 2013;22:245–9.
Pun DK, Waliszewski MP, Waliszewski KJ. Survey of partial removable dental prosthesis (Partial RDP) types in a distinct patient population. J Prosthet Dent. 2011;106:48–56.
Rehmann P, Orbach K, Ferger P, Wöstmann B. Treatment outcomes with removable partial dentures: a retrospective analysis. Int J Prosthodont. 2013;26:147–50.
Ribeiro MT, Rosa MA, Lima RM, Vargas AM, Haddad JP, Ferreira E, Ferreira E. Edentulism and shortened dental arch in Brazilian elderly from the National Survey of Oral Health 2003. Rev Saude Publica. 2011;45:817–23.
Richards W, Ameen J, Coll AM, Higgs G. Reasons for tooth extraction in four general dental practices in South Wales. Br Dent J. 2005;198:275–8.
Sadig WM, Idowu AT. Removable partial denture design: a study of a selected population in Saudi Arabia. J Contemp Dent Pract. 2002;15:40–53.
Tramini P, Montal S, Valcarcel J. Tooth loss and associated factors in long-term institutionalised elderly patients. Gerodontology. 2007;24:196–203.
Tuncer N, Gözler S, Şakar O. Evaluation of a group of dentists' opinion about partial denture design. Dişhekimliğinde Klinik. 1991;4:60–4.
United Nations. World population prospects: 2012 revision. New York: United Nations; 2013.
Urzua I, Mendoza C, Arteaga O, Rodríguez G, Cabello R, Faleiros S, Carvajal P, Muñoz A, Espinoza I, Aranda W, Gamonal J. Dental caries prevalence and tooth loss in chilean adult population: first

national dental examination survey. Int J Dent. 2012;2012:810170.

Waliszewski MP. Turning points in removable partial denture philosophy. J Prosthodont. 2010;19:571–9.

Walton JN, Mac Entee MI. Choosing or refusing oral implants: a prospective study of edentulous volunteers for a clinical trial. Int J Prosthodont. 2005;18:483–8.

World Health Organization. Oral Health. Fact sheet No.318. Geneva, 2012 April. http://www.who.int/mediacentre/factsheets/fs318/en/index.html.

Wöstmann B, Budtz-Jørgensen E, Jepson N, Mushimoto E, Palmqvist S, Sofou A, Owall B. Indications for removable partial dentures: a literature review. In J Prosthodont. 2005;18:139–45.

Xie Q, Ding T, Yang G. Rehabilitation of oral function with removable dentures-still an option? J Oral Rehabil. 2015;42:234–42.

Zitzmann NU, Hagmann E, Weiger R. What is the prevalence of various types of prosthetic dental restorations in Europe? Clin Oral Implants Res. 2007;18 Suppl 3:20–33.