Abstract

Whilst increasing numbers of older people retain natural teeth, a sizable proportion of older people are still edentate. Replacement of missing teeth is important for function, aesthetics and to facilitate social interactions. The process of providing oral rehabilitation for edentate older adults can be challenging but clinicians can utilise a number of treatment options including removable or implant retained prostheses. In this article complete denture construction will be described using both conventional and copy denture techniques. Recent innovations in the process for constructing complete dentures using computer aided design and manufacturing (CAD-CAM) techniques will also be discussed. Dental implants can be used to help retain removable complete prostheses for edentate patients and the use of implant retained overdentures is presented as a treatment alternative.

MESH terms

Dentures, edentate, complete dentures, copy dentures, implants, implant overdentures, CAD-CAM

Learning objectives:

- Appreciate the challenging clinical situation which edentulism presents
- Understand the clinical process for fabricating complete dentures including conventional and copy techniques
- Understand the advantages that implant supported overdentures can provide to edentate older patients

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Introduction

Epidemiological surveys have shown a steady decline in edentulism as patients retain natural teeth into old age (1,2). Edentulism however, will not be completely eradicated due to the chronic nature of destructive oral diseases particularly within lower socio-economic groups. Although the overall prevalence of total tooth loss has fallen sharply over recent decades, patients are now becoming edentate at an older age when they are generally less able to adapt to the limitations of complete dentures. As edentulism shifts to an older age cohort many of the patients affected will also encounter chronic systemic diseases including frailty and loss of independence. Currently the majority of edentate older patients are provided with complete replacement dentures and it is estimated that almost 61 million sets will be manufactured in the United States alone in 2020 (3). However, whilst some older patients can adapt to the use of complete dentures, others can benefit from the use of dental implants to retain and stabilise their prostheses.

Complete Dentures

Complete dentures should have pleasing aesthetics, restore speech, provide occlusal support and function for the patient as they replace all of their missing teeth (Figure 1). They should be comfortable and maintain the health of the supporting tissues. A thorough clinical history and oral examination should precede any clinical treatment with radiographs used to investigate pathological conditions. Any previous dentures must be assessed and discussed with the patient as these can provide essential information prior to considering new prostheses.

Complete dentures can be constructed using two different techniques: conventional and copy techniques.
Conventional Denture Technique

The majority of complete dentures are constructed using this technique. The clinical stages include provision of impressions followed by jaw registration, denture trial and insertion. A two stage impression technique is recommended to ensure high quality working models of the edentulous ridges can be produced. For the primary impression a muco-compressive material, such as impression compound, is favoured in a well-fitting stock tray to capture the entire denture bearing area (Figure 2). For the upper arch this should include the residual ridge, tuberosities and hamular notches; frenal extensions; functional sulcus; hard palate extending just beyond the vibrating line. In the lower arch the impression should include the residual ridge including the retromolar pads; the external oblique ridges; frenal extensions; functional sulcus; lingual sulcus, mylohyoid ridge and retromylohyoid areas. Good quality impressions should facilitate production of good quality special trays. Clinicians need to understand the design of special tray which they are prescribing in accordance with the material used for the major impression: for zinc oxide eugenol paste a close fitting tray is required as opposed to a spaced tray for materials such as silicone (Figure 3). The master impression should record the entire permitted denture bearing area so that the denture will have the maximum support and stability during mastication. The quality of retention is related to the area covered by the base, to the accuracy of fit and also to the development of an effective border seal. To achieve this the master impression should displace the tissues sufficiently to create a border seal (4).
Figure 2 Primary lower impression taken using compound

Figure 3 Master impression for complete upper denture taken using zinc oxide eugenol paste in a closely fitting special tray

During the jaw registration stage upper and lower record blocks are used to record the maxillomandibular relationship in the Retruded Contact Position (RCP). The maxillary occlusal rim should be modified to ensure adequate support for the upper lip and adjusted to indicate the incisal level of the upper anterior teeth. The wax rim should be adjusted to ensure it is parallel to the alar-tragal and interpupillary lines to provide the technician with information on the
position of the occlusal plane. The occlusal vertical dimension should be established to provide a free-way space of 2-4mm. The prosthetic teeth are selected including information on shade, shape and size as assessed from previous dentures or from the patient's facial features (4). Photographs of the patient's previous natural dentition can also serve as an excellent reference guide.

Prior to denture insertion a trial stage should always be considered. This stage enables an assessment of the aesthetics, occlusal plane, vertical dimension and jaw relation to be assessed and corrected if necessary. The planned tooth position should be considered as adjustments can be made to ensure adequate lip support, tongue space, aesthetics and function. Patient involvement is crucial at this stage and both the patient and clinician should be satisfied with the dentures prior to finish (Figure 4). This can help to avoid patient discontent with the final prostheses.

Figure 4 Complete upper and lower dentures at insertion

Copy Denture Technique
Whilst the conventional technique essentially involves starting a new set of dentures from scratch, an alternative approach is to produce a copy of the patients' existing set of dentures. This technique offers a number of advantages to both the clinician and the patient as the dentures can be fabricated in fewer clinical stages therefore potentially speeding up the
Copy dentures can be an excellent treatment approach when managing older patients particularly in a non-clinical environment such as a residential care home or the patient’s own house. The technique can offer significant psychological advantages to patients as many of the features which they value in their existing dentures can be incorporated into the new set, therefore reducing the challenges of acclimatisation. However, case selection is very important and poor quality dentures with large occlusal discrepancies cannot be corrected with the copy technique. The copy technique should be considered where the polished surfaces of the dentures are generally satisfactory but alveolar resorption has impacted on denture retention. Where the occlusal surfaces of the teeth have worn in an otherwise successful case then the copy technique can also be considered. It is can be a very useful technique if a spare pair of dentures is required (5,6).

The technique for producing copy dentures involves making wax copies of the patient’s existing denture as the first clinical stage (Figure 5). As with all removable prosthodontics excellent laboratory support is crucial to support the clinician during this technique. It should be noted that modifications to the existing dentures should be undertaken prior to making a copy. This could include extending the peripheries of the dentures to account for alveolar resorption. The wax copy is then inserted into the patient’s mouth where a wash impression is taken in the upper and lower prosthesis. This can be completed using silicone impression material or zinc oxide eugenol paste. The jaw registration is also completed at this stage by adjusting the wax copies and sealing them together (Figure 6). After the combined stages of major impressions and jaw registration are complete the dentures can progress to trial stage and finish (Figure 7).

Figure 5 Existing complete dentures and wax copy
Figure 6  Wax copies after major impressions and jaw registration

Figure 7  Completed dentures fabricated using the copy technique

**CAD-CAM Complete Dentures**

The use of computer aided design and manufacturing (CAD-CAM) techniques in construction of complete dentures has recently gained popularity. CAD-CAM complete dentures can be constructed in as few as two clinical visits (7); in the first visit, all clinical records are captured (Figure 8). These records can take the form of traditional impressions or digital records which can be produced using intra-oral scanning technology. The records are transferred to the digital dental laboratory where the entire denture is designed virtually. This design preview is sent to the clinician for approval and the digital dental laboratory mills the complete denture. At the second clinical visit the dentures are ready for insertion. CAD-CAM dentures offer the potential for fewer visits, less treatment time and reduced chairside time (8). Evidence indicates that the milled CAD-CAM dentures can have better fit, material properties, and
surface properties than traditional flaked acrylic dentures (9,10). One of the practical advantages of digitally manufactured complete dentures are a permanent digital record is retained which could be utilized to fabricate additional protheses (11). Whilst this technology is still in its infancy it may offer significant benefits to older patients.

**Figure 8** Clinical records for production of CAD-CAM complete dentures (AvaDent Digital Dental Solutions, USA)

**Implant retained overdentures**

Severely resorbed residual ridges in edentulous patients can preclude the construction of retentive and stable complete dentures. Problems with poor denture retention and stability are predominantly associated with severely resorbed mandibles (12). Restoration of an edentulous maxilla usually is not as problematic as that of an edentulous mandible. Whist fixed implant retained prostheses can be considered, implant retained overdentures offer a form of removable dental prostheses that are partially or completely supported by dental implants (13). The mandibular overdenture on two inter-foraminal implants, opposing a
conventional maxillary complete denture, has been proposed as a “minimum standard” of care for edentate patients (14,15) (Figure 9). This concept has provided a predictable long-term success and is well documented in the literature (16,17). Although alternative implant configurations can be used, including mini implants (16,17). The advantages of using implant overdentures in older patients include improved masticatory function and quality of life.

Case selection is very important when planning implant supported overdentures (18). Whilst evidence suggests that implant success is very high in older patients, there are a number of systemic diseases and treatments which must be considered including previous radiotherapy or high-dose antiresorptive therapy (bisphosphonates) (19,20). Significant attention should still be drawn to the principles of conventional complete denture construction as outlined previously in this article when considering implant supported overdentures. As the majority of the prostheses is tissue borne the same steps should be followed to construct a high quality denture prostheses which can then further benefit from implant support. A poorly constructed prostheses supported by implants is unlikely to be successful.

**Figure 9** Provision of lower implant supported overdenture (illustration of direct pick up of retentive components)
Conclusion

Management of edentate older patients can be challenging particularly when patients experience complete tooth loss later in life. A number of treatment options are available for management of edentate older patients including complete removable dentures and implant supported alternatives. When managing older patients, particularly those out-with the traditional clinical environment, the use of the copy denture technique should be considered. This can provide significant advantages to the patient and the clinician as the difficult period of acclimatisation to new dentures can be minimised.


