The Less Than 7-mm Edentulous Mandible: The Implant/Overdenture Reconstructive Option

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The edentulous patient with a severely atrophic mandible (less than 7 mm in height) can be successfully restored with two endosseous implants and a clip-bar overdenture, with minimal morbidity. Two of the three cases reported illustrate the long-term potential of this treatment modality. (Implant Dent 1999;8:194–203)

Key Words: mandibular atrophy, clip-bar overdenture, mandibular edentulism, surgical and prosthodontic considerations

The restoration of function and esthetics of the atrophic mandible has always been a therapeutic challenge for the oral and maxillofacial surgeon, the prosthodontist, and the restorative dentist. After the loss of natural dentition there is a progressive and irreversible loss of the alveolar ridge.1-3 Atwood and Coy4 measured the anterior vertical bone loss in both the maxilla and mandible after the extraction of teeth and found that the average rate of resorption was four times greater in the mandible than in the maxilla. Over a 25-year period, Tallgren5 cephalometrically evaluated the bone height in complete denture wearers. The mandibular ridge exhibited a four-fold greater reduction in height as compared with the maxilla.

As they age, complete denture patients often complain of increasing difficulties such as loose dentures and sore gums associated with their prostheses. Translated into scientific terms, the reduction in the volume of the residual ridges leads to decreased support, stability, and retention for the overlying complete dentures. Additionally, diminished saliva production, decreased soft tissue tolerance, and declining neuromuscular control frequently compromise the ability of patients to successfully wear their dentures.

Various techniques have been described for treatment of the severely atrophic alveolar ridge (less than 7-mm superior-inferior height); for example, rib or iliac crest onlay grafts6-7 which increase mandibular height and augment the denture bearing area. Osteotomies, including the Visor osteotomy in combination with an interpositional bone graft, also have been described.8,9 Atrophic mandibles have been augmented using a tunneling procedure accompanied by the insertion of an alloplastic material. Mercier et al.10 used hydroxyapatite, either alone or with bonding agents (i.e., fibrinogen), to augment the atrophic ridge and showed no radiographic changes (loss of integrity or continuity of hydroxyapatite (HA) material, presence of zones of radiolucency throughout HA) in 77% of cases after 3 to 7 years. Haers et al.11 showed a 20% loss of height after 2 to 5 years using mixed autogenous and HA grafts in the posterior mandible. Transmandibular implants have also been described for rehabilitation of atrophic mandibles.12 Many of these reconstructive procedures present significant surgical and anesthetic risks to the patients and usually require general anesthesia and hospitalization. Minimizing the invasiveness of the techniques, such as using the implant/overdenture option, would reduce the risk, particularly in fragile, medically compromised patients.

Implants are relatively new tools in our armamentarium for the treatment of the severely atrophic mandible,13 and the literature contains articles discussing longitudinal treatment outcomes using dental implants.14,15 Many patients with severely atrophic mandibles have been treated with bone graft ridge augmentation and vestibuloplasty before implant placement. However, consideration should be given to placement of implants and prosthetic reconstruction without augmentation in the severely atrophic anterior mandible. We are reporting three such patients with less than 7 mm in height of the anterior mandible who each were treated with two Bränemark 7 mm × 3.75 mm (Nobel Biocare, Chicago, IL) implants and clip bar overdentures. Two of these patients have long-term follow-ups (5 and 7 years, respectively), and one of the patients has been restored in the past year.

Surgical Procedure

The surgical procedure involves: a) a labial vestibular incision; b) a
minimal periosteal reflection; c) vigilant observation of the superficial position of the mental nerves; d) atraumatic bone preparation when tapping; e) a grafting with an osteoinductive or osteoconductive material, or both; f) obtaining a double layer closure; g) application of a postoperative pressure dressing on the chin; and h) prevention of premature prosthetic loading.

The procedure usually is performed on an outpatient basis except when medical conditions require hospitalization under intravenous sedation or local anesthesia alone. This is preceded by an oral rinse with chlorhexidine and oral prophylactic antibiotics (usually 2 grams of penicillin V). The local anesthetic is administered via bilateral mandibular and long buccal blocks as well as infiltration in the labial vestibule of the anterior mandible. To obtain adequate pain control, it is essential to infiltrate locally because the mandibular blocks will not anesthetize the tissues at the inferior border of the anterior mandible.

The clinician must carefully examine visually and with bidigital palpation the local topography and trajectory of the anterior mandible and note any lingual concavities. Proper surgical orientation, knowledge of the slope of the mandible, assessment of the opposing occlusion, and awareness of the position of the mandibular denture base and anterior teeth will avoid malpositioned implants (usually too labial). This information is obtained by the use of a template made from mounted articulated study casts. The template is in the form of a denture base and teeth with the lingual aspect removed for visualization of the bony ridge at implant placement surgery. The anatomical configuration of the resorbed anterior mandible can vary (high well-rounded, knife-edge, low well-rounded, depressed), but there is frequently a “negative” ridge with the genial tubercles positioned superior to the resorbed mandible. Prolapse of the floor of the mouth, with its associated salivary gland and ducts, is another anatomical condition that can be associated with advanced mandibular atrophy. These tissues can be subject to surgical and prosthetic trauma during the implant process.

After a self-retaining cheek retractor is inserted and the lower lip outstretched, a labial circumvallate incision is made. This incision proceeds from canine-to-canine positions while the operator maintains an awareness of the tendency for the mental nerve to lie on the crest of the ridge. The initial incision is made through mucosa only, and the subsequent periosteal incision is made more superiorly toward the crest of the ridge. The purpose of this two-fold incision is to minimize periosteal reflection so as to avoid vascular compromise of the edentulous mandible. A midcrestal incision in the less than 7-mm anterior mandible is often not possible because the lingual tissue is usually thin and is positioned on the lingual edge of the mandibular ridge. Profuse bleeding and life-threatening airway obstruction have been reported when injury occurs to the arterial vasculature on the lingual side of the edentulous mandible. The lingually pedicled mucoperiosteal flap is preferred; it gives excellent exposure of potential implant recipient sites. A Molt curette or similar periosteal elevator is useful in reflecting the mucoperiosteal flap. Difficulty in flap reflection may be experienced as the surgeon encounters crestal bony irregularities or bony elevations on the anterior aspect of the mandible in the area of the mentalis muscle insertion. It is important not to reflect the mentalis muscle in its entirety so as not to lead to ptosis of the chin.

All bony surface irregularities should be smoothed to prevent trauma to overlying mucosa; soft tissue tags should be removed from the implant preparation site to prevent its proliferation, migration, and implant encapsulation before implant placement. The smallest length implant from Nobel Biocare (Yorba Linda, CA) is the 7-mm implant, which is longer than the available bone height in the less than 7-mm anterior mandible. The surgeon has three choices in this situation:

- Initially augment the mandible with an autogenous bone graft, usually from the iliac crest and place a longer implant either simultaneously or at a later time.
- Place the 7-mm implant and leave the coronal portion of the implant superior to the ridgecrest and place a graft around the platform.
- Place the implant and penetrate the inferior border of the mandible and “tent” the peristomeum in an effort to obtain guided bone regeneration (the platform portion of the implant should be flush with the ridgecrest).

In the cases presented, we have elected to place the implant slightly superior to the ridge crest and avoid penetration of the inferior border. Penetration of the inferior border may weaken the mandible and predispose it to fracture, infection, or both.

After the anterior mandible is exposed, the topography and orientation of the resorbed mandible is noted. The surgeon must avoid disorientation between the lateral and superior aspects of the mandible because there may be no distinctive demarcation evident. The midline of the mandible is marked on its crest with a bur by observing the lingual frenum and the paired Wharton duct openings. It is preferable to place only two implants between the mental foramina, so as not to weaken the mandible and predispose it to fracture. It is generally not advisable to place wide-diameter or wide-platform implants in the severely atrophic mandible. Otherwise, bony dehiscences, fenestrations, and fractures may ensue. Using calipers, the predetermined interimplant positions are marked with a round bur on the ridgecrest. The positions are generally equidistant from the marked midline.

The implant preparation is made ad modum Bränemark with new sharp burs and copious saline irrigation. If no bleeding is observed within the bony preparation, small bleeding points are made with a small round bur on the lateral walls of the preparation to facilitate heal-
ing. Because the quality of the bone in the severely resorbed mandible is generally dense cortical basilar bone, the preparation can be enlarged slightly with a 3.15-mm twist drill. It usually is necessary to use the screw-tap before implant placement because the basilar bone can be extremely dense, even when using self-tapping implants; overtapping with the hand wrench may produce stress fractures in the mandible.

Depending on the ridge morphology and the required implant trajectory, the implants can be placed in a slightly oblique manner to maximize the available bone and surface area for osseointegration. If the coronal portion of the implant is superior to the ridgecrest, or the buccal or lingual plates are thin or have dehiscences, bone grafting should be done. Autogenous bone can be harvested from the midline region of the mandible and/or a bone substitute such as the xenograft Bio-Oss® (Geistlich Pharma AG, Division Biomaterials, Wolhusen, Switzerland) can be packed around the bony deficiencies.

Primary closure is achieved in a double layer with resorbable suture material. One must be careful to properly line up the midline tissues. The repositioning of the musculature and deep layer closure is important to prevent hematoma formation, wound dehiscence, and chin ptosis postoperatively. A pressure dressing is placed for the first 24 hours postoperatively. Approximately 1 week after implant placement, the denture is relined with a soft liner, and the patient followed at two- to four-week intervals for soft liner replacement. Five to 6 months are allowed for osseointegration to occur after which the definitive abutments are placed.

**Prosthodontic Procedures and Treatment Sequence**

**Impressions**

The objective for complete denture impression procedures is to optimize the support, stability, and retention of the denture bases. Because of the severe atrophy of the mandibular residual ridge, a desirable conformation (contour) rarely is observed. The placement of two implants in the anterior region permits the use of retentive mechanisms that increase the retention of the lower denture. Because the implants are very short, extra efforts must be taken to minimize torquing forces applied to the implants by the denture base. Accordingly, attention should be directed to the selection of techniques that maximize the support and stability of the lower denture.

Most patients request that they retain the use of their dentures during the treatment process. Before making final impressions, the soft tissues should be brought to a state of optimal health. The use of tissue conditioning materials before making the final impressions is a well-established concept. The tissues adjacent to the implant abutments often tend to heal slowly and should be evaluated before the impressions are made.

To establish proper support and stability of the denture base, both in the short and long terms, it is necessary to ensure coverage of primary supporting areas. In the mandibular arch, the buccal shelves and the retro-molar pad areas resist resorptive changes and should be covered appropriately by the denture base.

**Maxillomandibular Relation Records**

Conventional techniques for establishing the jaw relations of occlusal vertical dimension and centric relation are selected according to operator preference. Gold cylinders can be placed in the mandibular record base during its construction. These cylinders then allow the record base to be attached to the implant abutments to retain the record base when the jaw relation records are made.

A facebow transfer procedure that anatomically orients the casts on an articulator is recommended. This will facilitate both the proper arrangement of the artificial teeth and their subsequent adjustment before placement of the completed dentures.

**Wax Trial**

The patient’s existing dentures provide a reference for the selection of new teeth and their arrangement. After considering the patient’s perception of his or her existing dentures, the dentist will need to select and arrange the new artificial teeth. While anterior teeth are selected primarily on the basis of esthetic considerations, the choice of the posterior teeth is more complicated. Currently, there is no consensus as to which posterior occlusal scheme is the most appropriate for the edentulous patient. The linguolabial concept, which uses anatomical or semianatomical teeth in the maxillary arch and opposing teeth with a lower cusp height in the mandibular arch, seems to provide the most generally acceptable blend of esthetics and control of occlusal forces.

Once the arrangement of the teeth has been completed, a gold bar is fabricated to splint the lower implants. Given the compromised support and stability of the lower denture base, its movement under occlusal loading forces must be recognized and compensated for. A clip-roundbar design that permits rotation will minimize torquing forces applied to the implants. Rotation may also be aided by orienting the bar perpendicular to the midsagittal plane.

The antero-posterior position of the bar is influenced by several factors. To control loading forces, the bar should be positioned with a minimal horizontal cantilever; that is, the implants should be connected in as straight a line as possible. Another influencing factor on its position is the need to keep the bar within the confines of the denture flanges. A bar that is placed too close to the denture periphery may weaken the base and predispose it to fracture.

**Processing the Dentures**

When flasking and processing the dentures, care must be directed to the interface between the gold bar and the denture base. Blockout around the bar, that will later provide relief (space) between the denture base and the bar, allows for base movement without torquing of the bar. It is helpful to deliver the bar with a matte finish (facilitates identification of rotational interferences) to ensure that no unwanted base con-
tacts develop. The retaining clips may be processed into the base at this stage or they may be added during the delivery appointment.

Placement (Delivery)

At the delivery appointment, the adaptation of the denture base should be evaluated with a pressure indicating paste. It is also recommended to simulate occlusal loading forces by applying finger pressure bilaterally to the posterior teeth to assess denture base stability and support. If the stability and support seem inadequate, a reline procedure is indicated to minimize base movement under future loading forces.

After intraoral placement of the gold bar with a matte finished polish, a radiographic assessment of the bar should be made to verify its complete seating on the abutments. This radiograph also provides a baseline reference for evaluating the bone level around the implants at future recall appointments.

A clinical remount procedure is performed to correct discrepancies in the occlusion. The stability and support of the record bases used to establish the maxillomandibular relation records is often compromised because of the atrophy of the residual ridge and the presence of overlying mobile soft tissues. The completed mandibular denture is stabilized by the gold bar and this facilitates obtaining more accurate records.

The instruction to patients in appropriate oral hygiene procedures includes techniques to clean both the dentures and the bar. Before dismissing patients, their ability to perform these hygiene procedures should be verified. Patients can then determine which combination of devices and techniques works best for them.

Postplacement Adjustments

The adjustment of the dentures after placement follows a similar course to that of conventional dentures. However, the bar should be evaluated for areas of undesirable contact with the denture base. This is visualized easily because the bar has been placed in a matte-finished state. After ensuring no undesired contact exists with the base, the bar can be highly polished.

At the adjustment appointments, the patient's oral hygiene efforts often need to be improved. Complete denture patients frequently are not in the habit of performing intraoral hygiene procedures, and time needs to be spent on reinforcement.

Case 1

An 81-year-old woman, with a history of coronary artery disease and chronic obstructive pulmonary disease, presented to the Department of Oral and Maxillofacial Surgery with a chief complaint of inability to function with her loose-fitting mandibular denture. She had been edentulous for about 20 years, and her dentures had been relined several times without improvement. On examination, she had a severely atrophic mandibular ridge, prominent genial tubercles, mobility of her mucosa, and a small amount of keratinized tissue (Fig. 1). The patient gave a history of a mandibular fracture which had been treated via an open reduction with a titanium mesh (Fig. 2).

A labial vestibular incision was made exposing the residual mandibular ridge, which had a height of 6.5 mm. Two Bränemark 3.75 × 7 mm (Nobel Biocare, Chicago, IL) implants were placed in an oblique direction to gain more mandibular bone length (Fig. 3). Second stage surgery followed in 4 months after an uneventful healing period. Two 3-mm standard abutments were placed (Fig. 4). The patient was subsequently treated by the prosthodontist, and a clip bar overdenture was fabricated (Fig. 5). She is presently 8 years post denture fabrication, and no difficulties or complications have been identified on follow-up (Figs. 6, 7, 8). She has been functioning well with her dentures, and only routine dental hygiene maintenance has been required.

Case 2

The patient is a 70-year-old healthy woman with mandibular edentulism for 30 years who requested dental implants because of her inability to retain and function with her lower denture. She also was subject to denture ulcers and was embarrassed by her loose dentures. Her oral exam revealed an ulcer in the lower right mandibular labial vestibule. Her severely atrophied mandibular ridge (Fig. 9) was complicated by unattached, nonkeratinized mobile tissue. Her maxilla was also severely atrophic. The prosthodontist was able to fabricate a complete maxillary denture despite the atrophy. Significant ridge resorption was noted in the mandible (mandibular height of 6.5 mm) with the genial tubercles superior to the residual basal bone. Two 3.75 × 7 mm Bränemark (Nobel Biocare) implants were placed between the mental foramen in an oblique manner with a slight buccal trajectory. Four months postoperatively, second stage implant surgery was performed so as to place two 5.5-mm abutments. A clipbar overdenture was fabricated (Fig. 10). Because of the position of the implants, the labial flange of the denture could not be extended to cover the labial aspect of the abutments (Figs. 11, 12). The patient has been seen for routine implant maintenance over the past 5 years, and she is functioning well with her dentures. The surrounding tissues remain healthy without radiographic evidence of bone loss (Fig. 13).

Case 3

A 72-year-old woman, with a history of hypertension, arthritis, and cataracts, presented for implant consultation. She had been edentulous for many years, resulting in mandibular atrophy (Fig. 14). The bone loss had left her with 5 to 6 mm of anter ior bone height. Her complaints focused on her inability to wear and retain her lower complete denture and an inclination to have chronic denture ulcerations. Clinically, there was an alveolar ridge with the genial tubercles positioned superiorly and nonexistent buccal vestibules, (Fig. 15) resulting in poor stability and lack of retention of the lower denture. There was adequate bone width with minimal keratinized tissue. The mental nerves were dehisced on the
superior aspect of the ridge. This deteriorated condition contributed to her discomfort. She was evaluated by the prosthodontist and treatment planning prescribed the use of two fixtures and a clip bar overdenture. A labial vestibular incision was made, revealing an extremely thin mandible; 6 mm in height at its most superior point. Two Brånemark (Nobel Biocare, Chicago, IL) implants (7-mm length × 3.75-mm width) were placed in an oblique manner. The coronal portion of the implants were left superior to the ridge crest and grafted with bovine hydroxyapatite (Fig. 16). Stage II implant surgery (Fig. 17) was performed 5 months later, a clip bar overdenture was constructed (Figs. 18, 19, 20), and the patient is now approximately
1-year status post implant placement. The implants are well osseointegrated and the patient is functioning satisfactorily with the clip bar overdenture.

**DISCUSSION**

**Aspects and Consequences of Advanced Mandibular Atrophy**

Patients with advanced mandibular atrophy typically present complaining of poor retention and lack of stability of their dentures. These conditions usually result in chronic pain of the denture bearing areas. Severe loss of mandibular bone mass, loss of buccal and lingual vestibular depth, generalized reduction of attached tissue, decreased amount of keratinized tissue, and an overall diminution of the denture bearing area are aggregate factors that contribute to inadequate stability of the removable prosthesis.

As a result of this atrophy and denture instability, inflammatory hyperplasia and traumatic ulcers are common occurrences. Oral candidiasis and angular cheilitis are seen in geriatric patients who are the most likely to have advanced mandibular atrophy. The differential maxillary and mandibular resorptive patterns produce an increase in the interarch distance. This alters the maxillomandibular relationship so as to cause loss of vertical dimension and the resultant masticatory dysfunction. Mental nerve dehiscences occur as the result of advanced atrophy and produce neurosensory alterations from the compressive trauma of the mandibular prosthesis.

A “negative” ridge is observed in patients with severe mandibular atrophy where the genial tubercles are superior to the resorbed anterior mandible. Prolapse of the floor of the mouth and associated salivary structures over the ridge create potential interferences with the implant abutments, components, or prostheses.

The remaining basilar bone frequently is characterized by dense cortical bone with a reduced marrow content. This hypovascularity is further accentuated by the compromised blood flow seen in patients with atherosclerotic changes in the inferior alveolar artery. As a result, the periosteal blood supply to the mandible becomes more critical. This type of bone is more vulnerable to hyperthermia during implant site preparation and placement.

**Alternative Treatment of the Severely Atrophic Edentulous Mandible**

The oral and maxillofacial surgeon and the prosthodontist have various options for treating the severely atrophic edentulous mandible. New conventional complete dentures can be offered but most often these will not address significantly the chief complaints of the patient.
The transmandibular implant system has been shown to successfully restore denture function in a more predictable manner than augmentation procedures alone. However, this procedure usually requires hospitalization, general anesthesia, an extraoral incision, and the prosthesis is not easily retrievable in the event of a complication.

According to Marx, there are three general types of bone grafts (transplanted osteogenesis) that are recognized today for mandibular reconstruction. The first is a nonvascularized cortico-cancellous block graft that transplants more mineral matrix than osteocompetent cells. The second type of graft is a vascularized transfer of a cortico-cancellous block from donor bones such as the fibula and rib. The third type is particulate bone and cancellous marrow which usually requires an alloplastic or al-
logeneic tray to confine the material. Although these procedures are biologically sound, they are fairly invasive. They also may increase morbidity and are more costly.

In patients with high cosmetic and functional requirements, or younger patients with advanced mandibular atrophy, grafting procedures and subsequent endosseous implant placement should be considered. The presence of endosseous implants in bone grafts contributes to preservation of the graft. Subperiosteal autogenous bone grafting for treating the severely atrophic mandible has been widely used in the past, but resorption rates without the coexistence of endosseous implants has been reported to be as high as 44% and 30% to 40%. Split thickness skin graft vestibuloplasty alone is contraindicated in this group of patients because of the extremely diminished bone height.

The Endosseous Implant Reconstructive Option

It is possible to place implants successfully, with minimal morbidity, and have them function effectively in the patient with a severely atrophic mandible. Keller et al. reported on reconstruction of the severely resorbed mandibular ridge using tissue-integrated prostheses. They reported successful short-term reconstruction in three patients with fixed detachable prostheses in mandibles with 7-mm or less mandibular height. In 1995, Keller reported success in his 11-year experience in performing approximately 400 totally edentulous reconstructions in edentulous mandibles with 4-mm to 5-mm height and at least 6-mm width. These patients were safely and predictably treated with 4 to 5 implants and a bone anchored bridge.

The Overdenture Vs. Fixed Detachable Option

The simpler, less invasive and more cost-effective overdenture option (compared with a fixed detachable prosthesis) is the procedure recommended herein for the anterior edentulous mandible that is less than 7 mm in height. This type of reconstruction usually satisfies the most common patient complaints of lack of stability and retention. There is less operating and anesthetic time which limits the possibility of post-operative morbidity. With severe atrophy, there is an increased risk of mandibular fracture with the increased number of implants. Two implants are all that are required for overdenture reconstruction, whereas 4 to 6 are required for the fixed option. In severe mandibular atrophy, the mental nerves are usually dislocated on the superior aspect of the mandibular ridge and are more likely to be injured when numerous implants are placed. It is often difficult to obtain adequate antero-posterior spread of the implants when planning a fixed detachable prosthesis, thus limiting the extent of the cantilever. When overdentures are used, a full complement of teeth is restored and missing tissue contours are replaced with the denture base and flange. Most patients with severe mandibular atrophy also possess maxillary atrophy, and a fixed mandibular prosthesis can produce instability in the conventional maxillary denture. Oral hygiene practices are simplified and shortened with removable overdentures as compared with fixed prostheses.

The predictability of overdenture reconstruction is well established. The cumulative success rates for implants and for overdentures supported by two implants in the edentulous mandible were reported as 94.5% and 100%, respectively. Hemmings et al. compared treatment of 50 consecutive patients with edentulous mandibles and followed them for 5 years. During this period, overdentures were supported by 68 implants with a success rate of 92.65%, and 25 fixed restorations supported by 132 implants with a success rate of 90.15%. Postinsertion adjustments in the first year were more common for overdentures. Thereafter, fixed prostheses had more complications and required more maintenance than overdentures.

CONCLUSION

Although treatment of the patient with a severely atrophic mandible (an anterior mandible less than 7 mm in height) presents surgical and prosthetic complexities, the situation can be restored quite successfully with two implants and a clip-bar overdenture with minimal morbidity.

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Abstract Translations [German, Spanish, Portuguese, Japanese]

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ABSTRACT: Patienten mit schwer atrophischem Unterkieferknochen (weniger als 7 mm stark) kann mit Hilfe zweier knochengestützten Implantate und einer aufgeklammerten Prothese bei minimaler Sterblichkeit erfolgreich behandelt werden. Zwei der drei vorgestellten Fälle zeigen das langfristige Potential dieser Behandlungsmethode.

SCHLÜSSELWÖRTER: Unterkieferatrophie, Klammernprothese, Zahnlosigkeit im Unterkiefer, chirurgische und orthodontische Überlegungen
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ABSTRACTO: El paciente con una mandíbula severamente atrófica (menos de 7 mm de alto) puede ser restaurado exitosamente con dos implantes endósseos y una sobredentadura con barra-traba, con mínima morbimidad. Dos de los tres casos estudiados ilustran el potencial a largo plazo de esta modalidad de tratamiento.

PALABRAS CLAVES: atrofia mandibular, sobredentadura con barra-traba, edentulismo mandibular, consideraciones quirúrgicas y prostodonticas

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SINOPSE: o paciente com uma mandíbula seriamente atrofiada (menos de 7 mm em altura) pode ser restaurado com sucesso com dois implantes endósseos e uma sobredentadura com grampo de fixação, com morbidade mínima. Dois desses três casos foram relatados para ilustrar o potencial a longo prazo deste tipo de tratamento.

PALAVRAS-CHAVES: atrofia mandibular, sobredentadura com grampo de fixação, edentulismo mandibular, considerações cirúrgicas e prostodonticas

下顎骨喪失により厚さ7mm以下の下顎：インプラント/オーバーテンチャー修復オプション

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要約：
厚さ7mm以下の症例の下顎萎縮は、2つの骨内インプラントとクリップバーオーバーテンチャーにより修復できる。その場合の、罹患率は低い。ここで報告される3つの症例のうち2つが、この治療法の長期的な有効性を示している。

キーワード：
下顎萎縮、クリップバー、オーバーテンチャー、下顎骨喪失、外科的、歯科補綴的方法

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