



Overview on Steps of Complete Dentures: A Review

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JPRI/2021/v33i64A35813

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/84140>

Review Article

Received 25 October 2021

Accepted 28 December 2021

Published 30 December 2021

ABSTRACT

Total edentulism is a serious public health issue, particularly among the aged people. Edentulism has a detrimental impact on various elements of a patient's everyday life, including masticatory function, phonetics, and facial structure, with significant psychosocial implications. For those patients, complete dentures remain the first option. Despite the fact that age-specific rates of edentulism are expected to decline, demand for complete dentures will continue to rise in the next decades. Patients with new complete dentures who are edentulous are fairly pleased, however up to 30% of them have issues. They continue to struggle with issues such as unattractive appearance, ripping pain or discomfort owing to the failure of holding and stabilization, impaired articulation, food deposition under the denture, and trouble with chewing. These types of issues can lower one's quality of life and force him to seek additional help to resolve them. In some circumstances, a specific clinical technique known as rebasing is recommended as a solution to these issues.

Keywords: Edentulism; dentures techniques; facial structure.

1. INTRODUCTION

Total edentulism is a serious public health issue, particularly among the aged [1,2]. Edentulism has a detrimental impact on various elements of a patient's everyday life, including masticatory function, phonetics, and facial structure, with significant psychosocial implications [3,4]. In 1980, the World Health Organization (WHO) defined edentulism as a chronic condition that causes disability and impairment. [5]: Despite the growing popularity of dental implants, full dentures remain an important management option for certain edentulous people who cannot afford or are not candidates for implant therapy. Complete denture manufacturing has remained mostly unchanged over the past 100 years, relying on traditional techniques that include many steps requiring 4 to 5 clinical sessions, from preliminary impressions through denture placement, as well as extensive laboratory operations. This normally necessitates a lot of human intervention and a lot of material processing, which can lead to mistakes, processing errors, and more time and money spent [6,7].

According to statistics, 26% of the elderly in the United States are edentulous, with edentulous populations ranging from 15% to 78% in Europe, 24% in Indonesia, 23% in Brazil, and 11% in China [8]. For those patients, complete dentures remain the first option. Despite the fact that age-specific rates of edentulism are expected to decline, demand for complete dentures will continue to rise in the next decades. The history of dentures goes back to 700 BC [9]. The most accurate full upper and lower denture cases were discovered in Switzerland in the 16th century. It was made up of two curve-moulded bone patterns that were crudely cut from a bull's femur and entangled at their farthest rear points to form a pivot [10,11]. Then, in the late seventeenth century, Alexis Duchâteau managed to create the first porcelain dentures [12]. Recently, in 1937, Dr. Walter Wright introduced Polymethyl methacrylate as a base material for dentures, which became the most widely used polymer in the following ten years. Methyl methacrylate is the full denture base material with the most benefits and is extensively, primarily, used today, and in fact, it refers to a suitable technique of dealing with the ideal material [13].

In spite of the availability of different procedures such as implant-retained prostheses, the vast

majority of people will continue to use traditional dentures, owing to expense and the absence of availability of healthcare [7-17]. As a result, the need for traditional complete dental prostheses will continue in the foreseeable future [1,2,8]. The traditional method referred to as "T" and the simplified method referred to as "S" are regarded as two of the most frequent procedures for fabricating full dentures. Most dental schools teach the old way, which involves more sophisticated and time-consuming procedures. Meanwhile, most general dentists use simplified approaches to treat edentulous patients in order to reduce the number of visits and time it takes to construct the prosthesis [18–20].

Patients with new complete dentures who are edentulous are generally pleased, but up to 30% of them have issues. They continue to struggle with issues such as unattractive appearance, ripping pain or discomfort owing to the failure of holding and stabilization, impaired articulation, food deposition under the denture, and trouble with chewing [21–23]. These types of issues can lower one's quality of life and force him to seek additional help to resolve them [24,25]. In some circumstances, a specific clinical technique known as rebasing is recommended as a solution to these issues [26].

2. TYPES OF COMPLETE DENTURES TECHNIQUES

2.1 Traditional Technique

Artificial teeth and the denture foundation are the two primary components of complete dentures. An artificial tooth, as previously stated, is used to preserve the normal tooth's look, occlusion, oral function, and to aid in the pronunciation of words. The dental basis serves as the foundation for the artificial tooth and can be utilised to heal soft and hard tissues that have been damaged. Biting force is transferred from the artificial tooth to the oral mucosa and bone structures via the denture base. Because tooth support is not possible, complete dentures have a denture base that occupies a larger region of the oral mucosa than removable partial dentures (RPDs). Complete dentures can perform all of these activities, such as chewing and speaking normally. Complete dentures, unlike RPDs, don't include the use of connectors as there isn't enough space to put a major connector on the complete denture, and minor connectors can't be used because there isn't a healthy base [27].

Since the 1930s, the laboratory technique of denture production has remained mostly unchanged. The technique next required using paired flasks to make moulds of the wax-trial denture set-up, then removing the wax, placing mixed PMMA dough, flask trial closure, processing in a hot water bath, and finally diving, break-out, trimming, and polishing. The delivery of mixed PMMA dough has seen the most significant advancements. Dentures made with injection-molded methods now have a higher level of precision and stability than those made with traditional compression procedures. The injection process also results in an improved surface texture with smoother outlines [28–30]. The launch of the Eclipse® (urethane dimethacrylate) light-curable thermoplastic resin system in 2002 marked the most significant fundamental change in denture bases and manufacturing procedures. When compared to conventional PMMA, it has a number of advantages, including the elimination of monomer (methyl, ethyl, butyl, or propyl methacrylate), the elimination of packing, time-saving, and less shrinkage. It can also bind to normal PMMA denture base materials. As a result, Eclipse may create a distinct denture base in clear or tissue-colored material that can be combined with traditional wax-trial denture set-ups and PMMA materials to form an integral element of the final prosthesis [31,32].

9 steps for traditional denture fabrication: [33-35]

- 1- Making an initial imprint with alginate and a stock tray especially for edentulous patients. Wax can be used to increase the tray's borders.
- 2- Preparing a preliminary cast as well as a custom impression tray. In the periphery, this cast must be over-extended a little.
- 3- With Polyvinyl siloxane (PVS) or polyether, making a master impression with a border moulded customized tray.
- 4- Fabrication of master cast in the laboratory and recording wax rim.
- 5- Confirming that the record base fits and extends. Confirming that the lip support, incisal edge position, occlusal plane, occlusal vertical dimension, and midline contour wax rims are at the correct vertical dimension, recording facebow transfer and bite registration. Choosing the tooth moulds, tooth shade, and esthetic scheme.
- 6- using all the items, the lab will mount and index the cast and create trial denture

- 7- Initial denture set-up using a try-in method. This may be a "aesthetic try-in" of just the anterior teeth and this necessitates another try-in, or the full set-up. Examining for the mounting precision, occlusal dimension, aesthetics, and pronunciation. Making any necessary adjustments. Before moving on to the next level, both the patient and the clinician must be pleased.
- 8- Returning all items to the lab for creation of the prosthesis. To avoid any denture processing faults, dentures should be reinstalled and stabilized. Dentures should be polished on all external surfaces and returned completed. Clinical remount castings will be requested by many physicians and will be created and returned with the case.
- 9- Trying the dentures by the patient and make any required adjustments. 24-hour, one-week, and one-month appointments are common following the insertion, and follow-up visits.

2.2 Simplified Denture Technique

Denture manufacturing techniques studied in dentistry schools frequently need a long list of clinical and laboratory procedures, based on the idea that more complicated processes result in greater treatment quality. Nonetheless, in many regions, most general practitioners do not employ conventional dentures. Several simplified procedures for complete denture production have been developed, this method have been proposed to create clinically appropriate dentures while using fewer resources by simplifying or even avoiding some clinical and laboratory procedures.

In certain retroactive research, several steps of maxillomandibular relation procedures, such as the impression and recording, have been simplified. Duncan [36,37] described a simpler complete denture with a single-step stock tray impression. Several randomized trials comparing simplified and traditional procedures in terms of function, patient satisfaction, and costs have been reported. Depending on whether they utilize the simplified or traditional technique, Heydecke et al appear to use two alternative occlusal setups. To eliminate bias, the investigators provided the same patients both a simplified and a traditional complete denture [38-43].

Patients' pleasure with dentures was examined using a visual analogue scale (VAS) by Kawai et

al, Regis et al, and Nunez et al, which incorporated the patient's perception in connection to overall satisfaction with comfort, stability, ability to chew, ability to talk, and aesthetics. Despite using various occlusal settings (GYP, GEP) and conducting RCTs on the same individuals, Heydecke et al found identical results. There were no significant differences in patient satisfaction ratings between the simplified and traditional groups in any of these RCTs. Furthermore, according to Regis et al., patient satisfaction was somewhat higher with dentures made utilizing the simpler procedure [38,39,41,44].

Dentists were requested to evaluate the denture quality of both simplified and traditional complete dentures by Kawai et al and Regis et al. With 85 percent statistical significance, Kawai et al found no significant changes in denture quality scores between the traditional and Simplified ones. Speech was considerably better in the conventional technique group, according to Kawai et al, although this difference could be accidental. Dentures were evaluated by dentists in the areas of interocclusal, occlusion, articulation, retention, stability, pronounced movement, and displacement, according to Regis et al. [39,41]

Vecchia et al conducted an RCT to determine the cost of complete dentures, including direct and indirect expenditures, which indicated by Takanashi et al. The simplified method was inexpensive both directly and indirectly; in this study, a dentist needed 381.7 minutes for the traditional procedure versus 264.5 minutes for the simpler method. As a result, the total time saved was 117.2 minutes. Those findings were confirmed by Kawai et al¹¹. The traditional method's mean total cost was considerably higher than the simplified method's. In addition, the simpler procedure eliminates the need for additional adjustment visits [40,43,44,45-47].

3. DIGITAL COMPLETE DENTURES TECHNOLOGY

Complete denture treatment is changing dramatically as computer-aided design (CAD) and computer-aided manufacturing (CAM) technology advance. Intra-oral scanners (IOS) can now capture edentulous ridges and maxillo-mandibular connections, removable complete dentures can be digitally constructed using a variety of commercially available software, and

traditional flasks can be replaced by milling and printing machines. More significantly, for the first time, these technologies can provide a repeatable manufacturing quality. However, the variety of tools and procedures makes it difficult to integrate them into daily practice, especially since they are not all at the same maturity level. Nonetheless, entire dentures are being transformed by the digital age [48-58].

A digital scanner is a measurement instrument that records and rebuilds three-dimensional (3D) surfaces or volumes without touching them. It is made up of an optical acquisition equipment and software for 3D reconstruction. Extra-oral scanners (EOS) are used to digitalize models in labs, whereas IOS are mobile and record directly in the mouth. In maxillofacial prostheses, facial scanners can be used to record aesthetic lines or extra-oral abnormalities.

Scan bodies are markers on edentulous ridges that are employed in digital scanning for implant-supported rehabilitation. The similarities seen between landmarks, on the other hand, pose a danger of confusion for the reconstruction algorithm when it comes to customizing each implant. For digital scanning of implants, two approaches have been proposed: confocal microscopy (IOS) and stereo photogrammetry. 36 Both systems were studied in short-term clinical trials, with similar results: a satisfactory survival rate after 1 to 2 years, as well as clinical and radiological responsiveness of the artificial frames [59,60]. Several in vitro investigations compared the accuracy of digital scanning for distance and angulation to traditional impressions, and current IOS offered superior or equal findings. When evaluating these findings, however, caution is advised because errors reported in vivo can be twice when compared to in vitro observations [61-70].

Many laboratories already utilize EOS to scan impressions and models. A software program creates a 3d model of the object and an STL file that can be utilized in most CAD software packages, regardless of the measurement acquisition technology (laser, structured light, or touch). Despite the fact that IOS and EOS have similar performance,⁵⁶ EOS is often thought to be more precise than IOS due to the parameters controlled during acquisition such as temperature, illumination, and humidity. Because of the regulated settings, optical scanners are faster than contact scanners, although they may be impacted by the optical qualities of the

scanned object [71-73]. The materials used to make RCDs have also been impacted by new production procedures. Polymethyl methacrylate is the most common and widely used component (PMMA). Material shrinkage is caused by its exothermic polymerization. In the traditional technique, warmth, pressures, and polymerization time are all carefully controlled to improve material homogeneity and integrity of the denture surface, as well as shrinkage and pore sizes. Traditional protocols, on the other hand, were operator-dependent. RCD fabrication, whether by milling or 3D printing, eliminates these error sources.

For totally edentulous patients, digitally produced dentures can be a cost-effective and time-saving choice because this innovative technology improves the treatment procedure and produces clinically acceptable dentures with few issues. The key benefits of digitally produced dentures were dramatically reduced clinical time and appointment numbers, greater retention, digital application, and therefore reproducibility.

4. STABILITY IN COMPLETE DENTURES

The interaction between the denture base and the surface tissue is critical for stability. The design of denture borders should be determined by the activity of the orofacial muscles. The moveable tissue dictates the extension of denture flanges, which further aids in stability. To achieve optimal stability, the relationship between the occlusal surfaces should be used. Although it is critical to acknowledge the relevance of the neutral zone in tooth arrangement and the polished surface that provides stability, it is still debatable whether good dentures can be made without noting the neutral zone.

5. FACTORS CONTRIBUTING STABILITY

5.1 The Intaglio Surface

According to Friedman, connection of the flanges with the ridge slopes is a significant feature contributing to stability. Adjustable tissue must be used to keep the greatest connection between the tissue and the denture borders to a minimum. Those tissues that produce perpendicular resistance, which can be achieved by combining the surfaces of the maxillary and mandibular ridges, which are at right angles to the occlusal plane, are required for the maximal stability.

Bony foundations with firmly linked mucosal tissues, according to Boucher, contribute in stability.

5.2 The Cameo Surface and Surrounding Musculature

Muscle could assist with complete denture stability in two ways: by enabling particular muscles to work without being hampered by the denture base, or by leveraging the regular movement of certain muscle groups to aid in the seating of the denture base and improve stability. This is used to direct the dentures' sitting operation. During movement such as during speech, muscles like the orbicularis oris and the buccinator contract. To allow positive seating by cheeks and lips, the buccal and labial flanges must be concave. The correct sculpting of the denture flanges allows the forces generated during muscular contractions to be communicated as sitting forces. Another item that needs to be examined in order to establish stability is the tongue. During the recording of lingual flanges, the level of the tongue that it fills during its maximal function must be taken into account. The high level of the mouth's floor allows for the tongue's tasks that require it to be more than moderately extended [74].

5.3 Occlusal Surfaces

Stability is also aided by the harmony that develops between the opposing occlusal surfaces. The denture must be free of obstructions within the patient's functional range of motion. The occlusal surface must not contact excessively during movements. These undesirable forces cause lateral and lack of balance forces, which compromise stability [75].

6. REBASING AS A PROBLEM-SOLVING IN COMPLETE DENTURES

The whole repair, according to Sangiuolo, is totally rebuilding the base of the prosthesis with a heat-polymerized acrylic resin utilizing either an indirectly or directly approach requiring laboratory involvement. This method is used to remodel an old denture without having to make a new one by changing the existing denture base material on an existing prosthesis without changing the occlusal relations of the teeth to restore stability and retention, as well as to reestablish the correct relationship of the denture to the basal tissue [76].

The main benefit of this treatment is that it compensates for prosthesis instability and corrects bearing surface registration faults caused by faulty impressions or aggressive adjustments made by the physician in response to the patient's complaints in sessions [77]. It's also used to adjust the impacts of pathological or physiological modifications to bearing surfaces, such as in diabetic patients with faster bone resorption, and in immediate prostheses to correct for changes after bone and mucosal healing for a better bearing surface adaption [78]. For the treatment of significantly advanced resorbed ridges, rebasing is considered a conservative clinical strategy .

7. CONCLUSION

Complete denture is an old technique used in case of partial or total tooth loss, it is used mostly by elderly people, where statistics show the growing demand for it due to low cost and good efficacy. The traditional technique involves many sophisticated steps, while the simplified one is mostly used where some of these steps are removed or integrated into one step, the simplified one show the same patient's satisfaction, but it saves time and cost. Recently technology has been used to create computer-aided design and manufacturing, which showed great enhancement in the field of denture and have a promising future too.

Stability of the denture is another factors to be taken into consideration as it ensures the patient's satisfaction with the denture and provides the maximal benefits, many factors contribute to the stability such as the tongue position, the muscles of the lip and checks and connection of the flanges with the ridge slopes. Finally rebasing is another option in case of having unsuitable denture either due to physiological or pathological changes.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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