

COMPLETE PROSTHESES TREATMENT - PRESENT AND FUTURE PERSPECTIVESSorin Uram-Țuculescu^{1a}, Marian-Vladimir Constantinescu^{2b}¹Department of Prosthodontics, VCU School of Dentistry, Virginia Commonwealth University, Richmond, VA - 23298-0566, USA²Holistic Dental & Medical Institute - ROPOSTURO, RO - 020082 Bucharest, Romania^aDDS, MS, PhD, Associate Professor^bDDS, PhD, Professor, President

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Cite this article:Uram-Țuculescu S, Constantinescu MV. Complete prostheses treatment - Present and future perspectives. *Stoma Edu J.* 2017;4(4):282-288.**ABSTRACT**

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Background: Background: Tooth loss is a public health problem across the globe, especially in low-income populations. Traditional complete denture treatment is time consuming, and less embraced by general practitioners.**Objective:** The purpose of this paper is to review data on prevalence, future projections, and treatment modalities for edentulism. Most edentulous patients receiving care are treated with conventional, tissue-supported prostheses. Possible ways to improve efficiency in complete denture treatment, and ameliorate access to care are investigated.**Data Sources:** Information was obtained mainly from PubMed, American College of Prosthodontists databases, and non-indexed sources.**Study selection:** Considering the scarcity of information on some topics (simplified complete denture fabrication methods, digital techniques), a wide range of papers were selected for analysis, from systematic reviews, randomized controlled trials, cross-sectional studies to case presentations, expert opinions, surveys, and dental organizations' reports.**Data extraction:** The web search included the following key words: edentulism, demographic, implant, removable, denture, simplified, digital, denturist.**Data Synthesis:** The future of traditional complete denture treatment remains questionable, considering the reduced appetite of general practitioners and patients for time consuming treatments. Simplified techniques deserve an increasing attention from practitioners and dental educators, as available data suggest that they produce similar outcomes, when compared to traditional methods. Digital technologies are expected to further improve treatment outcomes, within simplified protocols. As mid-level dental providers became a reality in some jurisdictions, denturism could be considered part of the solution, especially in underserved areas.**Keywords:** edentulism, prosthesis, simplified, digital, curriculum.**1. Introduction**

Despite significant advances in prevention and oral care, tooth loss remains a public health problem, especially in low income populations^{1,2} and the elderly.^{3,4} Access to care in the underserved segment of population is a long standing problem.⁵ Overall, the prevalence of edentulism is still high, even in developed countries.^{6,7,8}

While prevalence of edentulism is decreasing from decade to decade, the increase in senior population fuels the need/demand for complete prostheses for decades to come. The Dental practitioners are expected to face a serious task in providing care for a large number of edentulous patients, most of them seniors, with specific needs that have to be addressed accordingly.⁹ Upgraded treatments with documented benefits,^{3,10,11,12,13,14,15} including implant overdentures and implant-supported fixed prostheses are available, but are only address a

fraction of the edentulous population, due mainly to increased costs. As such, the tissue-supported complete prostheses appear to be the mainstay in the treatment of edentulism,^{3,6,12,13,16,17,18} despite the fact that they do not constitute optimal replacements for the lost function, with lower bite forces and altered masticatory muscle activity.¹⁹

Trends in the dental work force indicate that the ratio of dentists to the population in the U.S. will be in 2020 less than in was in 2010,²⁰ due to a faster increase in population, as compared to the increase in number of dental graduates. In addition to the shortage of dentists in the US,²¹ a shortage of dental technicians²² is expected to add to the already established issue of access to care.

Increased chair time expenditure for removable prosthodontics due to numerous steps makes denture treatment less attractive for practitioners,²³ as revenue per time unit is lower, compared to other

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common restorative procedures. Increased number of trips to see the dentist also adds to patient's expenses.

Reduced space for complete dentures in dental schools' curriculum^{24,25,26} is likely to generate graduates less prepared for the treatment of edentulism.

Under these circumstances, it appears that the need/demand of complete dentures exceeds the offer of prosthodontic care within the limitations of existing dental care delivery systems, even in developed countries.

The purpose of this paper is to review data on prevalence and future projections on edentulism, also review treatment modalities for this condition. Possible ways to improve efficiency in complete denture treatment, and ameliorate access to care are also investigated.

2. Edentulism and demographics

The prevalence of edentulism in seniors observes a wide range internationally, from 11% in China, to 23% in Brazil, 24% in Indonesia, and 26% in the United States. In Europe, it varies from 15% to 78%.^{16, 27}

In the U.S., the prevalence of edentulism registered a decline during past decades,²⁸ which can be approximated by a 10% decline for each decade.²⁹ Using Census data and projections from 1996 (indicating a significant increase in adult population, especially adults over 55), Douglass³⁰ estimated that the adult population in need for complete dentures will increase by 2020 to nearly 37.9 million, even considering a utilization rate of dentures of about 90%.^{29,31} It was predicted that even if the estimated decrease in the prevalence of edentulism will follow previous trends, it will likely be offset by the 79% growth in the population over 55, triggering an increase of the need for complete dentures from 53.8 million (1991) to 61 million in 2020.³⁰ The fact that dentures need to be replaced periodically, in order to maintain reasonable function and the oral health related quality of life³² is also to be considered. Newer data indicate that during the past half century covered by surveys, the prevalence of edentulism in U.S. adults decreased from 18.9% to 4.9%.³³ As socioeconomic disparities increased during the same period, edentulism is currently concentrated in the low-income population.³³ The relative decrease in edentulism prevalence in the U.S. by 74% is comparable with data from other countries: 84% relative decrease in the U.K. over four decades.³⁴ A 57% relative reduction was noted in Finland,³⁵ 84% in Sweden,³⁶ and 61% in Australia,³⁷ during two-decade periods.³³

In the U.S., the rate of decrease in edentulism is expected to slow to 2.6% by 2050. Such decline is predicted to be partially offset by population increase and aging, indicating that the number of edentulous individuals will actually decrease by 30%, from 12.2 million in 2010 to 8.6 million in 2050.³³

In Europe, the prevalence of edentulism is also expected to decrease significantly during the next decades. The growth of the older segment of population is expected to counteract the trends in

prevalence, but the effect is not expected to be as dramatic as in the U.S.⁷

Prevention of edentulism is work in progress worldwide, with significant disparities, related mostly to access to care and education. Overall, it is likely that the elderly will lose teeth later in life,³⁸ contributing to an anticipated decrease in the need for tooth replacement, at least in some populations of the developed world.

3. Treatment modalities for the edentulous patient

Despite consistent advances in organ and tissue engineering,^{39,40} their current impact on the dental profession and practice is rather limited at best. Dentistry remains predominantly restorative nowadays, and the time when re-growing teeth will become mainstream is probably decades away.

The advent of dental implants more than half a century ago brought the hope to evade some of the shortcomings of conventional, tissue supported dentures. Constant development in materials and techniques enabled implant dentistry to become a predictable and lucrative enterprise. If cost were not a limiting factor, implant placement and restoration would be mainstream today, considering the excellent survival rates, even for implants being placed in predoctoral and residency programs.⁴¹

Most studies on implant treatment and oral function demonstrated an improvement of chewing function in the mandible.^{13,14,42,43,44,45,46,47} The implant restorations are well received within the stomatognathic system, with electromyographical activity values comparable to those of dentate subjects.⁴⁸

A systematic review by Fueki et al.¹¹ concluded that a mandibular implant-supported overdenture opposing a maxillary conventional complete denture provides significant improvement in the masticatory performance compared to the conventional upper and lower complete dentures for a limited population having persistent functional problems due to severely resorbed mandible.

After implant treatment, patients report high levels of satisfaction regarding various aspects

of their denture function and they are more satisfied than patients with similar problems who receive a conventional denture without implant support.^{13,44,49} Lindquist & Carlsson^{50,51} found that treatment with implant-supported fixed prostheses, generated a significant improvement of the patients' assessment of their chewing ability, and of the results of chewing tests (particle size reduction and masticatory force).

While implant-supported/retained prostheses demonstrated superiority in terms of retention, stability and patient acceptance, especially with fixed restorations, their cost remains prohibitive for a large majority of edentulous patients. During the past decades, using a reduced number of implants was proposed in order to provide the most value for money in such cases, and possibly define a standard of care. The McGill consensus statement proposed a standard of care for edentulous patients, including a maxillary conventional complete denture opposing a 2 implant overdenture.¹⁵ The said standard was

treated with circumspection later,^{52,53,54,55,56} as there is no solid evidence to endorse a single standard of care for the treatment of the edentulous mandible pertaining to a specific treatment option. It was shown that patient choice has a greater influence on treatment outcome, as compared to the practitioner's bias towards a treatment option.⁵² Fitzpatrick⁵² emphasized that "the standard of care in the edentulous mandible is the intervention judged by the well-informed patient, in consultation with an appropriately trained and experienced dental health care provider, to best meet the needs and circumstances of the patient."

Efforts to reduce the costs and provide simplicity in implant overdenture treatment went even farther by investigating mandibular overdentures retained by a single implant.^{57,58,59,60,61,62}

Well over half a century in the dental implant era, a large majority of edentulous individuals continue to wear conventional, tissue supported complete dentures, and the need for such prostheses will stay for years to come.^{8,63,64}

4. Simplified denture fabrication protocols

Most U.S. dental schools teach a traditional protocol in complete denture fabrication, including a multi-step approach using preliminary and master cast impressions, semi-adjustable articulators, face-bow preservation, laboratory/clinical remount.^{65,66} Despite the fact that the traditional multi-step method is preferred by prosthodontists and taught in a large majority of dental schools, most general dentists use simplified techniques in order to reduce the number of appointments and the cost.^{8,16,63,64,67,68}

Shorter, less expensive but still acceptable treatment methods would benefit especially elderly patients with chronic pathology and less mobility.^{1,17,69,70,71}

Simplified denture fabrication techniques make treatment more attractive for both practitioners and patients.

Most simplified techniques will condense impression making in one appointment, which often includes jaw records also (without face bow registration), and sometimes anterior teeth selection/mock-up of anterior set-up. A critical review by Carlsson et al⁷² established that "there was no support for the frequent textbook statement that the two-step procedure is necessary and superior to the one-step method". A try-in procedure is optional during most techniques, so the finished dentures can be delivered in as little as two appointments. In addition, such methods are likely to be integrated in a digital workflow.⁷³

There were no significant differences noted in denture quality and patient satisfaction between dentures fabricated by using the traditional multi-step protocol and prostheses made by using simplified methods.^{1,6,8,16,63,64,68,74,75,76,77} The goal of such methods would be to reduce the number of appointments while still observing the principles of complete denture treatment.^{78,79,80} Such techniques are more cost effective,^{64,67,69} and it was reported that by using a simplified technique, the clinical time can be reduced by as much as 34%, compared to

conventional methods.⁶⁹ At the same time, patient satisfaction and prosthodontist rating of prosthesis quality were comparable between the two methods. Patients appreciated the reduced number of appointments.⁶⁹

Overall, there is no compelling evidence to suggest that complete dentures fabricated following the traditional multi-step, complex protocol provide better outcomes than dentures made using simplified techniques.⁸¹

It is worth noting that the study by Regis et al.⁶⁸ employed relatively young dentists. Such young practitioners reached good results by using the simplified technique, which indicates that experience is not a factor under these conditions.⁶⁸ In addition, it was found that even predoctoral students can make adequate complete prostheses by using a simplified method.⁸²

A one-step complete denture technique was also documented.⁸³ It employs prefabricated complete dentures templates with thermoplastic bases (which come in different sizes), which are adapted on casts, then relined chairside. While customization in tooth arrangements could be more like an afterthought, the one-step denture is regarded as a fast and cost-effective method for complete prosthesis fabrication.

5. Fabrication of complete prostheses using digital protocols

It took less than a decade for digital photography to reach mainstream and even take over professional photography at the beginning of the century. During the same period, CAD/CAM technologies soared in various industrial applications.

The digital methods in complete denture fabrication are not entirely new, as literature mentions such an approach as early as in 1994.⁸⁴ If we remember that it took more than three decades for digital protocols in fixed restorations to become mainstream, and considering that removable prosthodontics accounts for a significantly smaller portion of the dental business, it is likely that we will wait at least another decade for digital denture fabrication to become mainstream.

While the clinical steps remain essentially analogic, digital technologies in complete denture may address some of the disadvantages of conventional denture fabrication protocols, like increased number of treatment visits, and questionable adaptation of denture bases to the tissues due to polymerization shrinkage. Moreover, generating duplicate dentures appears simple and reliable with digital technologies. In the long run, digital technologies in complete denture fabrication are expected to help dealing with many other issues such as increased demand, access to care around the world, standardization in clinical research.⁸⁵

On the flip side, the costs associated with complete denture fabrication by digital means are still high, as compared to fully analog methods. With widespread acceptance, however, these costs are expected to fall, and likely become lower than expenses associated to the traditional methods.⁸⁵ Moreover, due to the reversible feature of complete denture treatment,

in case of failure of a digital protocol, a traditional approach can always be instituted, or a combination of the two.⁸⁵

A survey of U.S. post-doctoral program directors and predoctoral department chairs found that the use of digital technology in denture fabrication is incorporated in more than half of the graduate programs, while only 12% of the surveyed schools observe it in predoctoral education. It is estimated that up to 10% of complete dentures delivered in academic settings are processed by digital means.⁸⁶ The use of digital technologies for complete denture fabrication in predoctoral education was found to be an effective and time saving method. The process was preferred and used effectively by students.⁸⁷

6. Denturists and clinical dental technicians

Denturism was defined as the practice of fabrication and fitting of removable dentures by dental technicians, who perform both the clinical and laboratory stages of denture making.⁸⁸ In some countries, denturists are known as clinical dental technicians.

In the U.S. the practice of denturism is regulated in WA, OR, ID, MT, AZ, ME. Other states are seeking regulation (WY, TX, IL, IN, KY, TN, PA, VT, MA), with recent legislative action in CA, CO, OK, GA.⁸⁹

Denturists practice legally also in Canada, New Zealand, and Finland. There is an indication of illegal practice of denturism in Belgium, Greece, and the U.K.,⁹⁰ but it is probably much more widespread, especially in the developing world.

It was speculated that the development of denturism was mainly driven by dental technicians. Access to care was supposedly improved in the areas where denturists are allowed to practice.⁹⁰

The literature on the practice of denturism is scarce; more data are needed before making informed recommendations on what role should such a category of dental professionals play in the modern prosthodontic care delivery.

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Questions**Current trends in demographics and edentulism indicate that:**

- a. Prevalence of edentulism is increasing overall;
 b. Prevalence of edentulism is decreasing overall;
 c. The utilization rate of dentures is increasing overall;
 d. The utilization rate of dentures is decreasing overall.

The standard of care for the edentulous mandible is:

- a. Conventional complete denture;
 b. Implant overdenture;
 c. Implant supported fixed prosthesis;
 d. Not pertaining to a specific treatment option.

Simplified complete denture treatment techniques:

- a. Provide comparable outcomes, as compared to traditional techniques;
 b. Are generally more expensive;
 c. Require digital protocols;
 d. Should be reserved to specialists in prosthodontics.

Fabrication of complete denture using digital protocols:

- a. Is time consuming;
 b. Requires an optic impression;
 c. Follows simplified clinical protocols;
 d. Is mainstream in the developed world.