



Case Presentation: Implant Retained Mandibular Prosthesis

12

Samer Abi Nader and Samer Mesmar

Abstract

This chapter will present a clinical case describing the treatment of a lower edentulous patient with an implant-retained prosthesis. The surgical strategies underlining the placement and the distribution of the dental implants to optimize the prosthetic outcome will be highlighted and discussed. The various clinical and laboratory steps starting from the planning to the completion of the prostheses will be presented as well as the criteria for the selection of single attachments for this prosthetic design. This also includes the description and review of the various techniques available to connect the matrix component of the attachment to the denture base. The advantages of each technique will be discussed and their inconveniences highlighted.

Digital dentistry can present tremendous advantages for the elderly patient. This chapter will also present the various clinical steps and digital workflow involved in the fabrication of implant-retained mandibular complete dentures for the edentulous patient. The advantages and

inconveniences related to the use of computer-aided design and manufacturing (CAD/CAM) in complete denture will be underlined.

12.1 Patient History and Background

A 62-year-old male patient presented with the following chief complaint: “I want new dentures, my lower denture is very loose and I can’t eat properly.” The patient’s maxillary and mandibular teeth were extracted when he was in his early 30s because he was unable to afford replacement restorations. He was rendered completely edentulous by the age of 33.

He presented with a moderately resorbed mandible (Fig. 12.1) and is interested in improving the stability and retention of his lower prosthesis. He is content with the general performance of his maxillary removable complete denture but would like to improve the appearance. The maxillary arch presents with a mild alveolar ridge resorption (Fig. 12.2).

S. A. Nader, BSc, DMD, MSc, FRCD(C) (✉)
Department of Restorative Dentistry, Faculty of
Dentistry, McGill University, Montreal, QC, Canada
e-mail: samer.abinader@mcgill.ca

S. Mesmar, DMD, MSc, FRCD(C)
Division of Prosthodontics, McGill University Health
Centre, Montreal, QC, Canada

12.1.1 Medical History

- Hypertension: controlled with medication
- Allergic to penicillin
- No history of smoking or drug abuse



Fig. 12.1 Mandibular residual ridge



Fig. 12.3 Mandibular residual ridge following implant placement. Surgery: Dr. Veronique Benhamou, Periodontist



Fig. 12.2 Maxillary residual ridge

12.2 Implant Placement Strategy

Clinical assessment of the edentulous mandible reveals a wide U-shaped jaw with moderate resorption of the posterior ridges. A preliminary assessment was completed, and an implant-retained mandibular denture was recommended. Three dental implants (Straumann Soft Tissue Level Implants) were planned for placement in the anterior sextant to improve the support, retention, and stability of his lower prosthesis. The two posterior implants were placed in the most retruded position considering the anatomy and location of the alveolar nerve. The third implant was placed most anteriorly to optimize the distribution. This placement strategy was discussed in the previous chapter and should enhance the effect of the indirect retainer provided by the anterior implant. This will minimize the rotation of the lower denture during function and improve denture stability as well as retention (Fig. 12.3).

12.1.2 Dental History

- Multiple extractions
- Complete upper and lower dentures

12.1.3 Clinical Findings

- Complete edentulism
- Inadequate existing complete dentures
- Compromised chewing function
- “U-shaped” mandibular arch form

12.1.4 Diagnosis

- Complete upper and lower edentulism
- Moderate mandibular residual ridge resorption
- Moderate maxillary residual ridge resorption

12.3 Clinical Procedures

12.3.1 Preliminary Impressions of the Upper and Lower Arch

The clinical procedure starts with preliminary impressions of the maxillary and mandibular arches following implant placement and an adequate healing period to ensure proper osteointegration. An irreversible hydrocolloid material (*Jeltrate Alginate, Dentsply Caulk, Canada*)

placed in stock edentulous metal trays (*Patterson Dental Supply, Canada*) is generally used for this step (Fig. 12.4a, b). Impressions are poured using type III dental stone (*GC America Inc., USA*) to produce preliminary casts (Fig. 12.5a, b) which will be used for custom tray fabrication.

12.3.2 Custom Tray Fabrication and Design

Customized trays are fabricated using a light cured acrylic material (*Triad TruTray, Dentsply, Canada*) following the basic principles of flange height reduction to allow room for border molding procedures (Fig. 12.6a, b). Custom trays are then tried intra-orally to verify extensions and fit (Fig. 12.7). Bolder

molding of the periphery is performed using dental compounds (*Kerr Dental, Canada*) (Fig. 12.8) and the manipulation of the patient's tissue to capture the muscles and soft tissue attachments.

12.3.3 Final Impressions of the Upper and Lower Arches

Final impressions are completed for the maxillary and mandibular arches by capturing the anatomical structure including the functional periphery, using polysulfide material (*Permlastic™, Kerr Dental*) (Fig. 12.9). Definitive casts are produced, and baseplates with wax rims are fabricated to register the appropriate clinical parameters.

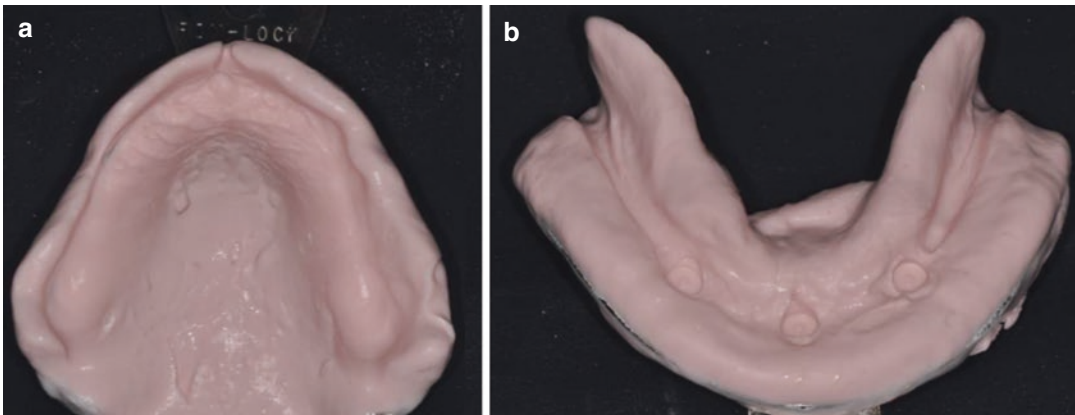


Fig. 12.4 (a) Irreversible hydrocolloid impressions of the maxillary and (b) mandibular arches

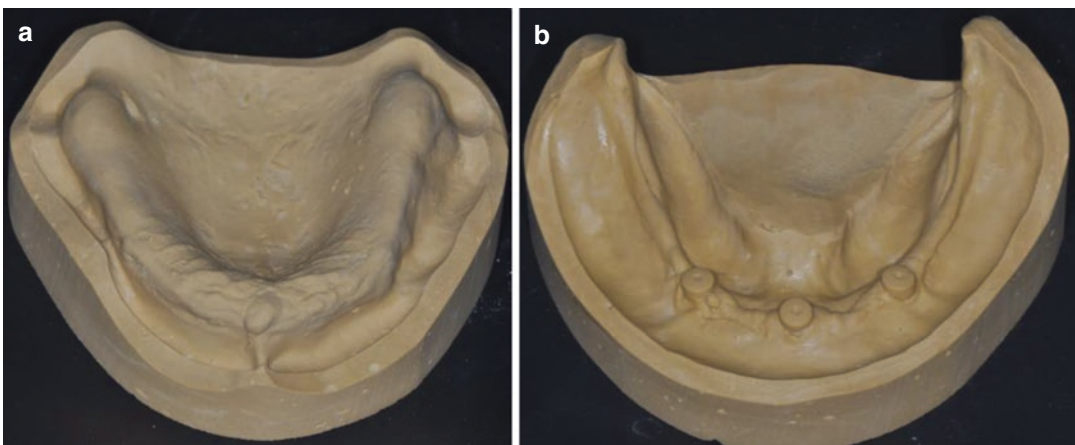


Fig. 12.5 (a) Preliminary cast of maxillary and (b) mandibular arches

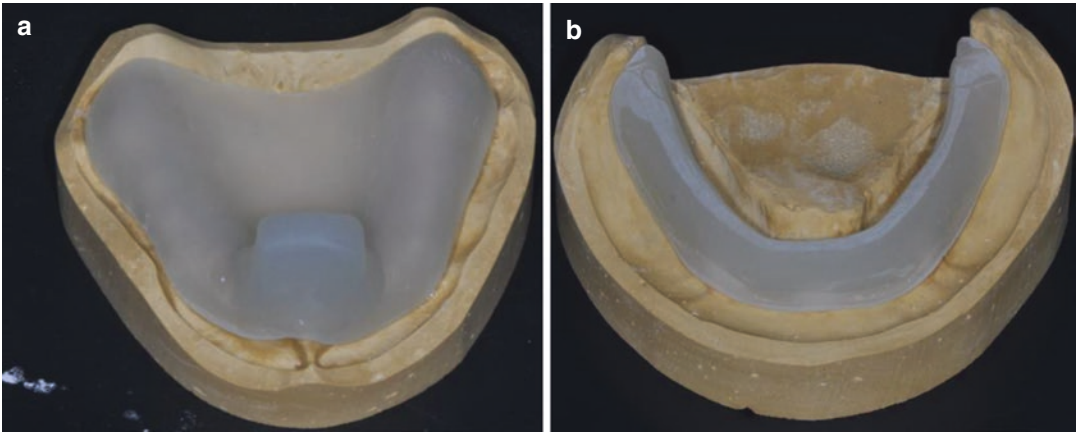


Fig. 12.6 (a and b) Design of the custom trays for final impressions

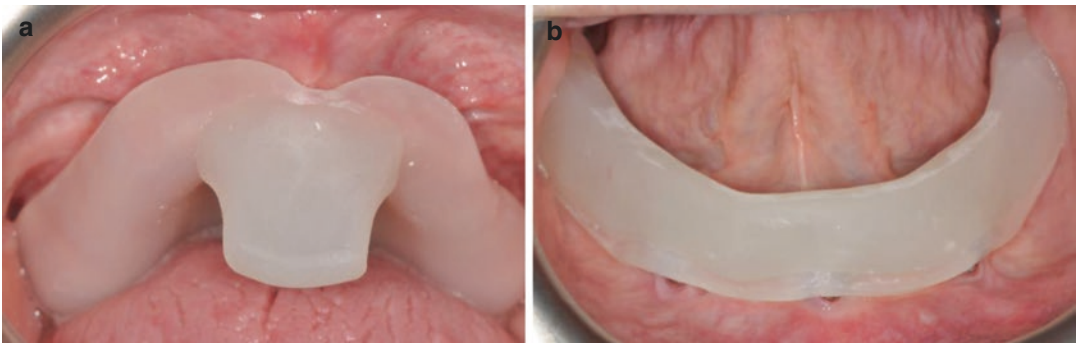


Fig. 12.7 (a and b) Try-in of the maxillary and mandibular custom trays prior to the border molding procedures

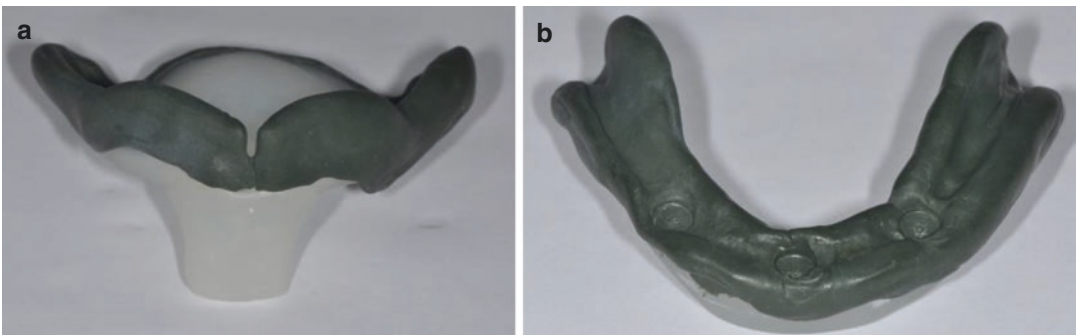


Fig. 12.8 (a and b) Border molding of the maxillary and mandibular arches using dental compound

12.3.4 Wax Rim Adjustments

Adjustments of occlusal wax rims start by determining the lip support, incisal display, and occlusal plane of the maxillary wax rim. Incisal display is determined by considering the age, gender, and

preference of the patient. With age, the maxillary incisal teeth tend to be less apparent; this is more significant for men when compared to women [1]. Lip activity should also be taken into consideration. Some patients have a hypermobile lip that could result in excessive display during smile.

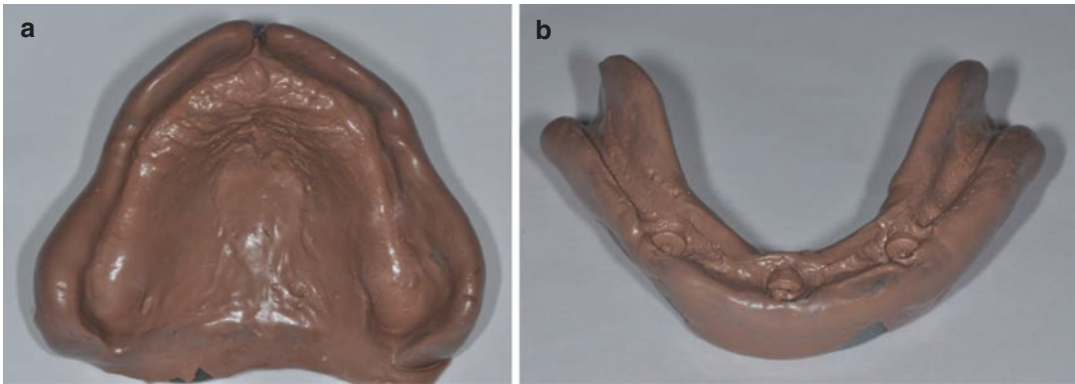


Fig. 12.9 (a and b) Final impression using polysulfide of the maxillary and mandibular arches

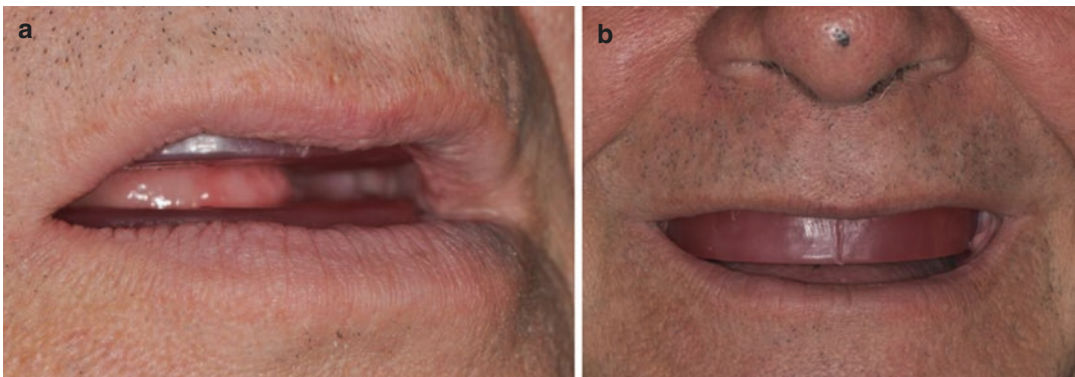


Fig. 12.10 Wax rim adjustments: (a) lip support and (b) esthetic and occlusal plane alignment

Once the display is determined, the midline and smile line are marked on the wax rim (Fig. 12.10).

The occlusal plane is adjusted to be parallel with the bi-pupillary and bi-commissural lines using the Fox Plane. In the posterior region, it should be parallel to camper plane joining the inferior border of the tragus of the ear to the infra-nasal angle.

Different methods have been described in the literature to determine the occlusal vertical dimension [2]. At this stage, the physiological rest position was used. This method starts by marking two reference points, one on the nose tip and the chin, in order to perform some measurements. The physiological rest position is then recorded using the phonetics approach by having the patient pronounce the labial *m* sound [3].

Once the physiological rest position measure is recorded, the occlusal vertical dimension is

obtained by subtracting the interocclusal space. The interocclusal space can vary depending on numerous factors including gender, age, and Angle classification. Several authors estimate an average value of 2–4 mm being acceptable for most of patients [3, 4].

Maxillomandibular relationship is then recorded in centric relation using a fast-set bite registration material (*Jet Blue Bite registration material, Coltene Whaledent*). The mandible can be guided into centric relation using patient- or dentist-mediated techniques. The recorded position is then verified for reproducibility (Fig. 12.11).

Finally, a facebow record is performed to position the maxillary cast and facilitate mounting on a semi-adjustable articulator. A maxillary positioning jig can also be used to mount the maxillary model within an average setting. This

will often position the model within the triangle of Bonwill. All records are sent to the dental laboratory to have the casts mounted and denture teeth set per the determined clinical and anatomical parameters (Fig. 12.12). Balanced occlusion is often recommended for complete denture therapy, although very little clinical evidence is available to support the use of this occlusal scheme for complete dentures and implant-retained/implant-supported prosthesis.

12.3.5 The Trial Denture

As described previously, anterior denture teeth for implant-retained overdentures are generally placed over the attachments as much as possible to decrease cantilevering effect and rotational movement anterior to the fulcrum line drawn



Fig. 12.11 Intermaxillary relationship recorded in centric relation using patient-mediated technique and bite registration material

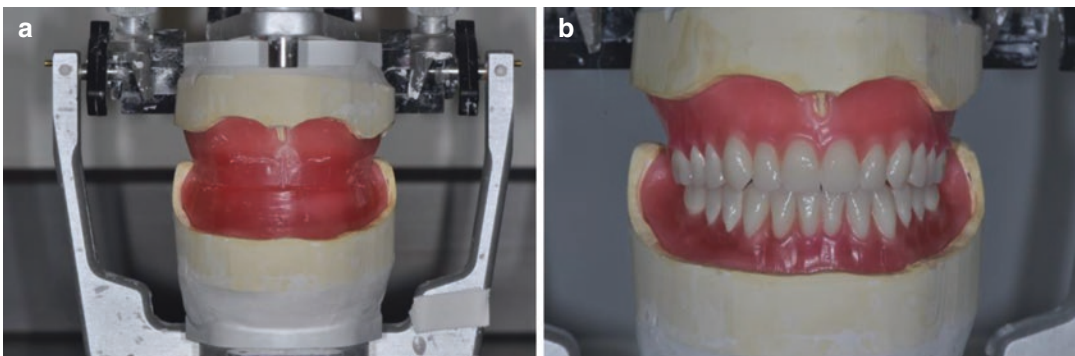


Fig. 12.12 (a and b) Mounting on semi-adjustable articulator and setting of denture teeth according to the determined parameters

between the implants [5] (Fig. 12.13). The addition of a third implant acting as an indirect retainer in this case greatly diminishes the rotational effect. Consequently, the stability of the denture is increased, and the accelerated wear of the nylon-retentive elements of the Locator attachment system is diminished.

The denture teeth setup is then tried clinically in order to evaluate the esthetics, phonetics, and occlusal stability (Figs. 12.14 and 12.15). Once all esthetic and occlusal parameters are verified and the patient is satisfied with the anticipated outcome, the case is sent back to the dental laboratory to start the acrylization process (Figs. 12.16 and 12.17).

12.3.6 Delivery of the Final Prosthesis

12.3.6.1 Locator Attachment

The Locator is a resilient attachment that has a self-aligning feature with dual retention provided by both external and internal mating surfaces. The nylon component is resilient and provides the ability to pivot in any direction over the matrix, which accommodates for the natural movements of the denture base during occlusion and the pliancy of the supporting soft tissue. It provides a multitude of nylon inserts with a varying degree of retention and angulation versatility. In fact, the extended range matrices allow for insertion of the overdenture with up to 40° of divergence between implants.

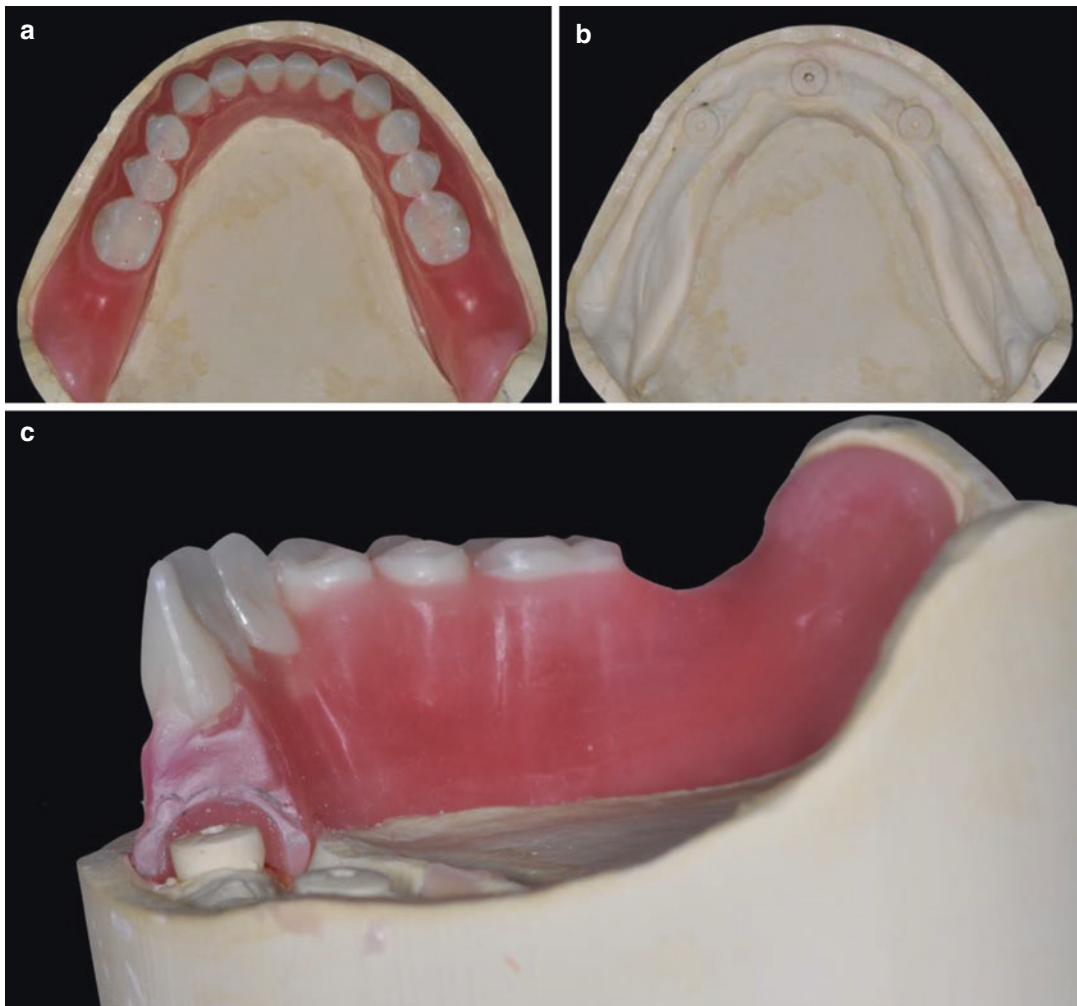


Fig. 12.13 (a, b) Occlusal view illustrating the denture teeth position. (c) Cross-sectional and lateral view demonstrating the position of anterior prosthetic teeth over the attachments as well as the effect of the third implant in minimizing the anterior cantilever

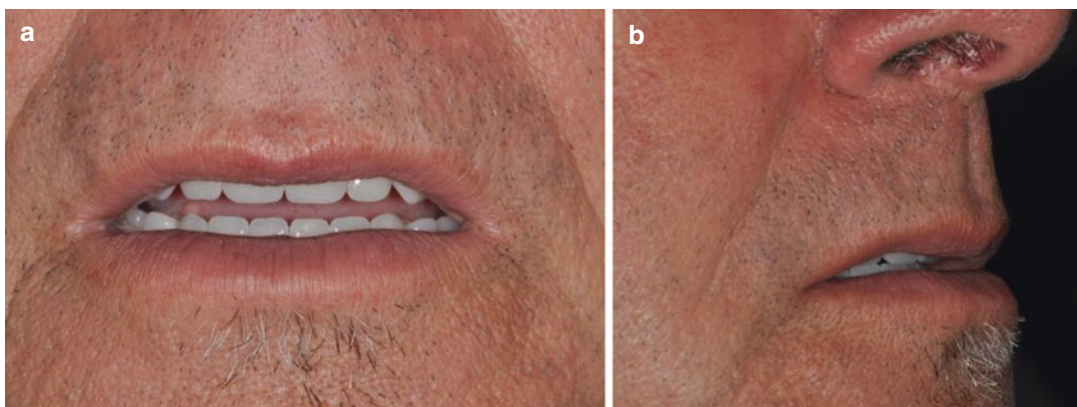


Fig. 12.14 (a and b) Denture teeth try-in to evaluate esthetics, phonetics, function, stability, and occlusal contacts during mandibular movements

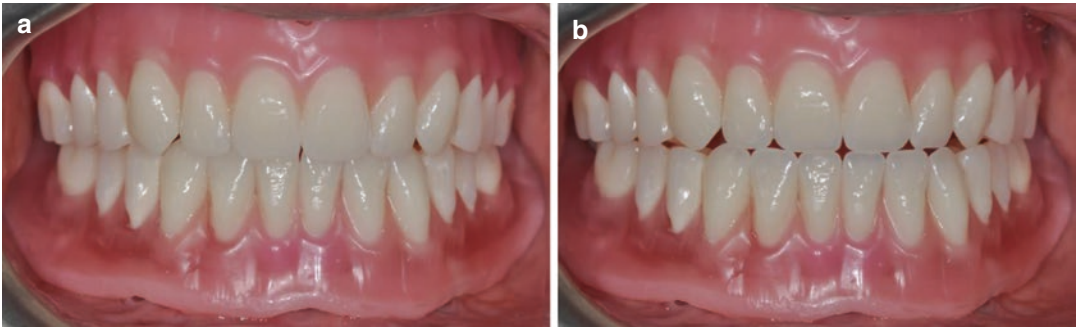


Fig. 12.15 (a and b) Verification of centric and occlusal scheme

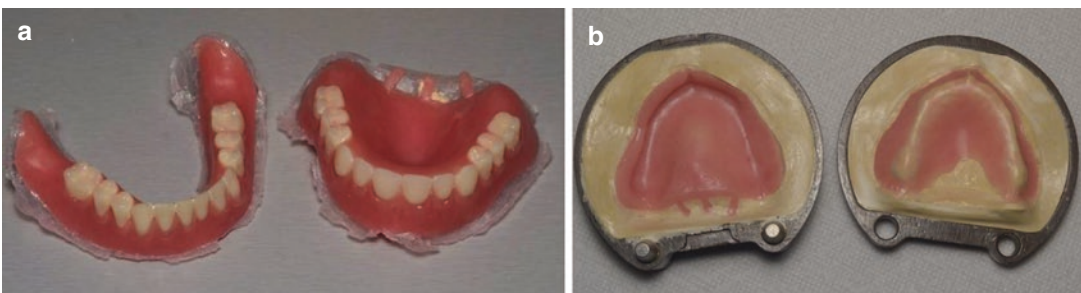


Fig. 12.16 (a and b) Conventional acrylization process



Fig. 12.17 Acrylized dentures ready for delivery

The Locator consists of a metal patrx made from a titanium alloy with TiN coating attached to the implant. The engaging component of the patrx is approximately 1.5 mm in length. The transmucosal cuff height varies depending on the soft tissue thickness. The total vertical height of the Locator attachment including the matrix and the engaging component of the patrx is only 3.17 mm (Fig. 12.18). Therefore, it

requires minimal interocclusal space. It is a relatively durable system that has been widely and commonly used.

12.3.6.2 Selection Process

The selection process for the Locator attachment starts by determining the type of implant and diameter being used. Secondly, the soft tissue thickness is measured from the apical rim of the implant body to the highest contour of the gingiva (Fig. 12.19). The required height of the Locator abutment corresponds exactly to the soft tissue measurement described previously or is the next closest higher size available. The working engaging part of the attachment will be positioned supragingivally. Once the abutment is selected, it is attached to the implant using an abutment driver that engages the inside diameter of the Locator abutment. Final torque tightening of the abutment is performed using a torque wrench. To prevent screw loosening, follow the torque value recommended by the implant manufacturer according to the implant specifications.

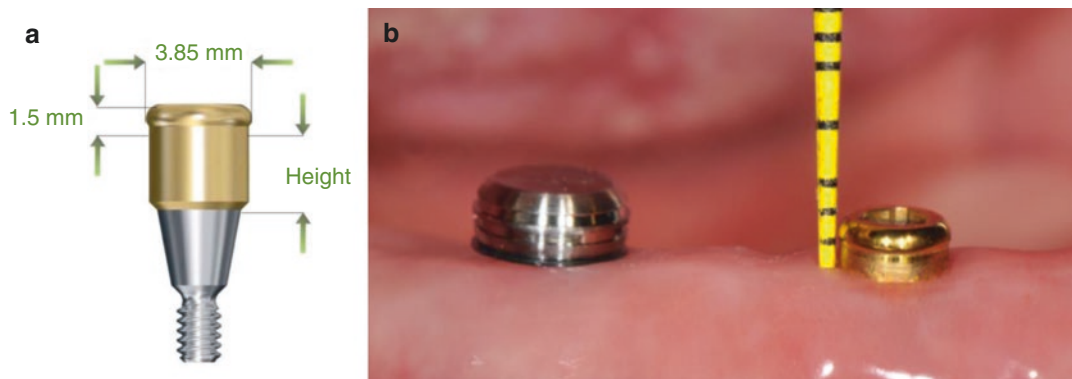


Fig. 12.18 (a) The Locator attachment and (b) height measurement of the patrix and the matrix

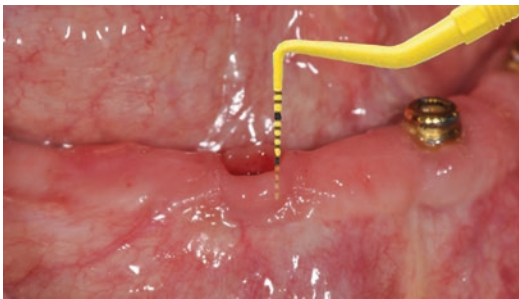


Fig. 12.19 Soft tissue measurement for Locator attachment height selection

Various techniques are available to attach the matrix component of the attachment to the denture base. They are classified as direct, indirect, or a combination of both. Several factors should be considered when selecting the technique for incorporating attachments for overdenture. The angulation of implants, complexity of maxillo-mandibular relationships, operator preference, availability of inventory of prosthetic components, and cost are some of these factors [6].

12.3.6.3 The Direct Method

The direct method involves the connection of the inserts and the housing to the abutment intra-orally using a resinous or acrylic material. This requires an additional clinical step when compared to the indirect method. However, it offers the advantage of minimizing errors during the acrylization process of the matrix component in the denture base.

It is important to consider that all attachments should engage and be passively seated with the denture base adequately supported by the soft tissue in areas of primary and secondary support. This will prevent any movements of the denture and/or wear of the attachment. Considering that the direct method is done intraorally with the denture seated and occluding properly with the opposing denture, errors in the acrylization process of the matrix components leading to improper seating are minimized.

However, the direct method requires additional clinical steps to be performed at the delivery appointment. Moreover, this method is technique sensitive and requires proper isolation and saliva control to ensure the success of the bonding procedure. Furthermore, it is imperative that all surfaces in an undercut area around the Locator attachment are blocked to prevent any flow of acrylic which could lock the denture in place and prevent its removal following the connection procedure.

Description of the Direct Technique

Once the patrix is torqued in place, it should be prepared for the pickup process. The first step is to verify if the denture is properly relieved to accommodate the addition of the matrix as well as the connection material (Figs. 12.20 and 12.21). The use of a disclosing medium such as a fast-set impression material (*Fit Test*, *Quick Up*, *VOCO*, *Germany*) syringed into the created space can alert to the presence of a contact between the matrices and the resinous base (Fig. 12.21a, b).

This should be done by placing the denture intra-orally and in occlusion (Fig. 12.21c). In that case, the denture is adjusted further by selective grinding at the implant location to accommodate for the attachment complex. It is important to eliminate any contact between the denture base and the metal matrix and to have enough thickness

for the material to function properly and prevent any excess pressure on the implant.

The pickup process starts by attaching the Locator matrix to the abutment using the black processing nylons that will maintain the overdenture in the upper limit of its vertical resiliency during the acrylization process (Fig. 12.22). This is followed by placing a prepunched piece of rubber dam over each Locator attachment.



Fig. 12.20 Mandibular denture adjusted to accommodate enough space for the matrices, the Locator abutments, and the material used for the connection



Fig. 12.22 Metal matrices with black processing inserts attached to Locator abutments

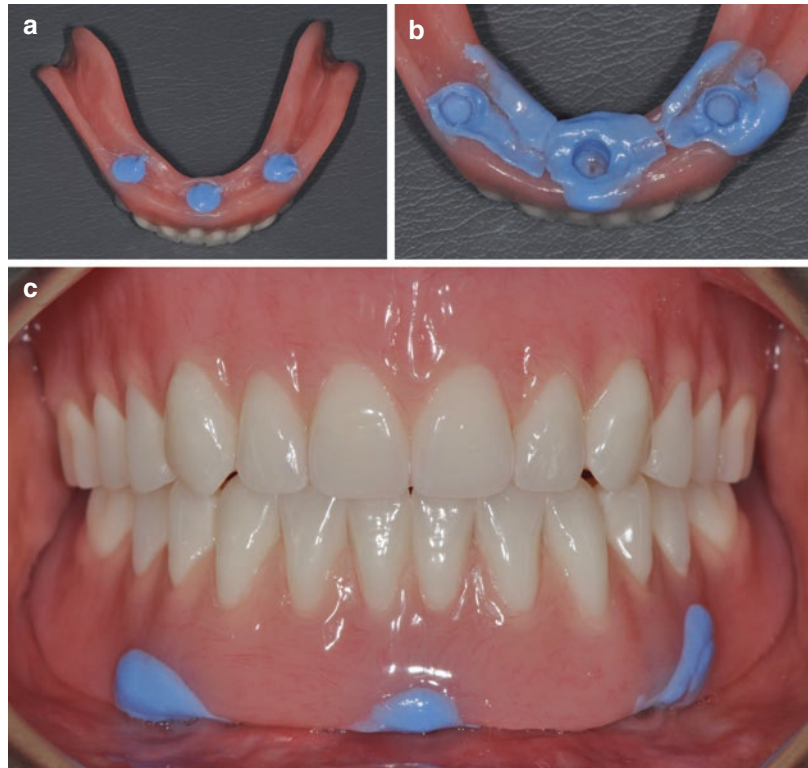


Fig. 12.21 (a) Disclosing medium placed inside prepared spaces of mandibular denture. (b) Anterior implant showing contact between the matrix and the resinous base; further adjustments are then done to relieve the area. (c) Mandibular denture placed over the metal matrices to detect any contact between the resinous base and the attachment complex

of the rubber dam will minimize the flowing of material in the undercuts of the male attachment and prevent the locking of the denture during the procedure. Secondly, a white blockout spacer is placed over the head of each Locator abutment. It is used to block out the area immediately surrounding the abutment and will provide the space required to allow for the resilient function of the matrix without traumatizing the tissue (Fig. 12.23).

The surface is then cleaned and a bonding agent placed (Fig. 12.24). The pickup procedure is done by placing a small amount of the auto-polymerizing resin (*Quick Up, VOCO, Germany*) around each cap as well as in the relief areas (Figs. 12.25 and 12.26). Intraoral saliva control is important for this technique. Any contamination during this procedure may cause the material to dissociate from the denture base. The denture is then positioned properly onto the soft tissues, and



Fig. 12.23 Isolating rubber dam and white blockout spacer placed under metal matrices

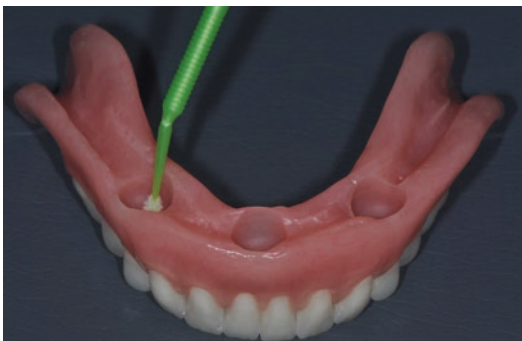


Fig. 12.24 The inner surface of the denture is cleaned prior to the application of the bonding agent into the prepared spaces



Fig. 12.25 Application of auto-polymerizing resin into the prepared spaces



Fig. 12.26 Prepared spaces filled with auto-polymerizing resin and application of auto-polymerizing resin directly onto the metal matrices intraorally



Fig. 12.27 Mandibular denture in occlusion during the setting phase

the patient is guided into occlusion (Fig. 12.27). It is important to have the patient hold the position without excessive compression of the soft tissue which could cause tissue recoil against the denture base and potentially cause dislodging and wear of the nylon inserts.

Once the polymerizing is completed, the denture is removed (Fig. 12.28). Any excess of material around the matrix should be removed with care, not to damage any of the components; the area is then cleaned and polished.

Using the Locator removal tool, the black processing nylons are replaced with the desired inserts (Fig. 12.29). Inserts are categorized based on their design characteristics and retentive capabilities. Selecting the appropriate ones is dependent on the desired retention, the angulation of the implants and the dexterity of the patient. To remove the nylons, the circular edge on the end of the removal tool is wedged down into the nylon and pulled at an angle out of the metal housing. The replacing nylon is placed using the Locator seating tool and firmly pushed in place while supporting the denture (Figs. 12.30 and 12.31).



Fig. 12.28 Mandibular denture removed showing excess resinous material

12.3.6.4 The Indirect Method

The indirect method is less time-consuming and requires no clinical time to attach the matrices into the denture base. This technique requires an implant impression to be made at the level of the implant or abutment with the appropriate impression copings in order to produce an accurate cast of the abutment or implant position. This cast is subsequently used by the laboratory technician to incorporate the metal housings into the mandibular denture during the acrylization process. This facilitates the connection procedure and ensures a more predictable outcome. However, any error during the impression-taking procedure, the connection of analogs into the impression copings, as well as pouring the impression could result in difficulty with seating the denture onto the attachments clinically. In a case where all attachments are not engaging passively, accelerated wearing of the nylon component could occur [6].



Fig. 12.30 Insertion of pink nylons into metal housing using the Locator core tool



Fig. 12.29 Trimming of the resinous excess and removal of black processing nylon



Fig. 12.31 Mandibular denture in place with Locator attachments engaged and passively seated

Description of the Indirect Technique

The indirect technique starts by taking an impression of the implant position and edentulous ridge. The impression can be made at implant shoulder level or abutment level.

The Implant Level Impression Method

The implant shoulder impression registers the implant angulation and position as well as the soft tissue height around each implant. Impression copings are attached to the implants, and seating can be confirmed radiographically. Open-tray or closed-tray technique can be used (Fig. 12.32). The remaining clinical steps such as border molding, wax-rim adjustments, try-in and delivery are similar to conventional denture procedures. The Locator abutment selection is then made on the cast using the same method described earlier. The abutments are ordered with the specific soft tissue height for each implant and delivered to the

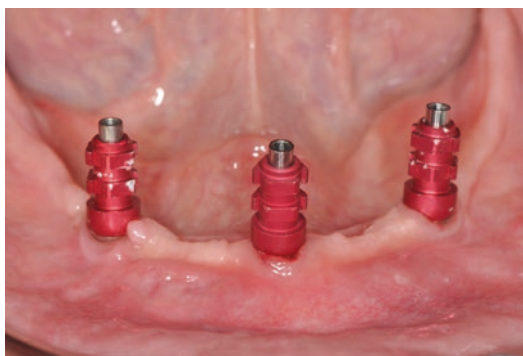


Fig. 12.32 Indirect technique: open-tray implant level final impression

patient during the delivery appointment. This method has the advantage of decreasing the inventory required of different heights and diameters of Locator abutments.

The Abutment Level Impression Method

This method requires the selection of the Locator abutments by measuring the soft tissue height intraorally. Once the abutments are inserted intraorally onto the implants, an abutment level impression is completed using Locator impression copings (Fig. 12.33a). The remaining clinical steps are similar to the conventional denture techniques described earlier (Fig. 12.33b).

When performing an abutment level impression, care must be taken to properly stabilize the impression copings during the procedure (Fig. 12.34). Improperly designing the tray may lead to a premature contact and possible displacement of the impression copings during the impression (Fig. 12.34b). A premature contact with the tray may cause the displacement of the impression coping, therefore creating an imprecise working model. This can be difficult to verify clinically during the impression procedure and would only be picked up at a later stage. Locator analogs are then placed onto the impression copings, and a cast is poured reproducing the Locator abutment inserted clinically (Fig. 12.35a).

The indirect method has the added advantage of allowing for the fabrication of a baseplate into which the Locator metal matrices can be incorporated and used during the different denture fabri-

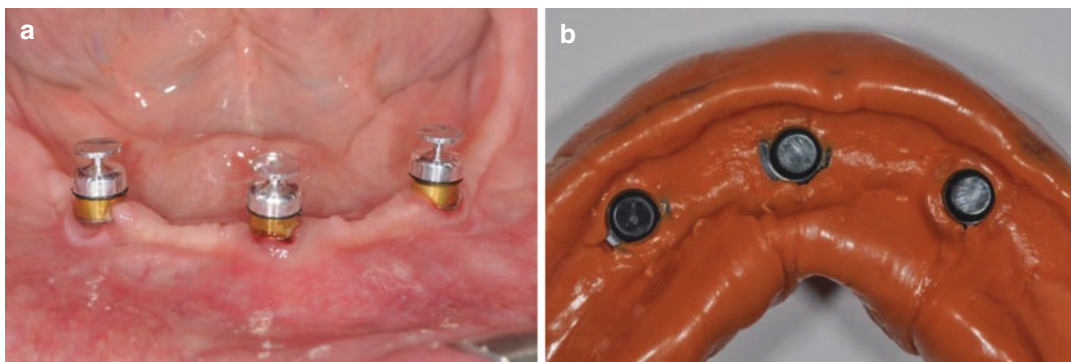


Fig. 12.33 (a) Locator impression copings placed on Locator abutments (b) abutment level final impression

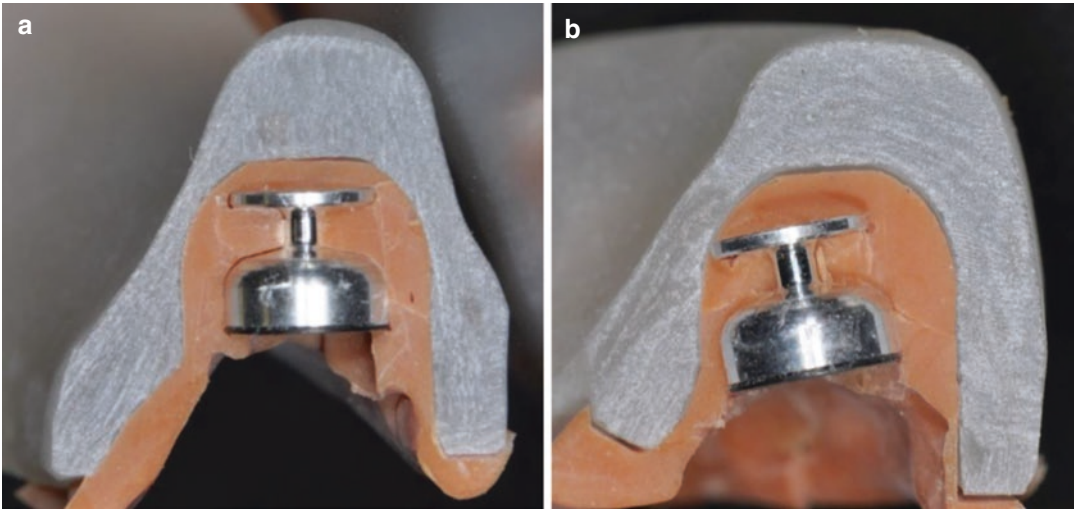


Fig. 12.34 (a) Proper seating of the abutment impression coping (b) displacement of the impression coping during the impression procedure

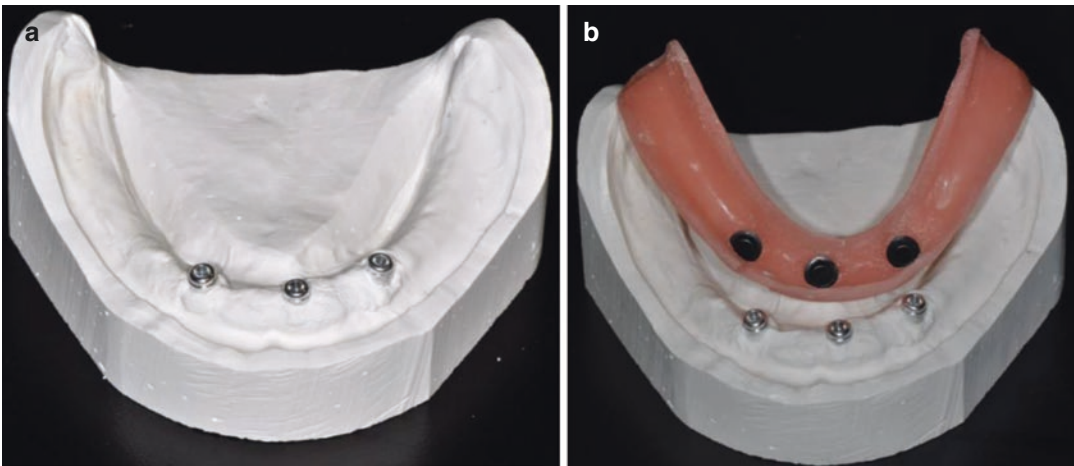


Fig. 12.35 (a) Mandibular cast with Locator analogs (b) wax-rim fabrication incorporating the metal matrices

cation procedures (Fig. 12.35b). It provides stability for the mandibular occlusion rims by having it engage onto the Locator abutments, which facilitates the adjustments of the wax rims and the registration of centric relation.

Both the direct and indirect techniques have been described and are widely used by clinicians today. The main advantage of the direct method is its simplicity and limited cost. However, this approach requires care not to cause binding of the prosthesis due to implant misalignment or to resin flowing into undercuts. There is also the

added difficulties in finishing and polishing the resinous material; in fact, porosities can often be observed in the vicinity of the metal housing (Fig. 12.36a, b). Benefits of the indirect technique include reduced chair time and optimal polishing of the resin in proximity to the matrices; however, the added technical steps may introduce certain discrepancies, which can create imprecisions in the final outcome.

Limited information is available when comparing the two techniques of connecting attachments to dentures. Nissan et al. in 2011 [7]

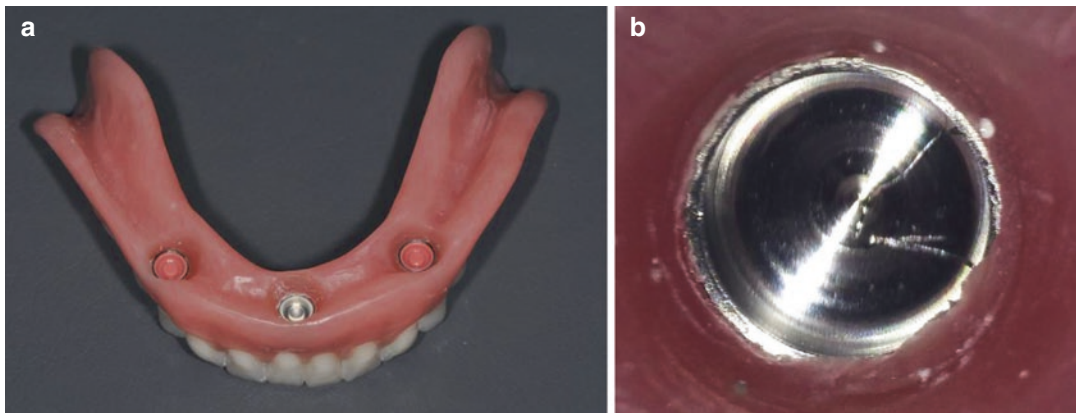


Fig. 12.36 (a) The incorporated Locator matrix housings using the direct method (b) showing porosities and excess material under a microscopic image

reported on the long-term prosthetic aftercare of direct vs. indirect techniques for mandibular implant-retained overdenture on ball abutments. A group of 45 patients were followed for a period of 20 years. The patients were randomly assigned to two groups based on the connection technique used. Prosthetic complications were significantly higher when indirect method was used. Interestingly, attachment replacement due to wear occurred mainly in the indirect technique group.

one of the main advantages of the digital environment is the preservation of all the parameters registered clinically. In fact, a significant portion of the patients' anatomical features as well as the image of the final dentures remains available in the software. Therefore, in case of lost or damaged dentures, the remake procedure is greatly facilitated. For this chapter, we proceeded to fabricate a set of digital dentures for the patient; the steps and procedures are detailed below.

12.4 CAD/CAM Complete Denture Fabrication

Complete denture rehabilitation is the most traditional prosthodontic treatment for edentulous patients. The methods of fabrication have remained relatively unchanged for many years. The conventional approach involves a sequence of multiple clinical and laboratory steps. An accelerated method of denture fabrication has been described by Kawai et al. in 2005 [8] and was shown to have comparable clinical outcomes to the more complex procedure. However, in both instances, the acquired clinical parameters are lost once the dentures are processed and delivered to the patient.

Digital dentistry can present a tremendous amount of advantages for the elderly patient. It is often presented to the clinicians by the manufacturers as a timesaving procedure. However,

12.5 Clinical Procedures

The clinical procedure starts with impressions of maxillary and mandibular arches (Fig. 12.37a, b) using an irreversible hydrocolloid material (*Jeltrate Alginate, Dentsply Caulk, Canada*) placed in stock edentulous metal trays (*Patterson Dental Supply, Canada*). Impressions are poured using type III dental stone (*GC America Inc., USA*) in order to produce preliminary casts (Fig. 12.38a, b).

The preliminary casts are used to fabricate custom occlusion rims for the upper and lower jaws (Fig. 12.39). If the existing dentures of the patients are acceptable or require minor changes, they can be utilized as a guideline for the fabrications of the rims. If there are changes necessary, these can be incorporated during the clinical procedures. The rims are then tried and adjusted intraorally as described earlier. The lip support,

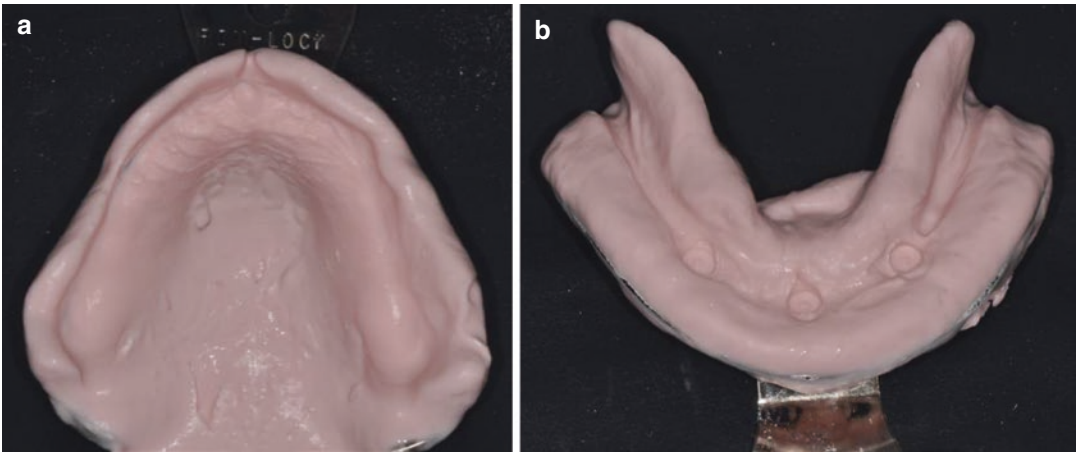


Fig. 12.37 (a and b) Alginate impression of the maxillary and mandibular arches using stock metal trays

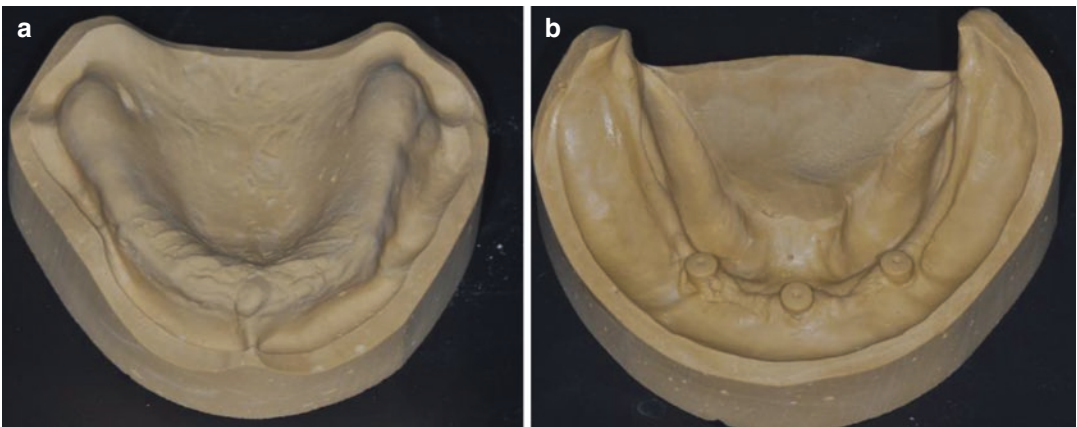


Fig. 12.38 (a and b) Preliminary cast of the maxillary and mandibular arches

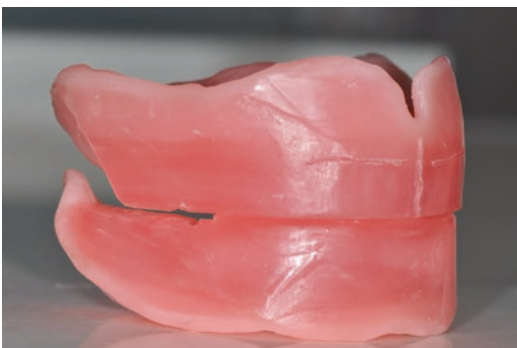


Fig. 12.39 Upper and lower occlusion rims

incisal display, midline, occlusal plane, and vertical dimension of occlusion are recorded following the conventional complete denture protocols (Fig. 12.40a). The rims are then used to capture the details of the soft tissues, the border of the muscular attachment, as well as the interocclusal registration (Fig. 12.40b).

This setup provides all the necessary information to the laboratory to progress into the digital medium (Fig. 12.41a, b). This sequence is one of multiple ways to transfer clinical information into the digital environment.

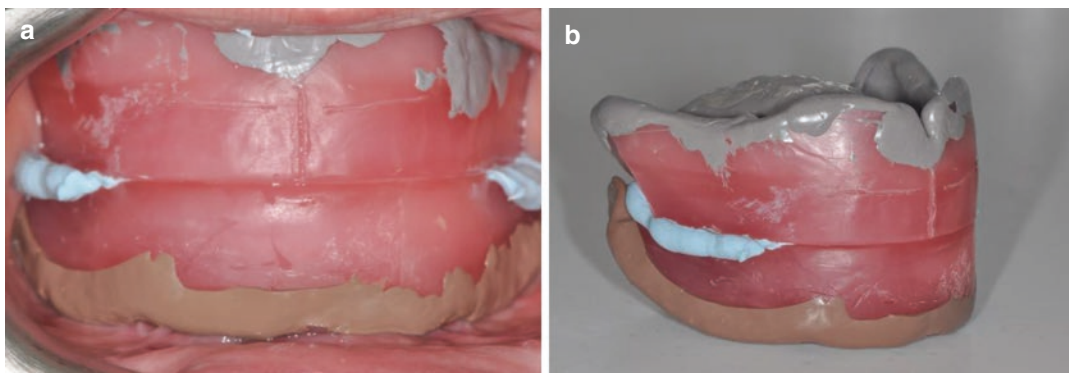


Fig. 12.40 (a) Final impressions of the upper and lower arches (b) bite registrations using the occlusion rims

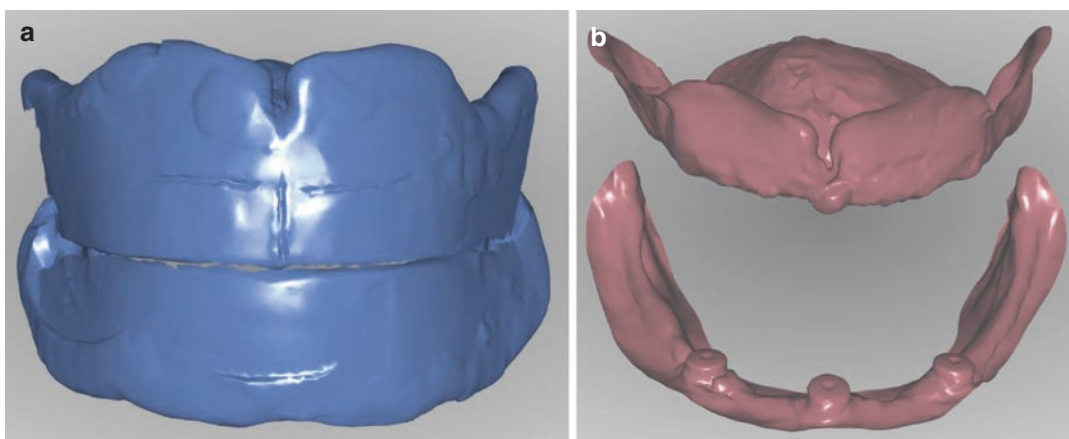


Fig. 12.41 (a and b) Digitized upper and lower wax rims with all the relevant clinical parameters

Once the clinical features are digitized, the tooth setup can be started on the software (AvaDent Digital Dental Solution, USA) by selecting the appropriate tooth mold and color. The placement of the teeth is guided by the parameters provided by the rims (Fig. 12.41a). It is important to provide the technician with all the information and guidelines to allow the placement of the prosthetic teeth (Fig. 12.42). Anatomic features such as the residual ridge and the retromolar pad can also be used to facilitate the setup procedure (Fig. 12.41b). Once the procedure of placing the teeth on the software is completed, the restorative dentist will generally have to validate the final setup. Adjustments can

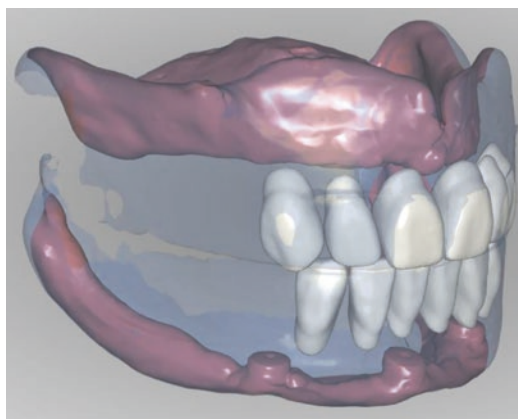


Fig. 12.42 Placement of the prosthetic teeth is facilitated by the clinical guidelines provided as well as some anatomical features

be made easily before the fabrication process. Working in the digital environment allows for a clearer unhindered view of the design process specifically for implant-retained overdentures. A clear image of the prosthetic teeth in relation to the residual ridges as well as to the implants can be obtained (Fig. 12.43a, b). Thus, an evaluation of the anterior tooth positioning in relation to the anticipated axis of rotation around the implants can be assessed, and alterations can be done accordingly.

Once the tooth setup is approved, the laboratory can generate a try-in denture that would allow to properly visualize the clinical outcomes. In fact, the try-in denture can assess certain esthetic parameters (midline, lip support, and tooth shape) as well as functional ones (centric relation and occlusal contacts). The try-in denture is generally

machined from a singular block of polymethyl methacrylate (Fig. 12.44a, b). If adjustments are required, they can be done directly on the try-in denture and sent back to the laboratory in order to modify the digital setup. This process may be limiting for patients with high esthetic demands that may have difficulty assessing the end result prior to the fabrication of the definitive prosthesis. For these cases a wax try-in may be indicated. Moreover, in cases where significant adjustments must be made to the try-in denture, it may require a digital modification with fabrication of an additional try-in denture to properly assess the modifications and allow for the patient to evaluate the result [9]. An additional appointment is required with an increase in the laboratory fees. Understanding the digital workflow is critical for the success of these cases.

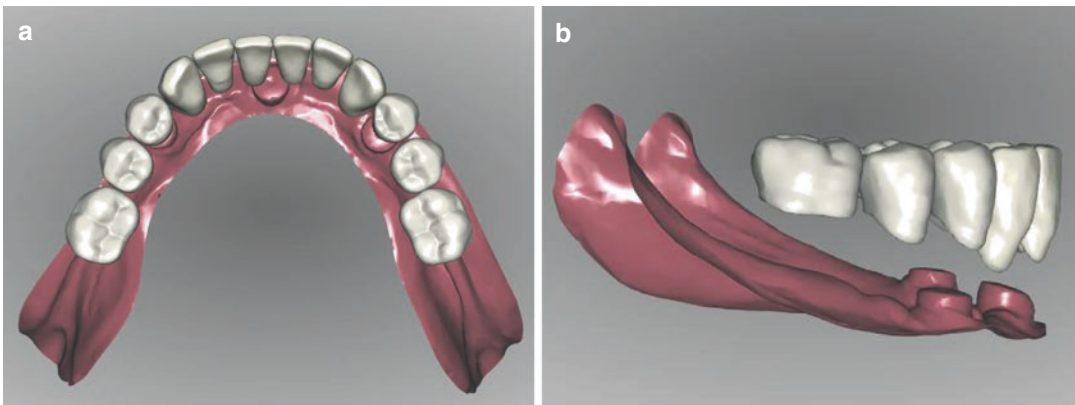


Fig. 12.43 (a) Occlusal view of the prosthetic teeth in relation to the mandibular ridges and implants (b) Sagittal view of the final tooth position for implant-retained mandibular denture

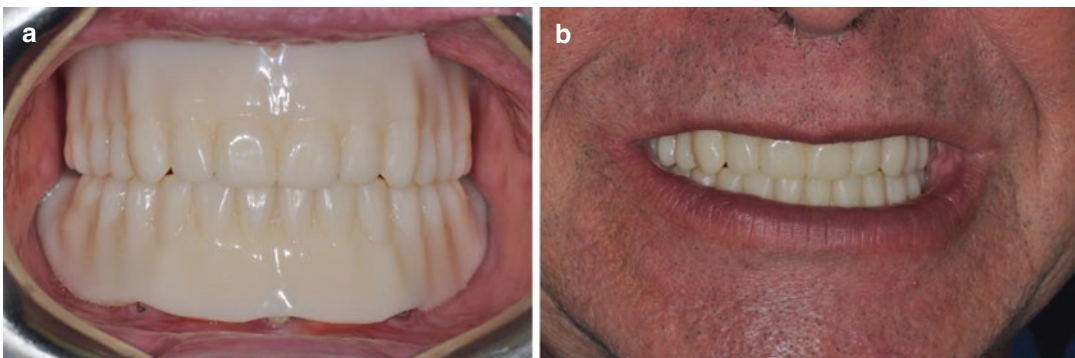


Fig. 12.44 (a and b) Trial upper and lower dentures to assess all the relevant clinical parameters



Fig. 12.45 Delivery of upper and lower CAD/CAM dentures

Once the changes are completed, the dentures can be machined for delivery to the patient (Fig. 12.45). This process requires that the female component be picked up directly in the oral cavity as described earlier.

The technique presented incorporates digital technology (CAD/CAM) without disregarding the fundamentals of complete denture fabrication. The main advantage of this technique is focused on providing the patient with complete dentures without losing the clinical information in the process. Therefore, in cases of lost or damaged dentures, the remake procedure is greatly facilitated. Most manufactures can regenerate a new set of dentures within a few working days. These can be provided to the patient or re-adapted to the oral condition depending on the changes in the residual ridges. In cases where significant intraoral changes have occurred, new impressions may have to be taken followed by the same steps described.

The fabrication process is also unique to the digital setting. All the bases are generally machined from a solid block of pink polymethyl methacrylate. Therefore, this process is not susceptible to any contraction due to conventional processing, material properties, or human errors [9]. Goodacre et al. [10] compared the denture base adaptation between CAD/CAM and conventional fabrication techniques to determine which process produces the most accurate and reproducible adaptation. They compared the conventional pack, press, pour,

and injection techniques to the CAD/CAM process. They concluded that the CAD/CAM fabrication process was the most accurate and reproducible denture fabrication technique. The dentures are also denser and less porous. This feature may have an impact on the wear behavior of the prosthetic teeth, the strength of the denture, as well as the plaque retention [11]. More research is needed to validate the importance of these parameters on the longevity and clinical outcomes of digitally generated removable prosthesis vs. conventional techniques.

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