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The mandibular complete overdenture

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Mandibular complete overdenture treatment uses a removable complete denture that overlies retained teeth, tooth roots, or dental implants. This treatment is not a new concept. Practitioners have successfully employed existing tooth structures or retained roots to assist with complete denture treatment for more than a century. In particular, during the 1970s this treatment enjoyed a noteworthy period of popular interest in the dental literature [1]. Today, however, despite the treatment's potential benefits of reduced ridge resorption, enhanced prosthesis retention and stability, and increased patient satisfaction, the tooth-borne version of this treatment is not widely endorsed by practitioners as a favored treatment modality. Problems arising from dental caries, periodontal disease, technical problems associated with denture fabrication, denture fracture, increased treatment costs, and the reality of working with a compromised, terminal dentition have made many practitioners reluctant to prescribe this treatment for their patients.

During the last decade, however, the increased use of dental implants in association with this treatment and the desire to provide less complex, more economical implant prosthodontic treatments for edentulous patients have led practitioners to use this treatment and the dental literature to report it to an unprecedented extent.

The recent thrust toward endosseous dental implants as the support and retention mechanism for mandibular overdenture treatment has occurred because of a number of important considerations. First, implant overdenture treatment provides many of the benefits of conventional tooth-borne overdentures while negating some of the most troubling problems, such as tooth decay and periodontal disease [1]. Second, dental implants provide

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a mechanism for establishing a foundation for overdenture treatment, even after all the teeth have been removed. Implants allow practitioners to regain lost supporting structures for edentulous patients already using conventional complete dentures. Third, implant overdenture treatment provides a cost-effective alternative to more costly treatments involving additional implants. Finally, the outcome of implant overdenture treatment is predictably and significantly better than that of conventional complete denture treatment [2,3].

This discussion considers both tooth-borne and implant modalities for mandibular complete overdenture treatment but focuses on implant overdenture treatment. Contemporary mandibular overdenture treatment would not be so extensively used without the use of dental implants.

Problems with conventional mandibular complete dentures

Any mandibular complete denture relies on the successful influences of prosthesis retention and stability to achieve a satisfactory treatment outcome [4,5]. Redford et al [6] demonstrated that more than 50% of conventional mandibular complete dentures have problems with retention and stability and that mandibular complete dentures produce significantly more patient problems than maxillary dentures, primarily because of poor prosthesis retention. When conventional complete denture therapy results in inadequate denture retention and stability, patient satisfaction, confidence, and comfort commonly suffer [2].

Diminishing oral tissue volume resulting from residual ridge resorption represents one of the most significant biologic conditions that negatively influence mandibular complete denture retention [7]. Studies have shown that the edentulous mandible loses four times more bone volume than the edentulous maxilla, and on average, 0.4 mm of mandibular anterior vertical resorption occurs each year [8,9].

Maintaining alveolar bone in a preventative fashion before the resorption process occurs is an important consideration for denture treatment outcome. After residual ridge resorption occurs, few treatment options are available for reestablishing the supporting tissue volume for dentures. These options include alveolar ridge augmentation using natural and synthetic materials and tissue extension procedures for exposing additional intraoral tissues and repositioning muscle attachments. Unfortunately, these procedures have demonstrated mixed long-term success, can significantly increase treatment costs, and have occasionally introduced significant complications and morbidity [10–12].

Tooth-borne mandibular overdentures

When natural teeth are extracted, residual ridge resorption is inevitable, but the extent of this process varies depending on individual anatomic,

biologic, and mechanical factors. Retention of teeth or tooth roots in the alveolar bone can improve bone maintenance around and between these structures [13]. Bone maintenance is the most significant advantage of a tooth-borne mandibular complete overdenture treatment because the maintenance of bone volume and vertical height can produce improved prosthesis retention and stability. A 5-year clinical study followed patients treated with either conventional mandibular dentures or mandibular overdentures using retained canine teeth. Results indicated that patients with conventional dentures experienced eight times more vertical ridge resorption in the anterior mandible than patients with overdentures [13].

Because tooth-borne overdenture patients are not rendered completely edentulous, other advantages of this treatment are also likely. Psychologically, patients may perceive the preservation of a few teeth as an important factor in maintaining a more positive self-image. Likewise patients may sustain a more precise oral tactile discrimination through the periodontal ligaments of the remaining overdenture abutments.

Tooth-borne overdentures have a number of disadvantages that must be considered when planning this treatment. Certainly the maintenance of alveolar bone should be considered a positive feature of overdenture treatment, but the anatomic contour of maintained osseous tissue and the space required for the underlying teeth or tooth roots can frequently impose on the limited space necessary to accommodate an overdenture prosthesis. Consequently, compared with a conventional denture, the denture base may be perceived by a patient to be bulkier, although in reality the base is trimmed very thin around abutment teeth, making the overdenture prosthesis more susceptible to fracture around the thin denture base material. Prominent osseous tissue undercuts in the area of abutment teeth, especially in the mandibular anterior, may make it difficult to develop a denture's vestibular extensions properly. In this case, the denture base is likely to be underextended, negatively influencing prosthesis retention and the esthetic outcome of the treatment.

Dental caries and diminishing periodontal health considerations are significant complications associated with this treatment (Fig. 1). Because an overdenture prosthesis completely covers retained teeth or tooth roots, homecare maintenance for these structures may be less intuitive to a patient. Caries-prone patients and individuals with progressive periodontal health problems may be poor candidates for overdenture treatment or at least may require frequent recall maintenance visits, an effective oral hygiene regimen, and a limited prognosis for the abutment teeth.

Contact between the denture base and an overdenture abutment, either by design or because of tooth eruption, can produce a fulcrum in the denture base where the contact occurs. Movement of the denture base around this fulcrum can interfere with denture retention and stability or may focus stress in the denture base around the tooth contact that can lead to denture fracture. Over time, the complications associated with focal stress

Fig. 1. An explorer tip is placed into a carious lesion on a mandibular overdenture abutment tooth. Dental caries represents a significant complication associated with tooth-borne mandibular overdenture treatment.

contacts may generate fatigue-related maintenance problems that are generally unique to overdenture treatment. For this reason, denture-base contacts with abutment teeth should be avoided or should occur only under conditions of heavy occlusal loading forces.

Finally, overdenture treatment is more expensive to provide than conventional dentures because abutment teeth typically require endodontic therapy so that the coronal aspect of abutment teeth can be removed without interfering with pulpal tissues. Periodontal and restorative procedures, including cast copings to augment and protect abutments, are frequently necessary. These additional procedures also usually lengthen the treatment time.

Thoughtful treatment planning is mandated to assure that mandibular tooth-borne overdenture treatment will be successful. Overdenture treatment is suitable when a few remaining teeth are available to be used as overdenture abutments, but frequently these teeth are not in sufficient health, quantity, or position to be suitable for fixed or removable partial denture treatment. Using abutment teeth for overdenture treatment requires more interarch space than with conventional dentures. Failure to assess the available space between the occlusal plane and the mucosa is a common error and one that is difficult to correct after treatment is initiated. Diagnostic casts articulated at the anticipated vertical dimension of occlusion are essential. Proposed abutment teeth can be prepared on the cast and, if necessary, the ability to accommodate long abutment copings or attachments can be assessed. A metal framework incorporated within a denture base can provide additional prosthesis strength but requires additional space as well.

Radiographic and clinical evaluation of proposed abutment teeth must be carefully completed during treatment planning. Overdenture abutments need to be periodontally healthy, but one benefit of this treatment is that the abutment tooth crown-to-root ratio may improve if the treatment uses short,

dome-shaped preparations or cast copings that project just above the gingiva. Generally, employing two to four overdenture abutment teeth is sufficient. When two are used, they should be located bilaterally in the mandibular anterior. The selected abutment teeth should be remote from one another to provide a broad distribution of contact between abutment teeth and denture base. Interproximal gingival impingement and plaque control can complicate treatment when a denture base fits closely over two adjacent teeth. Dental caries assessment is necessary to determine whether a patient is a good candidate for overdenture treatment. This treatment should not be planned with patients exhibiting significant caries potential.

Patients need to demonstrate an active interest in assuring successful treatment. Additionally, there must be evidence of good oral hygiene ability, good neuromuscular coordination, especially if attachments are used, satisfactory appreciation for the subtleties of treatment and its limitations, and adequate financial resources to afford the additional treatment expense.

Typically, tooth-borne overdenture abutments are prepared using a short, dome-shaped contour that is hemispherically rounded in all dimensions just above the mucosa. These preparations usually require endodontic therapy in advance. After restoration of the endodontic access opening for each abutment, the exposed dentin is polished and treated with fluoride. Alternately, rounded cast copings can be fabricated and definitively luted over the exposed root surfaces. These copings incorporate dowels, 4 to 5 mm long, that extend into the root canal spaces to enhance retention (Fig. 2).

Overdenture prosthesis retention and stabilization can be improved by lengthening the vertical wall contacts between abutment teeth and the denture base. In this regard, the abutment teeth are prepared similarly to complete veneer crown preparations and are covered with nearly parallel-sided cast metal copings that engage the denture base along their surfaces.

Fig. 2. Tooth-borne overdenture abutments may be treated with cast copings luted onto the exposed root surfaces. These castings incorporate a 4- to 5-mm dowel-post extension into the root canal space for added retention.

This design and its variations have been referred to as telescopic prostheses. Likewise, the use of attachments to provide a mechanical interconnection between the tooth roots and a denture base can further enhance prosthesis retention and stability.

Long copings or attachments, however, should be incorporated only after careful consideration. They significantly increase the complexity and cost of treatment. They require additional interarch space because of the vertical height necessary to accommodate them. Overdenture abutment teeth frequently start out with a guarded periodontal prognosis, and long copings or attachments may exert mechanical forces on them that can jeopardize their long-term maintenance. Both usually require custom-made castings that are luted onto abutment teeth. With the attachments, the coupling parts are fitted together precisely, and the denture component is transferred into the denture base, while the base is simultaneously positioned onto the supporting mucosa. This degree of simultaneous precision fitting can be quite challenging, both clinically and in the dental laboratory. Relining and repair of prostheses with attachments also can be difficult and time-consuming.

Maintenance of tooth-borne overdentures is more involved than with conventional complete dentures. The proper denture-base contact with the abutment tooth/ridge combination must be established and adjusted as necessary. If bone resorption occurs, the denture may rock around the teeth, causing patient discomfort, occlusal and retention problems, and potential denture fracture. This rocking also can make recording of jaw relationships difficult. Periodontal and restorative maintenance of abutment teeth must be regularly assessed. Professional cleaning, review of oral hygiene instruction, and fluoride application should be routinely provided.

Implant-supported mandibular overdentures

Dental implants are increasingly used as suitable prosthodontic substitutes for natural teeth. Decisions regarding the maintenance and restoration of compromised mandibular teeth can be difficult because guidelines addressing these decisions are sparse and controversial. Mericske-Stern [14] compared numerous investigations of mandibular overdenture treatments using both natural tooth abutments and implants and indicated that the probability for treatment success was greater with the use of implants. She concluded that significant endodontic, periodontal, or prosthodontic treatments to maintain teeth as overdenture abutments were not as cost effective or predictable as the use of implants (Fig. 3).

Mandibular implant overdenture treatment has gained considerable acceptance. It has effectively replaced the tooth-borne version of this treatment for many practitioners and has been recommended as the new standard-of-care treatment when compared with conventional mandibular complete dentures [1,3,7]. Even when conventional complete denture treatment in the mandible is successful, superior clinical outcomes can be

Fig. 3. In compromised situations when natural teeth are not in good health, significant endodontic, periodontal, or prosthodontic treatments to maintain teeth as overdenture abutments are not as cost effective or predictable as use of implants.

achieved with an implant overdenture [3,15]. Its relative simplicity, minimal invasiveness, predictability, efficacy, and affordability make it an especially attractive treatment option [7,16,17].

Evidence suggests a negative correlation between edentulism and socioeconomic status in the United States. Compared with the general population, edentulous individuals are less likely to be able to afford dental treatment, making affordability an important issue [18,19]. Van der Wijk et al [20] compared first-year treatment costs associated with conventional dentures, mandibular implant overdentures, and conventional denture treatment in combination with preprosthetic surgery. They found that endosseous implant overdenture and conventional denture treatment following preprosthetic surgery resulted in a similar cost that was three times that of conventional denture treatment without preprosthetic surgery. When compared with other, more complex, implant prosthodontic treatment options that have significantly higher treatment costs, mandibular implant overdenture treatment can be considered the most affordable implant option. This option is so attractive because it can provide a better treatment outcome than possible with conventional mandibular dentures while minimizing increased treatment costs [2,3,15]. Likewise, the time required for practitioners to provide mandibular implant overdenture treatment does not differ significantly from that required for conventional denture treatment [21].

Just like natural teeth, dental implants also can have a positive influence on the maintenance of alveolar bone that surrounds the implants. When teeth are extracted, physiologic changes result in alveolar bone resorption. Longitudinal studies indicate that following the first year after tooth extraction, a mean annual alveolar ridge height reduction of around 0.4 mm can be expected in an edentulous anterior mandible [8,9]. Evidence indicates that after implant placement, alveolar resorption decelerates to

a rate of around 25% of that expected in a non–implant-treated anterior edentulous mandible [7]. Furthermore, Von Wowern and Gotfredsen [22] demonstrated an unpredictable increase in alveolar bone height that is believed to be associated with an occlusal load-related osseous deposition of the bone surrounding dental implants.

Treatment planning is as important for mandibular implant overdenture treatment as for the tooth-borne version, but implants have some significant advantages that make their use more accommodating and predictable. Certainly dental caries, periodontal disease, and tooth-related restorative issues are not concerns when implants are used.

A patient needs to be examined clinically and radiographically and needs to be a good candidate for implant placement in terms of overall health. There should be sufficient bone volume and height in the anterior mandible to accommodate implants. Fortunately, many of the problems of tissue undercutting and interarch space associated with tooth-borne overdenture abutments can be avoided with implants. Additional vertical space is required, however, because nearly all implant overdentures use an attachment mechanism between the implant and denture base. Mounted diagnostic casts positioned at the desired vertical dimension of occlusion are always useful during treatment planning and are necessary when interarch space is limited. Generally a minimum of 5 to 6 mm of vertical space is needed to accommodate implant attachment mechanisms. When this amount of space is not available, two solutions can be used. First, there are attachment mechanisms such as the LOCATOR abutment (Implant Innovations, Inc., Palm Beach Gardens, Florida) that have a short vertical height and can accommodate limited vertical space requirements. Second, if there is sufficient vertical height and volume of the anterior mandibular bone, an alveoloplasty can be performed at the time of implant placement to reduce the superior bone height and allow a more inferior positioning of the implants in the bone, essentially increasing the interarch space. Numerous other considerations that must be addressed in planning and carrying out the surgical aspects of implant placement are beyond the scope of this discussion.

Because mandibular implant overdenture treatment normally uses implants placed in the anterior mandible, it is possible that, relative to the supporting hard and soft alveolar tissues, the prosthesis may function more akin to a bilateral distal extension removable partial denture (RPD) than a complete denture. In other words, the anteriorly located implants provide prosthesis support, retention, and stability in a fashion similar to that occurring with anterior natural teeth and RPD treatment. In this regard, reports have described a condition similar to combination syndrome seen with mandibular distal extension RPDs but occurring when mandibular implant overdenture treatment opposes a maxillary complete denture [23,24]. This concept remains controversial; however, it is speculated that when posterior mandibular alveolar ridge resorption occurs, the implants

function similarly to mandibular anterior teeth, transferring inappropriately high occlusal forces into the anterior maxilla and potentially leading to tissue inflammation and anterior maxillary bone resorption. Likewise, even when appropriate posterior support exists, the improved stability of the mandibular implant overdenture may enable patients to masticate more easily using anterior teeth, also generating inappropriate anterior occlusal loading forces in the anterior maxilla. Other reports have described improved tissue conditions in conjunction with mandibular implant overdenture treatment and suggest that when posterior prosthesis support is adequately maintained, the implants may provide a stabilizing influence on the mandibular prosthesis, providing a more stable occlusion and promoting improved tissue health [7,25,26].

Minor complications associated with mandibular implant overdenture treatment are common, regardless of the initial clinical success. In fact, Muftu and Karabetou [27] warned that complications associated with this treatment cannot be dismissed and that managing them may require extra clinical time and expense, a fact that should be considered when identifying a patient's total financial commitment for this type of treatment. Most complications are not serious. Breakage of retentive clips associated with bar attachments, peri-implant mucosa problems, and implant screw and acrylic resin component fractures are the most common complications associated with mandibular implant overdenture treatment [28–30].

Time needed for implant integration varies, depending on the surgical protocol that is followed during treatment. A conventional surgical protocol commonly uses a 4-month implant-integration period before implant use. In contrast, immediate surgical protocols are becoming more popular and allow implants to be used in conjunction with a prosthesis at or near the time of implant placement and to function with little or no delay. Implants can likewise be placed immediately into an extraction site at the time of tooth removal. The immediate loading of implants used with mandibular implant overdentures is an increasingly promising treatment concept. Numerous studies have promoted the practice and have found the success rates of immediately loaded implants to be similar to those obtained with conventional implant treatment protocols that call for implant loading only after implant–tissue integration has occurred [31–34]. Immediate loading shortens the necessary treatment time, resulting in improved patient satisfaction [31].

The number of implants necessary for implant overdenture treatment remains controversial; the most common choices seem to be using either two or four implants. Two dental implants are usually considered the minimal number necessary for mandibular implant overdenture treatment [35]. Both the supporting mucosa and implants provide support, retention, and stability for an overdenture prosthesis. As more implants are used, the responsibility for these functions shifts from the mucosa to the implants. Any subsequent improvement in the clinical outcome for this treatment that would result from increasing the number of implants is not clearly

understood. Technical problems associated with conventional mandibular dentures are primarily associated with inadequate prosthesis retention and stability [6]. Additional implants may improve prosthesis support, but retention and stability, and ultimately the clinical outcome, are probably not significantly improved by increasing the number of implants used with mandibular implant overdenture treatment [7,35]. In fact, a growing body of evidence promotes the use of two implants placed bilaterally in the anterior mandible (Fig. 4) [36–39]. The anterior mandible has demonstrated a high predictability for implant–tissue integration, and consequently there is little need for planning the placement of additional implants in anticipation of potential implant integration failure [7].

A similar debate exists regarding the rationale for rigidly interconnecting mandibular implants. Many of the technical procedures that describe the interconnection of implants were originally adapted from those used to interconnect natural teeth, but factors considered essential for teeth are not necessarily as important for mandibular implants. Nonetheless, some practitioners prefer to use bar attachments (Fig. 5). A bar is especially useful when implants are misaligned or nonparallel to one another, making it harder to develop a common path of placement between the implant abutments and the denture base. The bar attachment provides a separate, parallel path for placement of retentive bar-clips located in the denture base and simultaneously allows the bar to connect to a variety of nonparallel implant angulations. When more than two implants are used, parallel implant placement becomes progressively more difficult to achieve, making a bar attachment a popular choice when more than two implants are used with overdenture treatment. Angled independent implant overdenture abutments are also available, such as the ERA attachment (Sterngold Inc., Attleboro, Massachusetts), that also will correct some implant alignment problems. Interconnecting bars require more space within the denture base than

Fig. 4. Two implants are used in the anterior mandible with O-ring overdenture abutments (Nobel Biocare, Yorba Linda, California).

Fig. 5. A bar attachment is commonly used in conjunction with more than two implants.

independent implants and may render a prosthesis more susceptible to fracture. Practitioners continue to struggle with decisions as to the importance of implant interconnection in the mandible, but a growing body of research evidence supports the use of two independent implants with mandibular implant overdenture treatment [40–43].

If it is possible to provide a similarly satisfactory clinical outcome for mandibular implant overdentures using less costly, simplified treatment modalities involving fewer, non-interconnected implants, the treatment would probably become financially more attractive to an increasingly larger segment of the edentulous population, a group whose socioeconomic status in general makes the affordability of dental treatment a concern. The answer to this consideration remains controversial, but the research continues to indicate that simplified treatment modalities are as effective as more complex and costly alternatives.

Clinical technique for mandibular implant overdenture treatment

To illustrate the treatment, this clinical example presents a single, simplified methodology, even though numerous alternative variations and methods can also be appropriately applied. This mandibular implant overdenture treatment uses two independent implants, a conventional surgical protocol, and an opposing conventional maxillary complete denture. Using two independent implants makes the treatment less complex and costly and has become increasingly accepted in the literature. Some practitioners, however, prefer using additional implants or rigid implant interconnection.

The necessity of a surgical guide for the placement of two implants in the anterior mandible is controversial. When needed, a guide can be fabricated in clear acrylic resin by duplicating a mandibular diagnostic denture setup, a diagnostic waxup, or a patient's existing mandibular complete denture. Regardless of whether a guide is used or not, implants should be placed close to the mental foramen bilaterally, generally between the canine and lateral

incisor areas. Additionally they should be placed parallel to one another, and perpendicular to the proposed plane of occlusion of the prosthesis.

After implant placement, conventional surgical protocols often mandate a 2-week initial healing period. During this time no prosthesis should be used over the implant surgical site so that early healing can occur without functional loading. Patients need to be aware of this necessity in advance, so they can plan accordingly. After this 2-week period, interim complete dentures are routinely used while the implant integration continues and until definite overdenture treatment is provided. The tissue surface of an interim prosthesis must be relieved in the area overlying the implants. Resilient relining material can be placed into the relief area to restore intimate tissue contact. With the conventional protocol, implants are usually allowed to integrate undisturbed in the bone for a minimum of 4 months.

The relining procedure may be repeated after the healing abutments are placed at or shortly after the second-stage surgery appointment. Around 3 weeks following the second-stage surgery, when the soft tissue has healed, the healing abutments are removed, and measurements from the top of each implant's flat interface surface to the top of the mucosa are made using a periodontal probe. These measurements, in millimeters, correspond to the length of the desired overdenture abutment for each implant. The correctly sized overdenture abutment is temporarily connected to each implant, and the attachment's denture-base component is snapped onto the abutment. For this procedure, the substitution process involving the overdenture and healing abutments is repeated a number of times during the course of treatment, but the transfer is quick and easy to accomplish during these intermediate steps (Fig. 6).

An edentulous mandibular alginate impression and preliminary cast are made that incorporate the entire attachment mechanisms including the

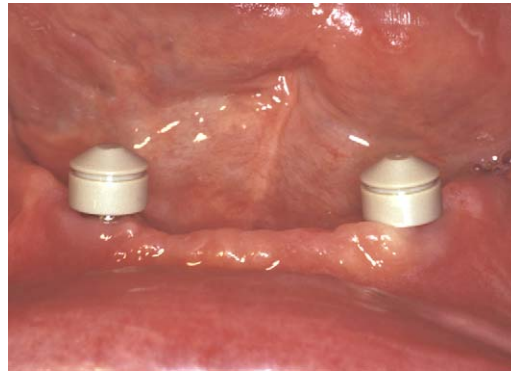

Fig. 6. The complete O-ring overdenture attachment mechanisms (Nobel Biocare, Yorba Linda, California), with the denture-base components snapped onto the implant. Abutment components have been placed intraorally.

denture-base components. Likewise, an edentulous custom tray, fabricated from the preliminary cast, is made to incorporate the overdenture attachment mechanisms. This edentulous custom tray is border molded using basic prosthodontic principles, and a master impression is made using polyvinylsiloxane. The entire attachment mechanisms are again substituted so that they are incorporated in this impression. Impression material should be carefully syringed around each attachment to diminish the likelihood of voids. After the impression is removed, any attachment components remaining in the impression are removed. Occasionally, depending on the type of attachment used, the gingival aspects of the impression around the attachments are constricted and need to be opened with a blade so that the stone cast will not be thin and subject to fracture in these areas. The impression is beaded and boxed and poured using improved stone. Care must be taken when separating the cast from the impression so that the attachment areas are not fractured. The benefit of having the entire attachment mechanism incorporated in the master cast is that the space allocation necessary for the attachments is accurately detailed from the beginning. This practice allows a more accurate tooth arrangement in relation to the position of the attachments and, eventually, accurate space allocation in the processed denture base (Fig. 7).

The edentulous impression for the maxillary complete denture is made and poured using conventional techniques. Record bases are made for both master casts. Relief wax 2 mm thick is placed over the attachment mechanisms on the mandibular cast so that the record base can be removed without cast fracture.

Jaw relations are completed using standard techniques (Fig. 8). The mandibular record base is relieved to fit around the attachment mechanisms and not the healing abutments. Nonetheless, generally the healing abutments need not be substituted during the jaw relation procedure because they are usually not as prominent as the attachment mechanisms. To rule out

Fig. 7. The mandibular master cast is fabricated so that the entire O-ring attachment mechanisms, including the denture base components, are incorporated in the cast.

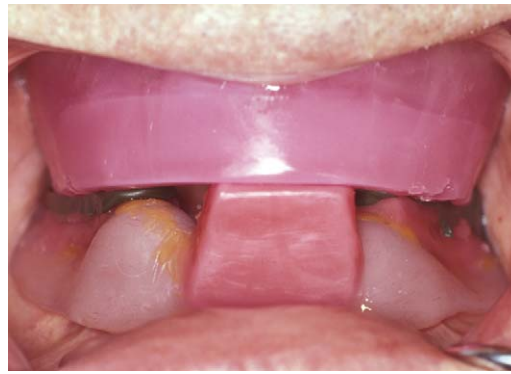

Fig. 8. The maxillomandibular recording for the maxillary complete denture and mandibular complete implant overdenture is accomplished. The mandibular record base conforms around the attachment mechanisms.

interferences between the record base and healing abutments, contact can be readily identified by using a pressure indicator paste (Mizzy, Inc., Cherry Hill, New Jersey) in the record base around the attachment mechanisms. Interferences are removed from the record base.

Teeth are selected and arranged on the record bases for a trial denture setup (Fig. 9). Occasionally the space for setting teeth around the attachments is tight. When this problem occurs, the record base can be removed from the master cast, and a perforation window can be created through the record base in the area where space is limited. In this same area on the cast, abutment undercuts are minimally relieved with wax and one layer of tin foil (Buffalo Dental Manufacturing Co., Syosset, New York) is swaged over the area. It is unlikely that this foil will interfere with the accurate repositioning

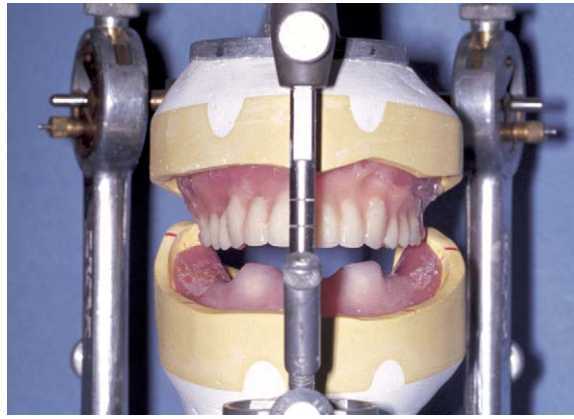

Fig. 9. Teeth are selected and arranged on the record bases for a trial denture setup. The mandibular record base is made to fit around the two attachment mechanisms.

of the record base on the master cast. When the record base is replaced on the master cast, denture teeth can be set into the perforation window and against the tin foil. This procedure provides an accurate accounting of the space required for the attachments and allows a close tolerance of fit between the denture teeth and attachment mechanisms.

The trial denture setup is evaluated. Inadequate space between the attachments and denture teeth or attachments that are vertically too tall relative to the plane of occlusion would be considered a diagnostic error. Additional alveoloplasty should have been considered before implant placement to allow a vertically lower implant position. At this point, sometimes a smaller attachment mechanism can be substituted. When both the practitioner and patient approve the trial denture, the denture waxup can be completed. Because of the accurate relationship between the attachments and the denture base, the denture-base thickness around the attachments can be optimally developed during the waxup and festooning process so that no thin areas are generated.

After denture processing, the tissue surface of the mandibular denture base includes the relieved areas where the attachment mechanisms were accurately transferred from the master cast. Clinically, both denture bases are adjusted to the supporting mucosa using pressure indicator paste. Only after these denture-base tissue-surface adjustments are complete should the attachments be incorporated into the denture base.

The attachment abutments are connected to their respective implants. The denture-base attachment components are snapped onto the abutments. It is generally useful to make an access opening through the denture base from the attachment relief area to the lingual flange at each attachment site (Fig. 10). This opening allows visualization of the attachments under the mandibular denture base after seating the denture onto the mucosa.

Because each attachment relief area in the denture base was generated from an accurate transfer of the attachment size and position on the master cast, the relief areas need to be increased in size before the denture base can passively fit over the attachments intraorally. They are easily enlarged using a #8 round bur in a slow-speed handpiece. A uniform 2-mm reduction is desired on all surfaces of the relief areas.

This process should eliminate interferences, but when the denture base is accurately positioned, there must be no contact between the denture base and attachments. This contact can usually be identified using a mouth mirror and visually evaluating the proximity of the attachments relative to the denture base relief areas. Observation should show an even relief of the denture base around the attachments with no attachment movement as the denture base is moved slightly on and off the tissues. Fit Checker disclosing silicone (GC America, Alsip, Illinois) also can be used to identify contact between the attachment mechanisms and the denture base.

The attachments are luted into the denture base using an autopolymerizing denture-base material such as Perm Reline & Repair Resin (Coltène/

Fig. 10. Access openings are placed through the denture base from the attachment relief areas to the lingual flange.

Whaledent, Cuyahoga Falls, Ohio). Powder and liquid are placed into separate dispensing dishes. With a brush, a thin layer of resin is painted over the denture base portion of the attachment mechanism intraorally (Fig. 11). This process wets the surface of the attachment component with resin and assists with its transfer to the denture base. The process must be completed without delay so that the denture base can be seated over the painted attachments while this resin is still soft.

Resin can be introduced into the denture base using two methods. First, powder and liquid are mixed with a brush and placed into the attachment

Fig. 11. A thin layer of resin is painted over the denture-base component of the attachment mechanism intraorally. This procedure wets the surface of the attachment component with resin and assists with its transfer to the denture base.

wells in the denture base, filling them about halfway. The denture base is then firmly seated onto the mucosa without delay. Second, the denture base is fully seated onto the mucosa and over the attachments. Resin is carefully injected into the access openings at each attachment using a syringe (Monoject 412 curved-tip syringe, The Kendall Co., Mansfield, Massachusetts) (Fig. 12). The last 3 mm of the syringe tip should be removed to produce a larger lumen so that the resin will flow out of the syringe easily. Care must be taken in mixing the resin to assure that it is not too runny, and only enough resin should be injected so that after polymerization the denture base attachment component is accurately transferred, but the implant abutment is not locked into the denture base.

The resin should fully polymerize intraorally before the denture is removed. This process can take 8 to 10 minutes. When the denture base is removed, the tissue surface can be observed to evaluate the attachment transfer process. The attachment components should be positioned tightly in the denture base. If an attachment did not transfer, or if it is loose in the denture base, the transfer process must be repeated. After successful completion of the process, additional resin can be added around the attachments to fill voids and bring the resin contour up to the level of the soft tissue (Fig. 13). The access openings may also require additional resin to bring them back to contour. After all resin has been added, it is recommended that the mandibular denture be placed in a pressure pot to finalize polymerization. Finally, excess material is removed, and the area is polished (Fig. 14). The fit of the mandibular denture base to the mucosa should be reevaluated using pressure indicator paste and should be adjusted as necessary. The attachments must fit passively with the simultaneous accurate fit of the denture base on the mucosa, without any rocking movement.

Fig. 12. The denture base is accurately seated onto the mucosa and over the attachment components. Resin is carefully injected into the access openings using a syringe. After the resin polymerizes, the denture-base components of the attachments should transfer from the interconnected implant abutment components to the denture base.

Fig. 13. After successful transfer of the denture-base components, resin is added around them to fill voids and bring the contour up to the level of the soft tissue. Black resilient O-rings are seen inside the denture base housings.

Finally, after incorporation of the attachments, clinical remount procedures can be accomplished and the occlusion perfected (Fig. 15). Homecare instructions regarding denture care are given, and the patient is asked to remove and replace the lower denture a few times. Patients should be told that food can occasionally become lodged beneath the mandibular denture base and that this drawback is a limitation of treatment that is shared by most implant overdenture procedures. Patients should be seen frequently during the first month to assure that proper postplacement adjustments can be accomplished.

Summary

Mandibular complete overdenture treatment has been available for decades, but its use was limited when the treatment relied on retained teeth

Fig. 14. The lingual flange access openings are filled with resin, finished, and polished.

Fig. 15. After incorporation of the attachments, clinical remount procedures are accomplished, and the occlusal contacts are perfected.

as overdenture abutments. This treatment, however, is currently experiencing more popularity than ever before. In fact, dentistry may be experiencing a philosophical shift, in which mandibular implant overdenture treatment may become the new standard of care for the treatment of the edentulous mandible. Practitioners are looking for simplified treatments that can provide cost-effective alternatives to more complex implant prosthodontic procedures. Implant overdentures provide a strong return for the investment in treatment time and expense and are a treatment suited to the lower socioeconomic status of many edentulous patients. The clinical outcome of this treatment is significantly better than that achieved with conventional mandibular dentures, especially when patients are experiencing technical problems because of compromised prosthesis retention or stability.

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