

# DIGITAL COMPLETE VERSUS CONVENTIONAL COMPLETE DENTURES : A REVIEW ARTICLE

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## ABSTRACT

The aim of this review article was to investigate the use of computer aided design in the creation of removable dentures. In the past few years CAD-CAM has drawn interest of many people. This article provides a comprehensive, critical, and objective analysis of the current knowledge of CDs and related technology. Patients' experience has been acknowledged as a critical dimension of healthcare quality alongside their safety and clinical effectiveness. However, patients' experiences in complete removable denture wearing have not been well established qualitatively. This review synthesizes qualitative studies that investigated the experiences of people wearing removable dentures in order to gain a deeper understanding of the issues and their causes. This study is an access to existing literature concerning 3D-printed complete dentures, covering aspects like innovative biomaterials, manufacturing methods and processes, workflow, and clinical effectiveness. A total of forty studies were included along with an appraisal of abstracts, and finally a selection of articles for rigorous textual analysis. This article concludes that CAD/CAM technology continues to transform an impact on denture fabrication, promising improved patient care and efficiency in dental practice.

**Key Words:** Complete dentures, CAD-CAM, Digital, Conventional.

## INTRODUCTION

The evolution of dental prosthetics has proved to be an influential boon to technological advancements, particularly with the fabrication of Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM) systems. Traditional methods of denture fabrication, while having served the dental profession for decades, are characterized by labor-intensive and clinically sensitive processes that can be prone to errors, affecting the fit and comfort of the final prosthetics. The advent of CAD/CAM technology in dentistry has revealed a new era of precision, efficiency, and patient satisfaction [1].

Acrylic resin-poly methyl methacrylate (PMMA) was developed as early as in the 1930s and by 1940, 90 to 95% of all denture bases were made using this material. Even today, PMMA is the

most commonly used denture base material. Clinically optimal dentures manufactured by minimal repetition of laboratory steps require good coordination and cooperation between the experienced dentist and the skilled technician. Relying solely and completely on the skills of laboratory personnel particularly with the manual conventional methods for denture fabrication, poor adaptation of dentures is more frequent and this may affect patient's satisfaction with the new prosthesis, though the feedback by the patient is often under reported[2].

The application of CAD-CAM in the fabrication of dentures represents a transition from conventional techniques to offering a digital approach of design and manufacturing a prosthesis that enhances the accuracy and aesthetic of dental prostheses. Despite the advantages, the incorporation of CAD/CAM technology into dental practices encounters several challenges. The high cost of equipment, the need for specialized training, and the selection of appropriate materials are considerations that dental professionals must delve into [3].

## **DISCUSSION**

### **Manufacturing techniques of CAD-CAM Complete Dentures**

#### **Design of virtual complete dentures:**

The feasibility of designing virtual complete dentures starts from the physical models by using the modeling processes of full dentures available in CAD-CAM software. During the design, a 3D digital edentulous models is generated which further determines the occlusal plane, the feature points, and the border for baseplates, arranged artificial tooth dentitions, fixed local defects, and adjusted occlusal relation .

1. Determine the boundary line for the anterior teeth on the basis of the maxillary record base. With the entered information, the software calculates the common arrangement lines and suggests an applicable set of artificial teeth .
2. Select the preferred artificial teeth and let the software automatically arrange them in their correct position.
3. Design the gingival parts of the dentures on the basis of the suggestion of the software with the help of the different tools provided, for example, a virtual wax knife or paint brush
4. Send a preview of the virtual arrangement to the clinician for evaluation.
5. Shorten the basal surfaces of the artificial teeth virtually according to the contour of the alveolar ridges and the minimum denture thickness and provide them with retention for later fixation in the denture bases. Generate the data sets for the denture bases and the tooth sockets.
6. Mill the denture bases with a 5-axis milling machine from a gingiva-colored wax blank
7. Modify the conventional denture teeth according to the individual clinical situation. For this, mount them in a special blank/device and mill their basal surfaces corresponding to the prior computation.

8. Wax the adapted denture teeth into the sockets of the wax bases and evaluate the completed trial denture in the conventional articulator. Send the trial denture to the clinician.
9. In the dental office, evaluate the trial dentures in the patient's mouth. Make adjustments to the arrangement in the conventional way, if necessary.
10. Send the trial dentures to the dental laboratory for their completion by flasking.
11. Deliver the completed dentures .

### **Advantages of CAD-CAM Complete Dentures**

Some studies on CAD/CAM dentures showed significantly reduced clinical time compared to conventional dentures surplus better retention and the ability to save digital records for patients. Therefore, in cases where a patient loses or breaks their denture, a replacement of that prosthesis can be achieved easily. The CAD/CAM denture can be finished in a minimum of two visits including manufacturing, while conventional dentures need five sessions to be completed. Moreover, CAD/CAM fabricated dentures seem to have considerably better material properties. This is due to the denture base being milled from polymethyl methacrylate (PMMA) which have been polymerised under high pressure and temperature resulting in a highly condensed resin. Consequently, significant improvements in the quality of CAD/CAM complete dentures are expected. The prevented shrinkage of the CAD/CAM dentures improves their physical properties. Additional advantages include the fact that the retention and durability in CAD/CAM fabricated dentures are significantly better than conventional dentures such as denture porosity are minimised.

### **Disadvantages of CAD-CAM Complete dentures**

The main clinical disadvantage regarding CAD/CAM dentures are in areas such as material waste, high cost, need for immediate reline and compromised aesthetics and phonetics. The CAD-CAM dentures face complications with occlusion and tooth arrangement errors, tooth wear, additional visits, post-insertion adjustments, overall patient dissatisfaction and the need for remake.

### **Manufacturing techniques of conventional complete denture**

1. At the first appointment primary impression is made, beading boxing is done and primary cast is poured. The cast is trimmed followed by spacer adaptation and special tray fabrication.
2. A wash of the impression material of choice is placed onto the intaglio surface of the old dentures if old dentures are available. Border molding techniques are used to extend or otherwise improve the fit of the new prostheses followed by the secondary or wash impressions.
3. The impressions/dentures are then boxed and poured.

4. The master casts are trimmed, indexed, and mounted on the articulator using the facebow transfer and C/R record . Note that the master casts and dentures are not yet separated from the impression media.
5. An index is obtained by closing the mounted maxillary denture.
6. The dentures may be separated from the master casts, cleaned, and returned to the patient. A record may be made of mold and shade, or new selections may be made.
7. A centric relation record is taken with a bite registration material, and a facebow record is made against the upper denture .The occlusal vertical dimension is measured and verified with the existing dentures Occlusal vertical dimension may be increased/restored or decreased by up to 3 mm on the articulator.
8. Tooth arrangement is facilitated by the use of the plaster index insofar as incisal edge placement, arch form, and occlusal plane are considered.

#### **Advantages of conventional complete dentures:**

Complete dentures are a highly affordable choice for patients, especially since they are hoping to replace many teeth. Process is quicker than that of denture implants because there is not much surgery needed to complete the procedure hence they are non-invasive. Adjustable: whether you want to adjust them for the sake of comfort or because additional tooth loss has been experienced, modifying complete dentures is a simple process. Good support: complete dentures provide sufficient support to your lips and cheeks. Improve self-confidence: your smile will greatly benefit from complete dentures, which will only serve to help your confidence.

#### **Disadvantages of conventional complete dentures:**

Discomfort and Awkwardness - Some individuals may experience discomfort and awkwardness in the initial stages of wearing conventional dentures. This is because the mouth needs time to adjust and adapt to the presence of the dentures. However, with patience and proper care, most individuals will get used to wearing dentures within a short period of time. Gagging, Sore Spots, and Irritation - Ill-fitting or improperly adjusted dentures can cause gagging, sore spots, and irritation to the tissues of the mouth. This discomfort may arise due to friction between the dentures and the mouth's soft tissues. Regular dental check-ups and adjustments can help alleviate these issues and ensure a more comfortable fit. Dentures that Slip and Fit Issues- When dentures don't adapt correctly to the contours of the mouth, conventional dentures may slip or move while eating, speaking, or laughing. This can cause embarrassment and difficulty performing daily activities. It is essential to seek professional dental care to ensure that your dentures are comfortable and to provide a secure, stable fit.

## CONCLUSION

The purpose of this review was to evaluate the advantages of CDs fabricated with CAD/CAM technology in comparison to conventional CDs.

### **Retention of denture bases**

The clinical performance of CDs is partly determined by their retention within the oral cavity. Lack of retention and instability are two of the main complaints from people wearing CDs. Retention refers to the amount of vertical force needed to resist the dislodgement of the prosthesis away from its supporting structures. If the resins' physical properties do not play a major role in CAD/CAM denture retention, then the manufacturing process itself could favor the precision of adaptation and the adhesion of digital CDs. Still, the precision of the manufacturing process of these resins favors adaptation and the adhesion of digital CDs and has shown that the retention of digital CDs is better than that of conventional prostheses.

### **Resistance to deformation and breakage:**

When worn, complete dentures are subjected to high stresses during chewing. This creates cyclic deformation of the denture polymer, which in turn can lead to crack formation and possible fatigue fracture of the denture . Therefore, good resistance of the resins to deformation is very important. CAD/CAM resins have proved to be of superior mechanical properties to conventional resins.

### **Adhesion of microorganisms:**

Preventing the adhesion of microorganisms to dentures helps preserve the health of tissues in the oral cavity. Microorganisms can cause pathology in the mucosa supporting the prosthesis, such as candidiasis (induced mainly by *Candida albicans*). Microorganisms accumulate more easily on prostheses than on natural tissue. The surfaces of removable maxillary prostheses are the main reservoir of *Candida albicans*. The physical properties of the prosthetic resin influence this adhesion, including surface roughness and hardness. CAD/CAM machined resins are globally more advantageous in physical properties than conventional resins.

## SUMMARY

Incorporation of CAD/CAM technology into the design and fabrication of complete dentures helps to simplify laboratory work and standardize complete dentures fabrication. With the help of proprietary software, the denture teeth can be arranged and bases designed. Dentures bases are milled from a wax blank, allowing for adjustments after clinical evaluation.

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