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Color Atlas of Dental Implant Surgery FOURTH EDITION

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The fourth edition of the *Color Atlas of Dental Implant Surgery* is dedicated to four very important individuals. My wife has always been at my side, pushing me to achieve excellence with compassion for our patients. She is a great woman and one of the smartest.

My daughters, Courtney and Celeste, are both active professionals who excel in everything they do. They always enjoyed watching me work on this book on weekends and evenings, with an understanding of what it takes to achieve something that hopefully helps others. My mother always drove me to achieve beyond normal expectations. She was brilliant with an insight that showed that humility and humbleness can co-exist with being on "top of your game." Thanks to these great influences on my life.

Preface

The third edition of this book was written to provide videos of multiple procedures to help surgeons learn and then utilize these techniques for improved patient care. This fourth edition is almost a complete rewrite, with older, more historical material archived to allow for more current methods to be discussed in detail. There are more videos covering a vast array of methods. By using the companion website associated with this book, I can add to the video library easily and keep our readers on top of their game.

The implant field is blossoming with technological advances being reduced to clinical practice. During the time from submission of the chapters to publication, more advances have occurred, which will be inserted into the website as evidence becomes available to justify new methods for use in our patients.

I always enjoyed watching students and residents learn new methods. They read and then with mentoring apply their new knowledge to patient care. Many thanks to the residents who continue to drive all of us to teach and keep up with the needs of our patients.

Michael S. Block

Key Features:

The fourth edition of the *Color Atlas of Dental Implant Surgery* continues to provide state-of-the-art information on procedures and techniques used in dental implant surgery. Organized by both oral anatomy and surgical technique, each chapter presents a different area of the mouth or a specific surgical technique. Features include:

- Clear **step-by-step procedure descriptions** that address treatment planning, including indications and contraindications, as well as pre-surgical guidelines, detailed surgical techniques, and postoperative follow-up.
- Over **1,500 atlas-quality clinical photos and radiographs** that clearly illustrate treatment from beginning to end.
- **Case examples,** with accompanying photo sequences, which provide clinical scenarios, each with a variant.

New to this edition:

Content has been updated to reflect **current information and advancements in dental implant surgery**. Older material has been eliminated or has reduced emphasis and outdated clinical photos have been eliminated entirely or replaced with photos demonstrating current procedures and materials. A tremendous amount of new material has been added. Some highlights include:

- New information on **"placement of implants into single tooth sites with tooth removal"** and **"placement of implants immediately into mandibular molar sites"** in Chapter 2.
- New information on **"grafting the thin maxilla"** in Chapter 3.
- New section on **"the use of interpositional osteotomy to restore missing vertical bone in the esthetic zone"** in Chapter 4.
- New section on the **"crestal approach for sinus elevation"** in Chapter 6.
- The **companion website** includes over **60 video clips** demonstrating implant procedures, as well as an image collection, which includes over **300 additional clinical photos** associated with either cases in the text or cases found on the website only.

Visit blockdentalimplantsurgery.com to see all of the resources available!

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Surgery of the Anterior Mandible

CHAPTER 1

Additional illustrations can be found on the companion website at www.blockdentalimplantsurgery.com

Placement of Two to Five Implants in the Anterior Mandible

General Considerations

Patients who are totally edentulous in the mandible may not be able to consume a normal textured diet because of mobility of their denture. As the jaws continue to lose alveolar height, the dislodgement forces from the perioral musculature become greater than the retentive aspects of the prosthesis. The denture moves on the edentulous ridge, causing discomfort, sores, and trauma to the mental nerve. The placement of endosseous implants into the anterior mandible is an excellent therapy for an implant-supported reconstruction, restoring the ability of these patients to consume a normal-textured diet. An improved diet results in normal nutritional intake, improved health, and greater self-confidence.

The options for the patient include (1) a conventional denture; (2) a tissue-borne, implant-supported prosthesis; or (3) an implant-borne and -supported prosthesis. The conventional denture is a viable option for many patients, especially those with financial limitations. After an initial attempt to wear a conventional denture, many patients look forward to receiving implants. As a result of a denture trial, they become easier to treat because they are confident about the decision to spend the money, dedicate the time, and deal with the perceived morbidity of implant surgery.

The tissue-borne removable prosthesis can be placed over one to five implants. Most often, two or four implants are used for a tissue-borne prosthesis. The implant-borne prosthesis usually requires the placement of four to five implants in the anterior mandible anterior to the mental foramen. For selected patients, six implants can be used with four implants between the mental foramen and one implant in each first molar location. Patients, treatment planned for a crown and bridge type fixed restoration requires further support with placement of two to three implants in each posterior quadrant with four implants in the anterior mandible, resulting in a multi-unit, precision-attached crown and bridge restoration. For posterior mandibular implants, adequate bone must be available superior to the inferior alveolar nerve. Surgical placement of implants for a full arch crown and bridge prosthesis with ceramic teeth requires meticulous planning and placement of the implants to locate them within the confines of the crowns, avoiding the embrasure spaces.

Based on the recommendations of the implant team and considering his or her desires and interests, the patient makes the decision after being informed of the advantages of the different types of prostheses and the financial responsibilities associated with each. After an informed patient has made the decision, surgery is scheduled.

Evaluation of Anatomy—Physical Examination of the Patient without Teeth

After reviewing the patient's medical and dental history, the surgeon performs a physical evaluation, focusing on the anatomy of the mandible. The range of opening of the patient's mouth is recorded. Limitations in opening may affect the treatment plan in extreme conditions. The general health of the intraoral soft tissues is evaluated. Any undiagnosed pathologic condition or dental infection, as well as mucosal infections, must be treated to completion before implant placement.

The soft tissue attachments of the floor of the mouth and the mentalis musculature are noted. The width of the band of *keratinized gingiva* (KG) on the alveolar crest is documented. The distance from the crest to the junction of the attached and unattached mucosa is recorded (Figure 1-1). Examination of the soft tissues is important to determine the need for vestibuloplasty, either before or at the time of implant placement.

The locations of the submandibular ducts are evaluated to ensure that they will not be violated during the procedure. The locations of the mental foramina are palpated and, if necessary, transferred to a diagnostic cast for further planning.

The slopes of the labial and lingual cortices are palpated. The height of the mandible is estimated by palpation of the anterior mandible. The location of the genial tubercles is noted. In a relaxed vertical position of the jaws, the relationship of the anterior mandible to the maxilla is observed to determine the benefits of positioning the implants to correct or mask a class II or class III skeletal jaw relationship. Occasionally, orthognathic surgery is necessary to correct severe skeletal discrepancies before implants are placed. At the conclusion of the physical examination, the surgeon

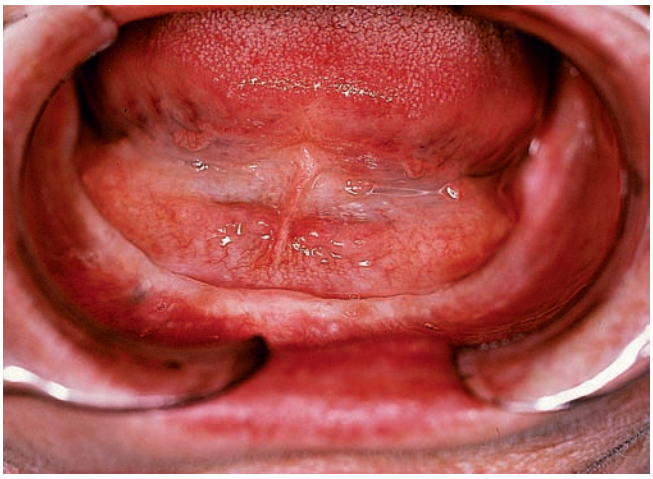


FIGURE 1-1 A, Preoperative view of the mandible. The unattached, mobile gingiva is more than 5 mm from the crest.

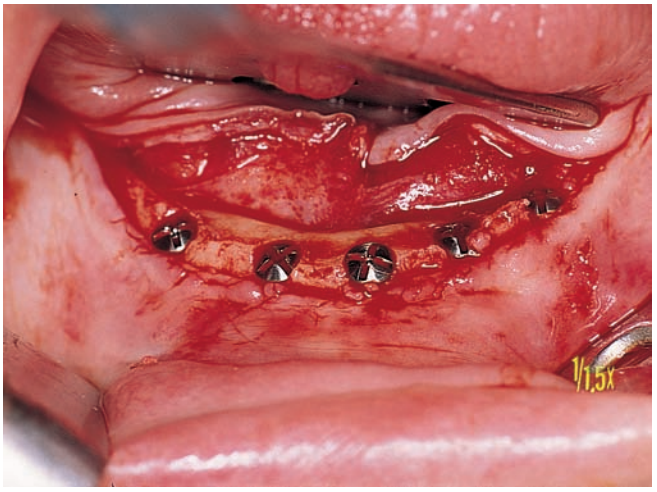


FIGURE 1-1 B, Crestal incision with no vertical release is used to place the implants. The implants are placed slightly countersunk to allow the cover screws to be level with the bone; this prevents potential supracrestal pressure points.

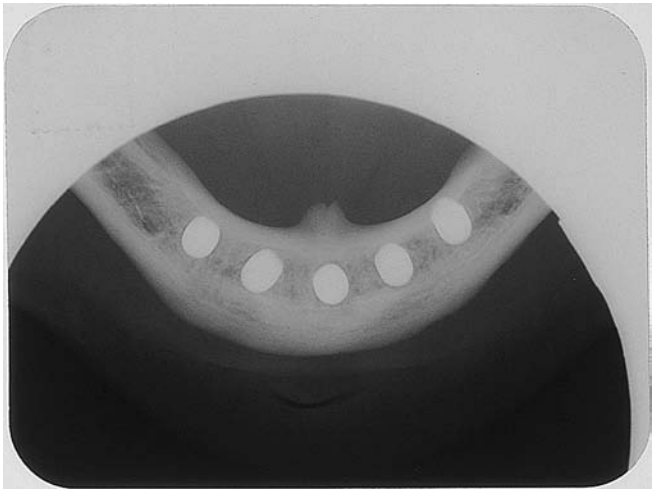


FIGURE 1-1 C, Radiograph shows proper positioning of the implants. The most posterior implants are approximately 5 mm anterior to the mental foramen. Note the 3-mm spaces between the bodies of the implants.

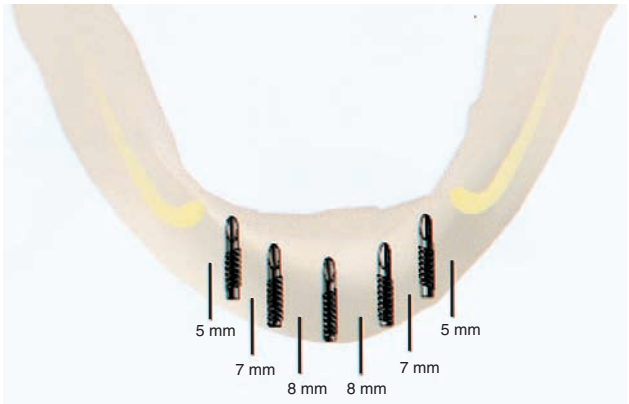


FIGURE 1-1 D, Drawing of ideal location and spacing of implants in the anterior mandible demonstrates the distance from the mental foramen.

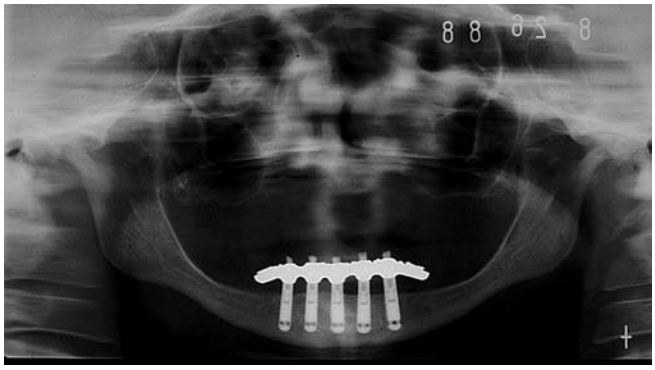


FIGURE 1-1 E, Panoramic radiograph shows suprastructure on the implants for the hybrid denture–type prosthesis.

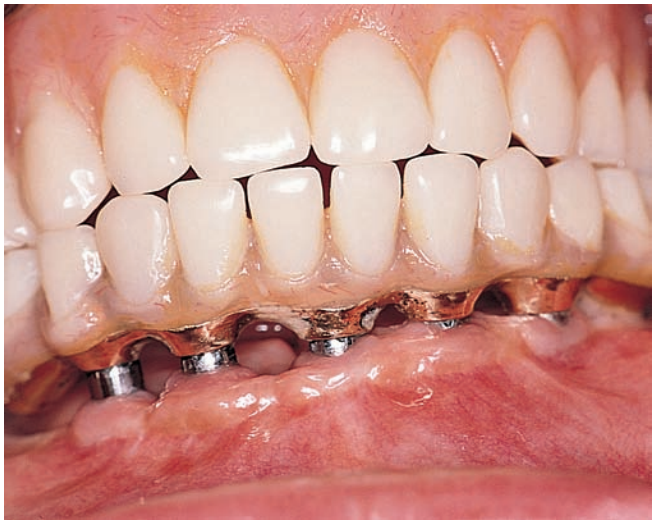


FIGURE 1-1 F, Frontal view of the mandibular hybrid denture opposing a conventional maxillary prosthesis. (Prosthetics by Dr. Luis Guerra.)

should have a good appreciation of the height and width of the anterior mandible, as well as the slopes of the cortices. The surgeon should be able to discuss with the patient the planned location of the implants and the need for an adjunctive soft tissue procedure, such as a simultaneous vestibuloplasty.

Evaluation of Anatomy—Radiologic Examination of the Patient without Teeth

A cone-beam scan is very useful to determine the specific anatomical morphology of the mandible. This scan will show the slope of the cortices, location of the mental foramen, course of the nerve as the nerve enters and exits the mandible from the foramen, and amount of bone present posterior to the foramen. The typical cone-beam scan generates four different frames of reference. One frame contains the lateral and frontal cephalograms of the patient; the second frame contains the axial, frontal, and sagittal slices; the third contains views of the condyle and glenoid fossa; and the fourth are cross-sections from a panoramic-type image (Figure 1-2).

The *lateral cephalogram view* from the cone-beam reconstruction is very useful by providing an image with minimal magnification with orientation of the mandible to the maxilla. The lateral views show the mandibular plane angle, which is used to assess vertical dimension of the patient. The lateral cephalograms is also useful to demonstrate skeletal class II or III relationships. For a full arch hybrid restoration, these views provide insight in angulation of the implants to compensate for skeletal relationships. In a class II mandible, the implants can be angled forward, and in a class III mandible the implants can be retro-angled to potentially provide a class I dental setup. The anteroposterior view shows asymmetry but also the position of the angles. Patients with prominent angle regions often have parafunctional habits, which need to be taken into consideration when restoring patients.

Axial views of the mandible are useful to determine the course of the nerve. By moving through these axial images, one can see the course of the nerve and understand the forward extent of the loop (see Figure 1-2, *A, E, F*). Each patient is unique, and this view helps avoid nerve injuries. The frontal projections can be used to assess presence of disease in the nasal and sinus regions. This is useful to understand potential problems and general health of the patient. An increase in dimension of the nasal membrane is found in patients with allergies to environmental material. Sinus membrane thickening is often found in patients with poor maxillary dentition. Obliterated sinuses may need treatment by the patient's otolaryngologist to achieve health.

The temporomandibular joint views are useful to ensure adequate joint stability and to eliminate future problems secondary to erosive condylar morphology associated with osteoarthritis. A patient who is planned for extensive implant reconstruction may have a long history of posterior occlusal loss, which can be associated with vertical dimension changes in the joints. A stable joint will be easier to treat than one with erosive changes. This is important patient information to recognize before the implant reconstruction because vertical changes may be necessary preoperatively or within the provisional prosthesis.

Cone-beam scanners have the capability to generate panoramic reconstructions. On the edentulous mandible, a spline is drawn on the axial view, and cross-sectional images are generated perpendicular to the spline. These cross-sections show the specific anatomy of the anterior mandible (see Figures 1-1 and 1-2). They are used to identify the planned

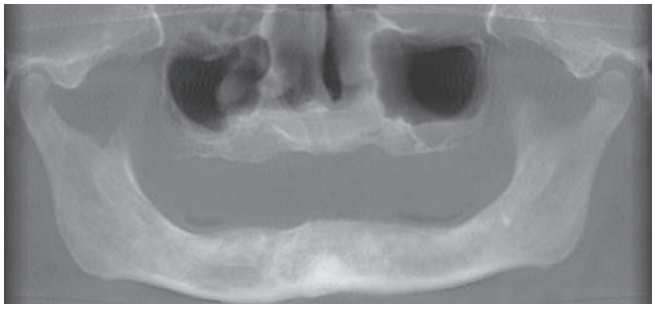


FIGURE 1-2 **A,** Panoramic reconstruction from a cone-beam scan.

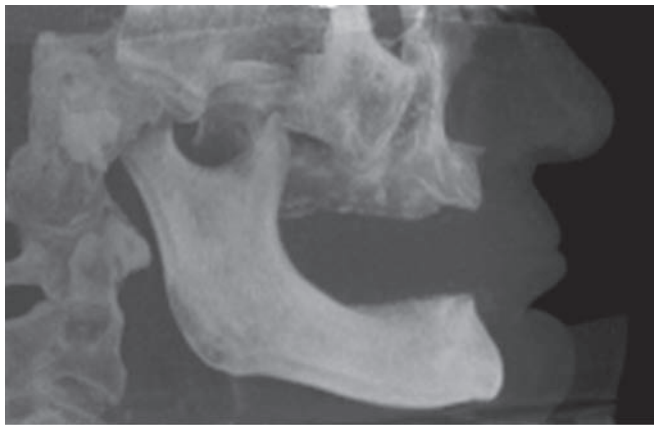


FIGURE 1-2 **B,** Lateral view of an edentulous patient showing contours of the ridges as well as ridge relationships.

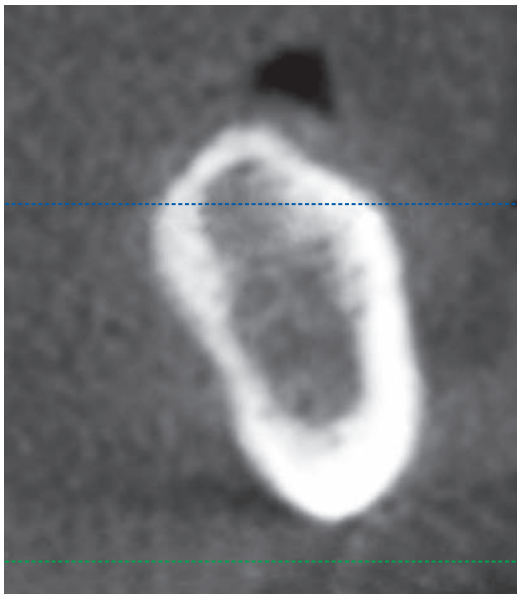


FIGURE 1-2 **C,** Cross-section image of anterior mandible in potential implant site. The slopes of the cortical bone and volume of bone allows for accurate implant choice. If bone reduction is necessary, the resulting thickness and mandibular height can be accurately determined preoperatively.

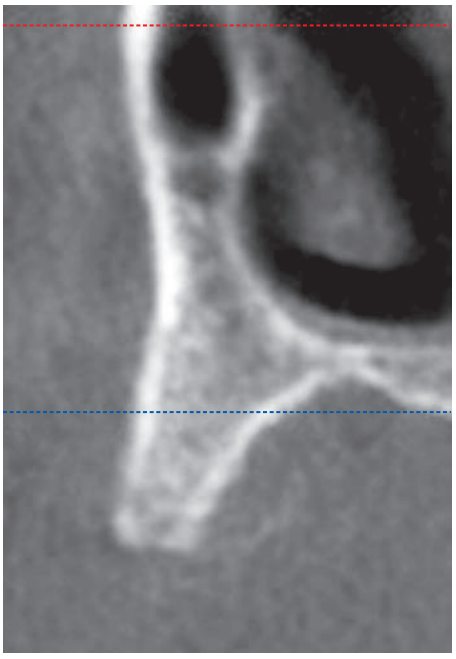


FIGURE 1-2 D, Cross-section image of anterior maxilla in potential implant site. The slope of the cortical bone and thickness of the bone indicate the need for angled abutments.

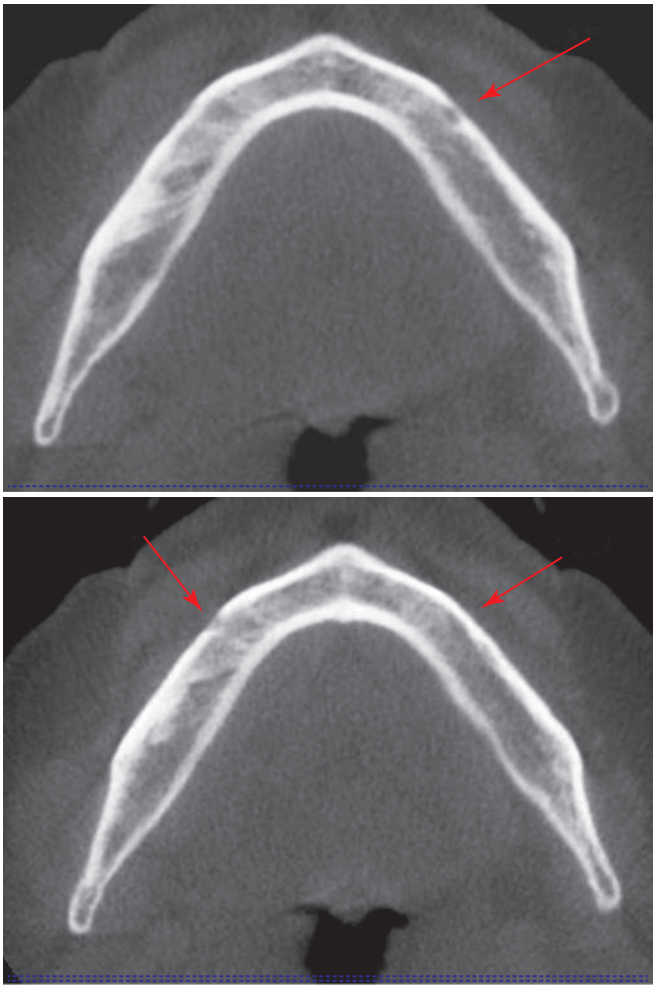


FIGURE 1-2 E and **F,** Axial views showing position of the inferior alveolar nerve as it exits through the mental foramen. Arrows show the foramen and course of the nerve before its exit from the mandible (**F**) right side.

angulation of the implants and whether the planned angulation parallels the labial or lingual cortices. The surgeon can then follow the specific cortical bone to guide implant placement by following the planned orientation using well-defined anatomical landmarks. In a class III mandible, one would angle the implants more posteriorly, often following the lingual cortex of the symphysis. The specific length and diameter of implants to be placed is accurately determined from the cone beam scan, with accuracy reported to within 0.5 mm of the measurements from the scan. This is in contrast to up to 20% magnification error from using traditional panoramic scans.

Surgical Treatment for Placing Implants in the Mandible

Incision Design Considerations. At the consultation visit, the surgeon notes the following when examining the patient:

1. Level of junction of attached and unattached gingiva
2. Level of attachment of mentalis muscle to the alveolar crest
3. Width of attached KG on the alveolar crest
4. Position of the genial tubercles in relation to the alveolar crest
5. Inclination of the lingual and labial cortical plates of bone
6. Skeletal relationship of the anterior mandible to the maxilla

Based on these findings and the height of the mandible, the surgeon decides which incision to use to expose the bone and subsequently to place implants into the edentulous mandible.

If the attachment of the mentalis muscle is 3 mm or more labial to the location of the attached gingiva on the alveolar crest, a crestal incision can be used (Figures 1-3 and 1-4). If the mentalis muscle is located adjacent to the alveolar crest, which would result in mobile, unattached gingiva directly against the implant abutment when restored, a vestibular incision is used. A type of lipswitch vestibuloplasty (Figure 1-5) is performed to reposition the muscle attachments inferiorly, resulting in nonmobile tissue on the labial surface of the implant abutment complex.

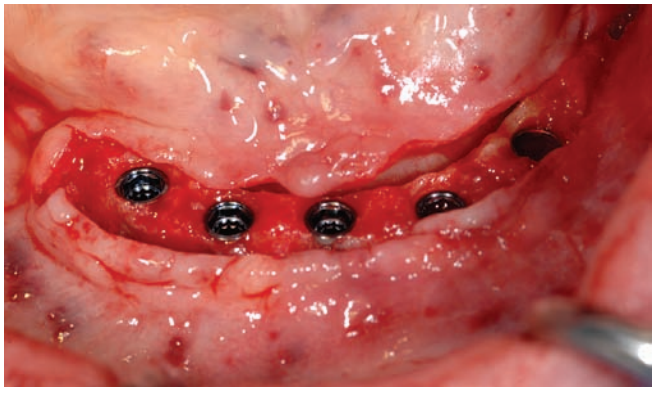


FIGURE 1-3 A, The incision is made bisecting the relatively thin band of keratinized gingiva (KG), with posterior vertical release incisions. A full-thickness flap is elevated carefully to avoid laceration of the crestal gingiva. The bone is reduced as necessary, and implants are placed.

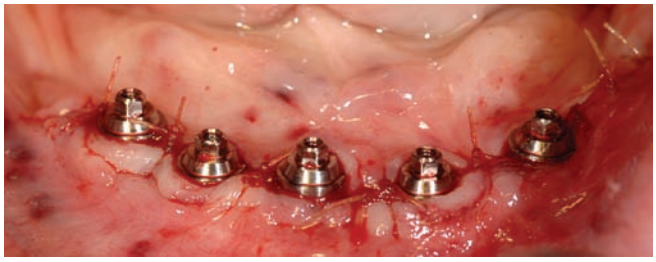


FIGURE 1-3 B, For an immediate full arch implant–borne provisional prosthesis, the abutments are placed with two or three gingival collar heights, and the incision is closed with interrupted sutures. Preservation of the KG is important for long-term gingival and implant health.

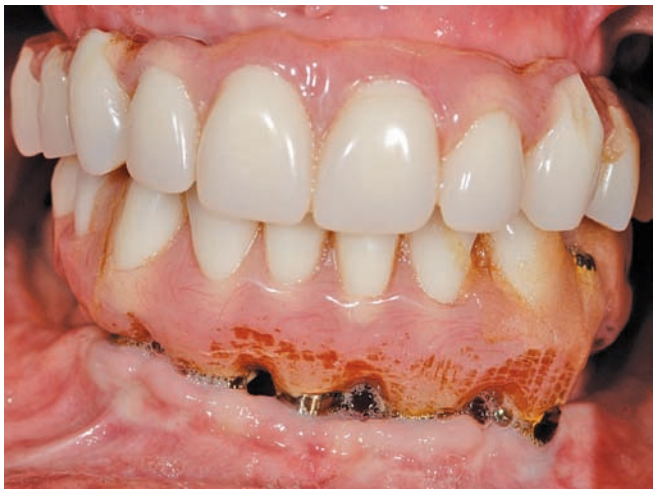


FIGURE 1-3 C, This patient demonstrates healthy gingiva after 4 months of healing. Preservation of the KG provides a necessary defense mechanism with attached gingiva for long-term success.

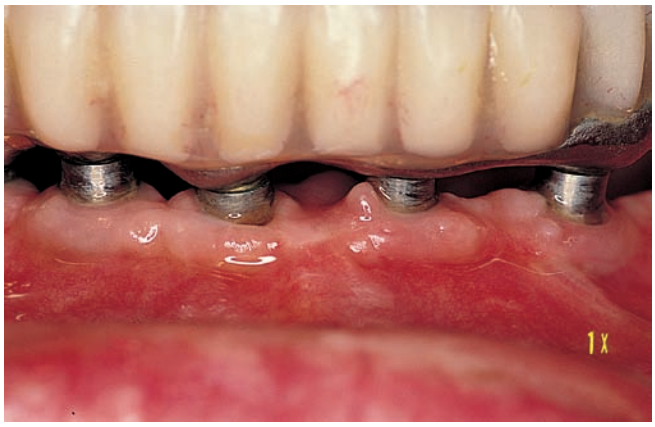


FIGURE 1-3 D, The patient has had a stroke and has had difficulty with oral hygiene. However, even with the presence of plaque, protection from the retained KG prevents adverse bone loss.

When the mandible is 12 mm or less in height, an incision placed labial to the thin band of KG allows for easier dissection. However, it cannot be accompanied by a lipswitch vestibuloplasty because displacement of the mentalis musculature in an atrophic mandible results in a drooping, soft tissue chin deformity. For the atrophic

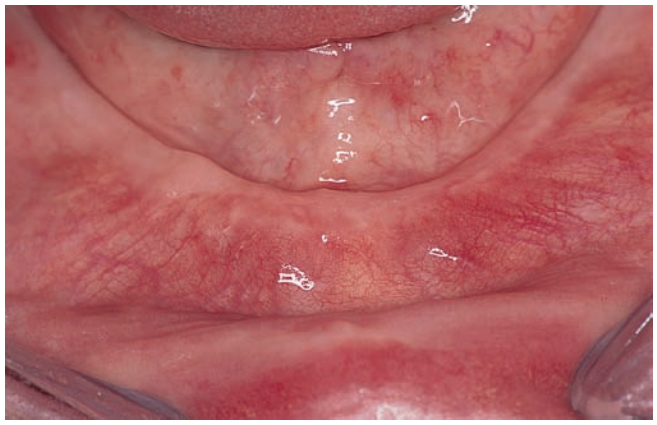


FIGURE 1-4 A, Implant placement for a tissue-borne overdenture is demonstrated in a mandible that is 12 mm tall. The lip musculature is more than 5 mm from the crest.

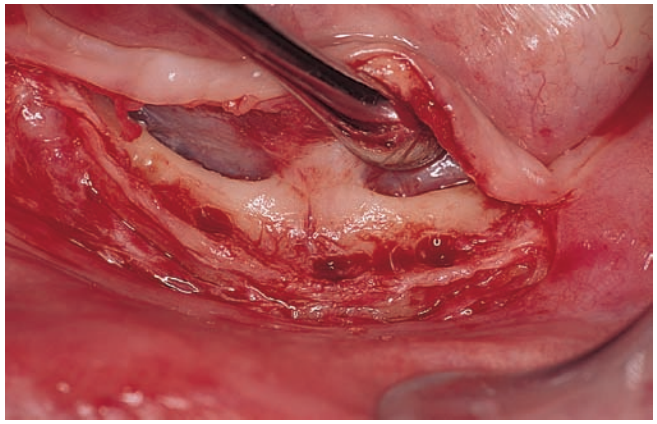


FIGURE 1-4 B, Incision is made bisecting the keratinized gingiva (KG). The subperiosteal reflection reveals the facial border of the crest and exposes the lingual bone. The expected presence of the genial tubercles is noted. The anterior position of the mental foramen is demonstrated on the left.

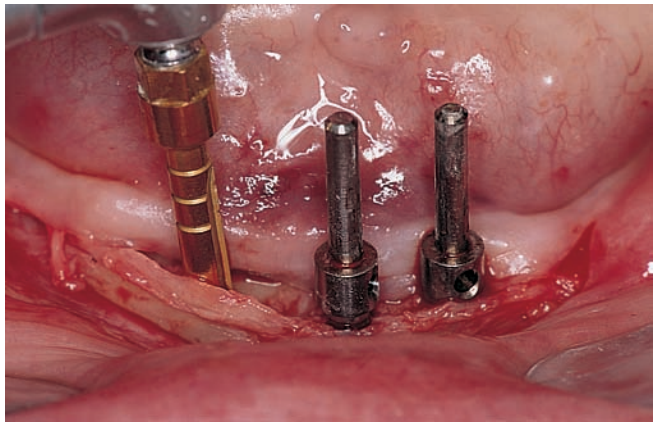


FIGURE 1-4 C, A round bur is used followed by a pilot drill. Guide pins are placed to facilitate parallel placement of the implants. These guide pins are used to orient the drilling as the diameter of the drills increases.

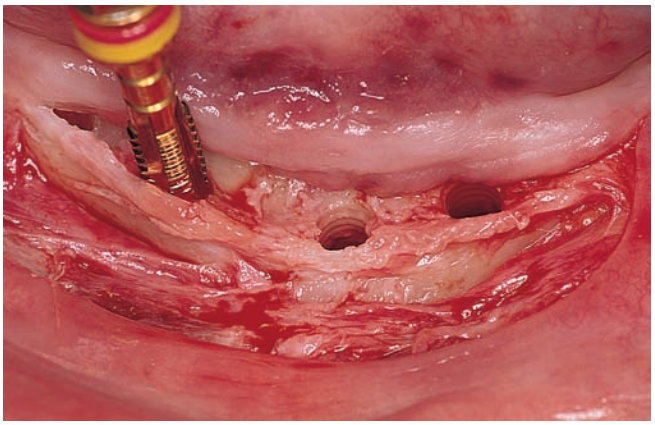


FIGURE 1-4 D, After the final-diameter drill is used, because of the density of the bone, a thread former is used to create threads in the bone for placement of the threaded implants.

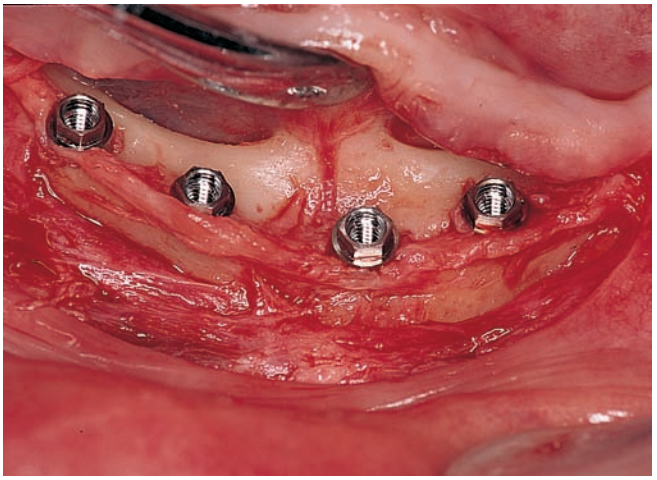


FIGURE 1-4 E, Implants before placement of the cover screws. The implants are placed such that the most facial surface of the implant is slightly lingual to the crestal bone. In an atrophic mandible, this prevents excessive lip irritation from unattached tissue.

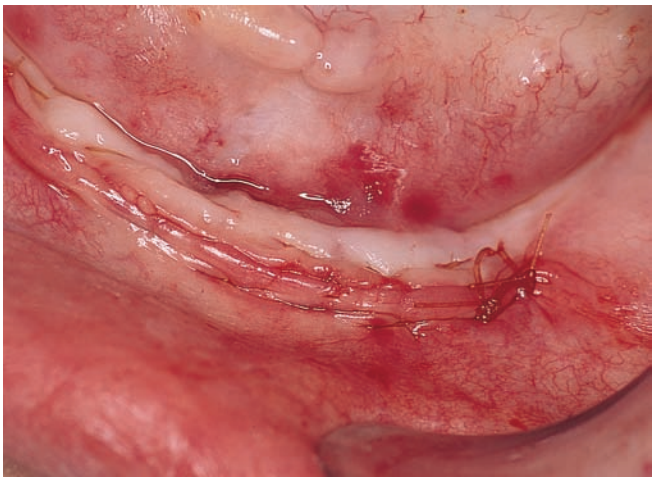


FIGURE 1-4 F, The incision is closed with resorbable sutures using a horizontal mattress suturing technique.

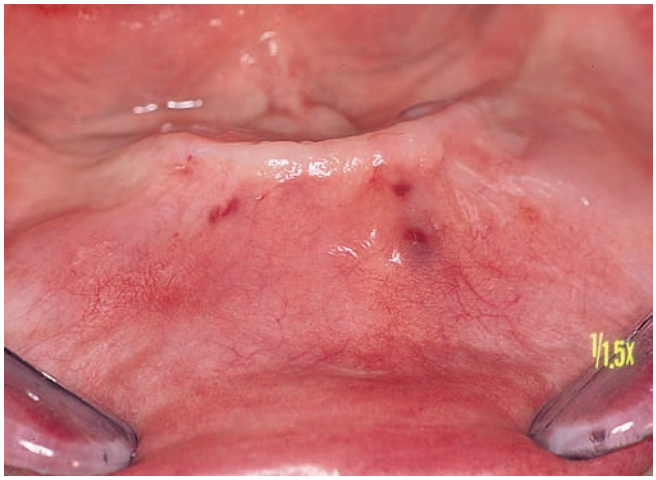


FIGURE 1-5 A, This 65-year-old woman was referred for a vestibuloplasty and placement of two implants. The high muscle attachments to the crest are noted.

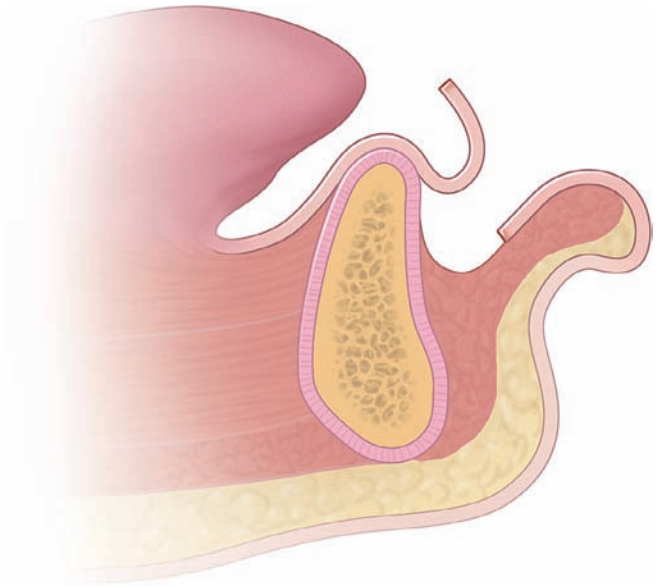


FIGURE 1-5 B, Incision for ridge extension for removable dentures is made far out into the lip. For implant-retained overdentures, the goal is to move the mobile, unattached gingiva from the abutments, not from the ridge extension. The incision is made, and a mucosa-only flap is raised superficial to the underlying mentalis muscle.

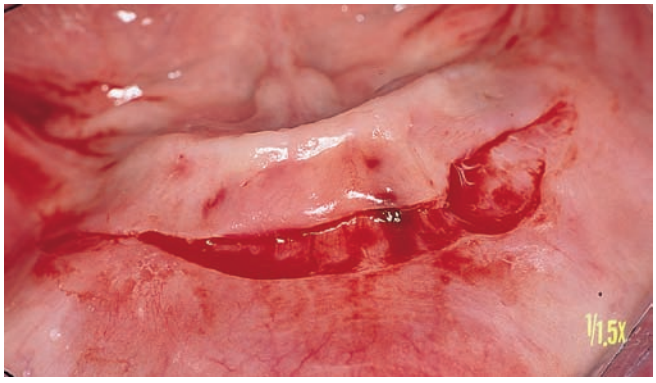


FIGURE 1-5 C, Incision is made with a #15 blade through the mucosa-only flap without incising the underlying mentalis muscle.

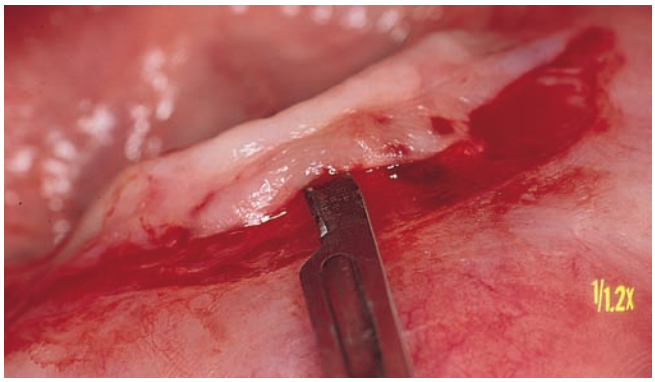


FIGURE 1-5 D, The scalpel blade is turned parallel to the muscle fibers, and a mucosa-only flap is raised sharply.

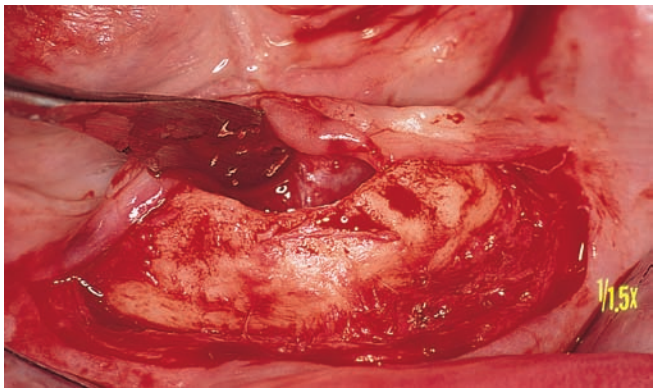


FIGURE 1-5 E, After the mucosa-only flap has been elevated to the crest, a scalpel is used to sharply incise the periosteum on the crest. The periosteum is elevated toward the facial, exposing the facial aspect of the anterior mandible. It is important to maintain 10 to 15 mm of mentalis attachment to the mandible to prevent chin droop. The lingual edge of the periosteum is raised over the genial tubercles.

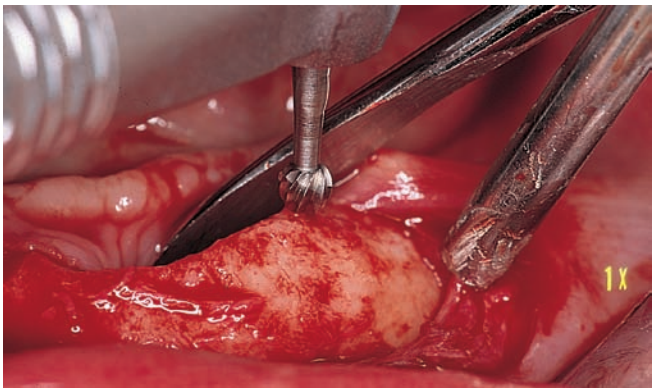


FIGURE 1-5 F, Rongeur forceps are used to mark the implant site. A round bur is used to create the first dimple in the cortex to allow for easy initiation of the pilot bur hole.

mandible with 8 to 12 mm of vertical bone height, the locations of the incisions and implants and the location of the incision for second-stage surgery are critical for successful restoration. The incision for placement should be made in such a way as to avoid loss of KG. Therefore, an incision placed at the anterior border of the mandibular alveolar

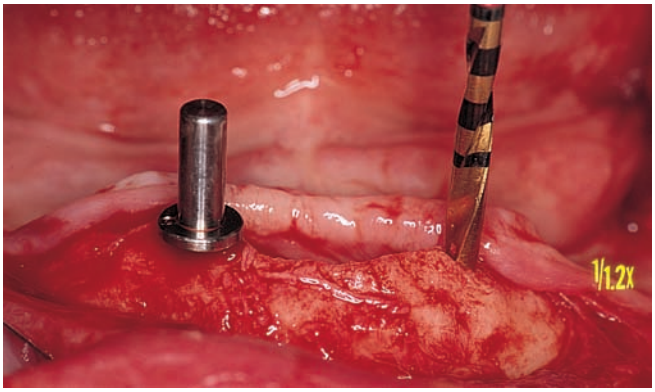


FIGURE 1-5 G, A pilot bur is used to initiate the implant site. Parallel guide pins are placed to aid in parallel implant site preparation.

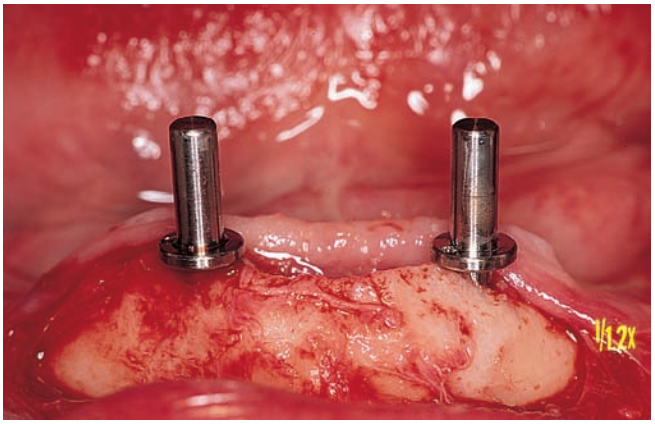


FIGURE 1-5 H, Parallel pins indicate the position of the implants. The next-sized drill is used with a guide pin in place.

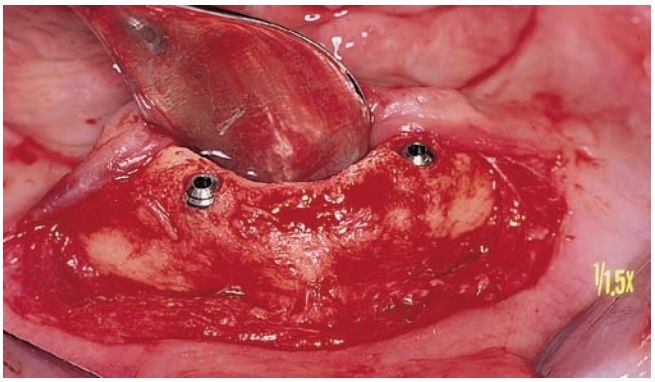


FIGURE 1-5 I, The implants are in position.

crest, typically labial to the KG, allows for adequate dissection. Often in a patient with an atrophic mandible, the thin band of KG is positioned lingually. Attempts to enlarge the band of attached KG have not been greatly successful because the lip muscles tend to displace the graft from the host bed. The implants must be placed slightly lingual to the crest of the ridge and thus lingual to the attachment of the muscles. If they are flared toward the labial, chronic irritation from the labially flared implants will be a constant source of soreness and will result in an unhappy patient. At the time of exposure, the thin band of KG

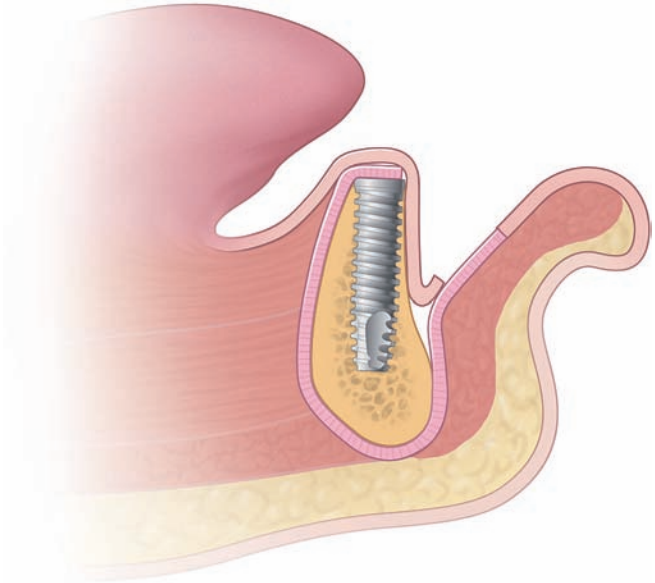


FIGURE 1-5 J, After the implants have been placed, the anterior edge of the mucosa-only flap is sutured in the depth of the vestibule. The sutures are placed to reapproximate the lip mucosa over the implants and to provide a barrier to the migration of muscle superiorly.

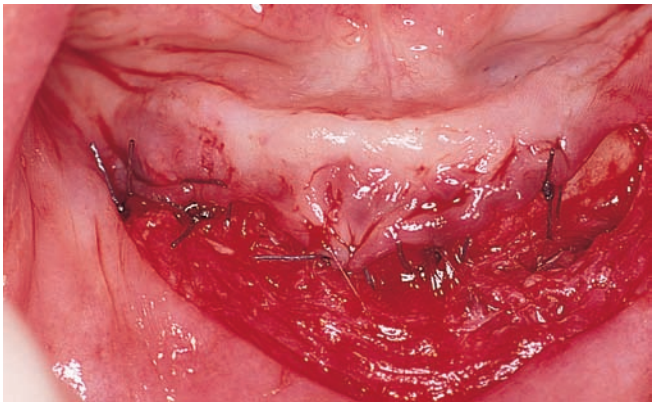


FIGURE 1-5 K, Resorbing sutures such as 4-0 chromic can be used in a horizontal manner to retain the lip mucosa to the depth of the vestibuloplasty site.

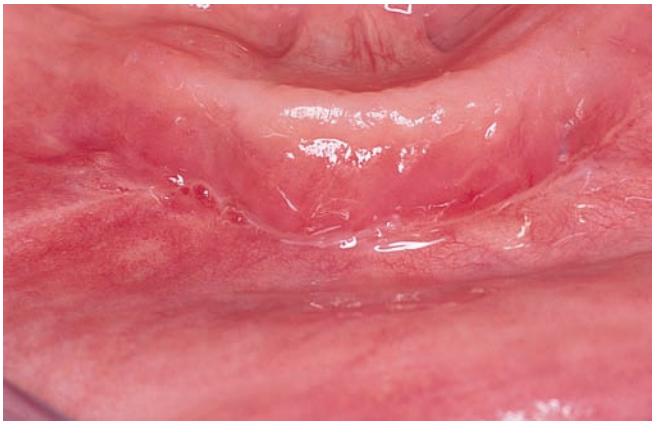


FIGURE 1-5 L, Three-wefi follow-up photograph shows healing of the site.

should be bisected and transposed labially, resulting in KG along the labial surface of the abutments.

For mandibles with a vertical bone height greater than 12 mm, the incision for placement may be made either on the crest or in the vestibule, depending on the location of the muscle attachments. An incision bisecting the KG allows the surgeon the luxury of knowing that the KG will remain on the labial surface of the implant abutment if the incision breaks down prematurely. Premature breakdown of the incision can occur for several reasons, including excessive pressure from the removable prosthesis, a supracrestal profile of the implant with the cover screw in place, surgical trauma to the tissues, or poor tissue quality and poor healing. If the alveolar crest is thin, with the band of KG over the thin portion of the crest, bisecting the KG may make dissection of the flaps difficult because the gingiva will be thin over the thin crest. Careful planning of the incisions and technical dissection without trauma promote long-term gingival health.

A local anesthetic, typically 1% or 2% lidocaine with 1:100,000 epinephrine, is infiltrated into the labial and lingual tissues. Infiltration includes the labial aspect of the inferior border of the mandible, the lingual cortical plate (to anesthetize branches of the mylohyoid nerves), and along the crest. Infiltration anesthesia on the crest creates a hydropic dissection, which aids in the subperiosteal dissection. Bilateral inferior alveolar nerve blocks are not necessary.

After several minutes have elapsed to allow the anesthetic to take effect and to be absorbed in the tissues to reveal the pre-injection anatomy, an incision is made. Typically, a #15 blade is used.

Crestal Incision and Dissection. The crestal incision should bisect the band of KG. Bisecting the KG is important because this prevents a potential soft tissue problem if the incision opens during the healing period. The incision should extend along the alveolar crest posterior to the mental foramen. When the mental foramen is on top of the crest, secondary to severe bone resorption, the incision should be stopped anterior to the foramen. After the periosteum has been reflected, the mental foramen is visualized, and the crestal incision then can be extended posteriorly along the lingual crest; this prevents trauma to the nerve. Occasionally, vertical release incisions can be used posteriorly. A midline vertical release incision is avoided because it causes increased patient discomfort during the first 2 wefis of healing.

After the incision has been made through the periosteum to the bone, a periosteal elevator is used to reflect subperiosteal flaps both labially and lingually. A clean subperiosteal dissection is important because it results in minimal bleeding, and lingual blood vessels can be avoided. If muscle attachments are found inserting into the crest, the surgeon severs them cleanly with a scalpel rather than tearing them, which can increase bleeding and trauma to the soft tissues.

Reflection of the labial tissues can be tedious because of the firm attachment of the dense, fibrous alveolar crestal tissue or if the ridge is narrow. Great care must be taken to raise an intact flap without multiple tears.

A lingual reflection is performed to allow the surgeon direct visualization of the lingual cortex, which also allows proper angulation of the implant parallel to the lingual cortex, if appropriate, and avoids implant perforation of the lingual cortex. The labial reflection includes reflection of a portion of the mentalis muscle to allow for proper visualization of the contours of the labial cortex. A limited reflection prevents the surgeon from seeing the bone contours and results in implants placed through the cortical plates rather than within them. The surgeon should be able to look directly over the alveolar crest, seeing both cortical plates. It is useful to visualize the implant surgery and anticipate any adverse problems. After the bone is exposed, the implants are placed according to manufacturer's recommendations. Review of cross-section images from the cone-beam scan may result in less tissue reflection because of prior knowledge of the anatomy.

Vestibular Incision and Dissection. Vestibular incision and dissection is the approach recommended to relocate the mentalis muscle from the alveolar crest, anticipating the ultimate location of the prosthesis and abutments (see Figure 1-5). The incision typically is placed 5 to 10 mm from the junction of the attached and unattached gingiva. The incision is made through mucosa, not into the underlying muscle. The incision extends from the approximate location of the mental foramen in the vestibule. The incision is made with a #15 scalpel blade and is kept superficial to identify branches of the mental nerves. Direct visualization of the branches of the mental nerve allows a meticulous dissection superficial to these nerves and prevents paresthesia.

After the mucosa has been incised, a mucosa-only flap is carefully dissected from the underlying muscle using either a scalpel or small scissors. The mucosa-only flap is elevated until it reaches the junction of the attached and unattached gingiva. At this location, an incision is made through the periosteum to the alveolar crest. The periosteum is reflected toward the lingual, with the overlying mucosa-only flap attached to the periosteum to expose the lingual aspect of the mandible. The mucosal flap is kept attached to the lingual mucosa and therefore is lingually based. The labial periosteum then is elevated from the bone with a periosteal elevator to expose the labial cortex. The extent of reflection is similar to that described previously for the crestal incision. After the bone has been exposed, the implants are placed according to the manufacturer's recommendations.

Placement of Implants.

Two Implants. In general, when two implants are to be placed for an overdenture, the surgeon should consider the potential need for additional implants at a later time; for example, the patient may decide to change from a tissue-borne prosthesis to an implant-borne prosthesis. Some patients prefer the overdenture prosthesis, but they may complain of food being caught under the denture and the mobility of the prosthesis when they are speaking, swallowing, or chewing. They also may want to eliminate the need to change clips or O-rings. For patients who desire the retention of a fixed or fixed-removable prosthesis, two or three additional implants may be placed, resulting in four or five implants in the anterior mandible, which will sufficiently support an implant-borne prosthesis. In light of this consideration, when placing two implants into the anterior mandible, the surgeon locates the implants 20 mm apart, each 10 mm from the midline of the mandible, to allow for later implant placement if needed. A caliper is set at 20 mm, and these locations are marked with rongeur forceps or a round bur (see Figures 1-4 and 1-5).

The labiolingual location of the implants in the crest is critical to the patient's long-term comfort. The implants must be located so as to prevent soft tissue irritation, which can occur if the implants are placed too lingual into the mobile tissue of the floor of the mouth or too labial, causing the mobile mentalis musculature to rub continually against the abutments of the implants, creating chronic problems. Ideal placement of the implants, in the center of the crest, is essential to ensure that the restoration is comfortable for the patient (Figure 1-6 and e-Figure 1-1).

The ridge of the mandible may be uneven or may have sharp contours. This author uses rongeur forceps to reduce the crestal bone when it is thin, sharp, or uneven. The use of rotating burs to reduce the ridge crest may result in bone trauma, with resultant bone loss around the implants. In addition, the rongeur forceps can be used to take a small

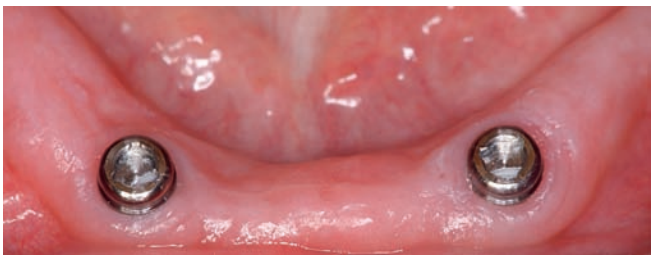


FIGURE 1-6 A, Locator-type attachments have a low profile yet provide retention of the patient's tissue-borne denture. (Biomet 3i, Palm Beach Gardens, FL.)

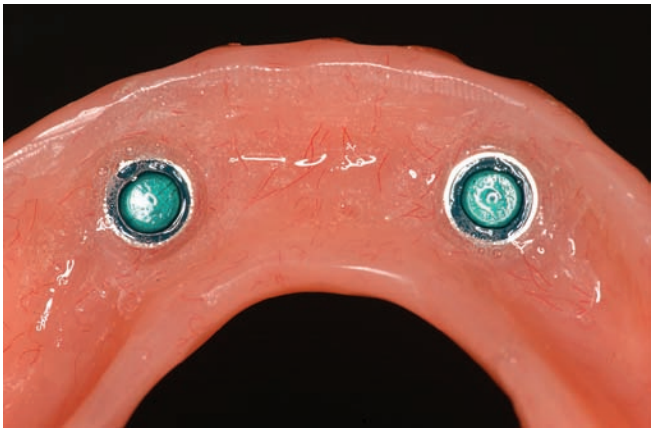
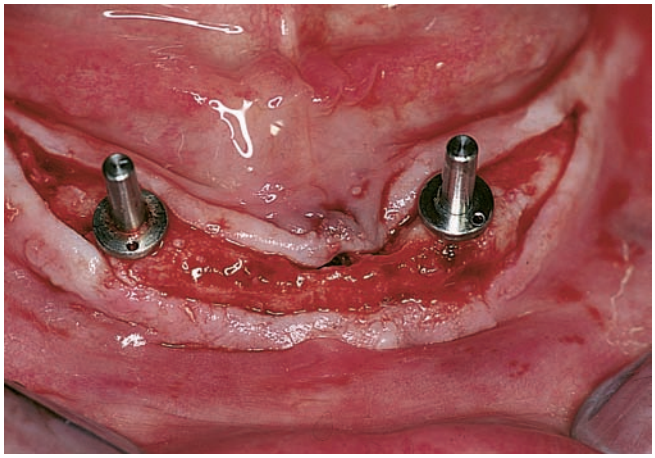
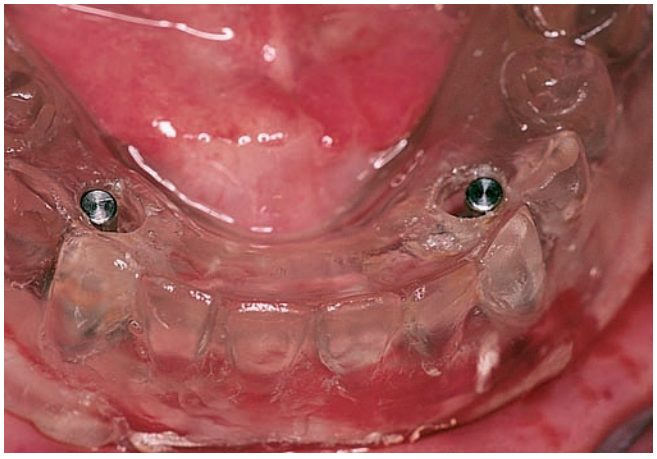


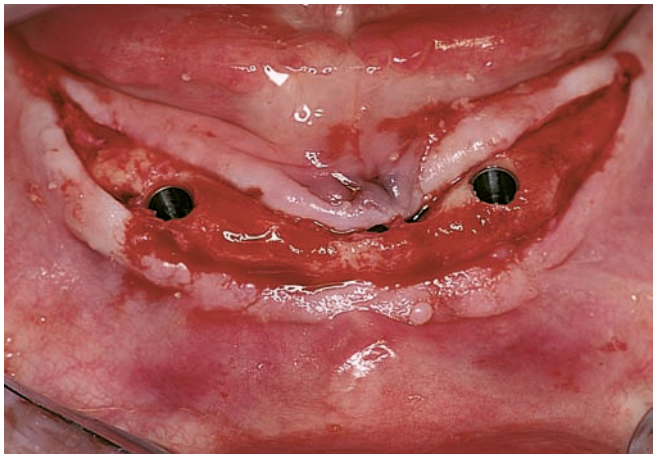
FIGURE 1-6 B, The patient's denture has inserts, which can be picked up by the dentist using a relatively simple protocol. Matching the parts in the denture to the attachments in the mouth, which are screwed into the implant, provides retention as an implant-assisted overdenture. The attachments can be retrofitted into an existing denture.



E-FIGURE 1-1 **A,** Two implants for O-ring retention of an overdenture prosthesis are planned. A crestal incision is made, bisecting the keratinized gingiva. The locations of the implants are determined by using a surgical stent, which is a duplicate of a denture setup approved by the patient.



E-FIGURE 1-1 **B,** Parallel pins can be seen through the holes made in the surgical guide stent.



E-FIGURE 1-1 **C,** Implants in place. O-ring attachments will be placed after the implants have integrated.

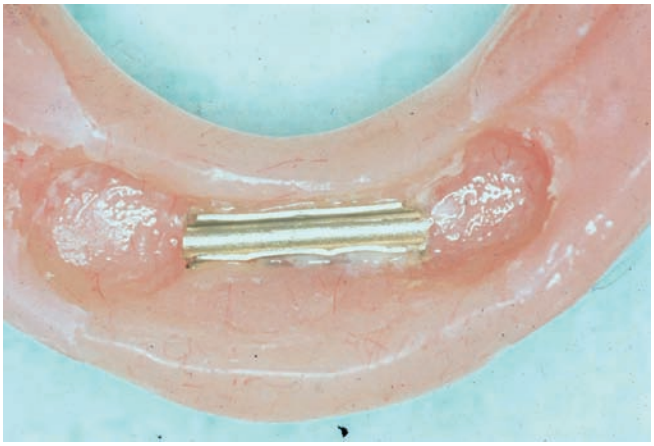


FIGURE 1-6 C, Bar fabricated on two implants. This bar has been in function for 20 years, is easy to clean, and rarely requires soft tissue reduction.

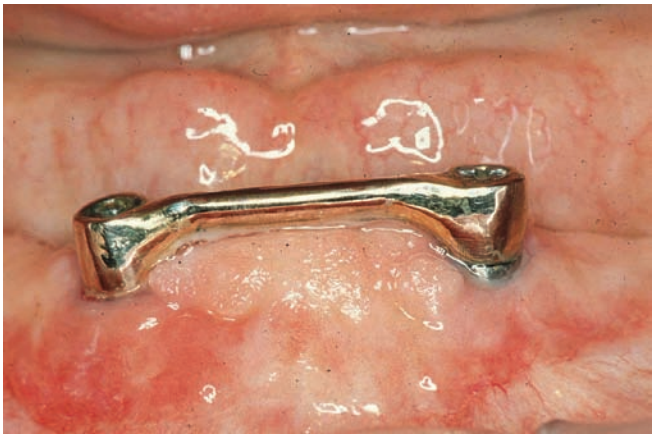


FIGURE 1-6 D, Retentive clip within the denture, which allows for rotational stress breaking when the patient chews on the posterior portion of the denture. This clip may need to be replaced yearly.

"bite" from the ridge, creating a small depression that can be easily engaged with the round bur and subsequent pilot drills. Adjacent bone can be removed with the forceps, creating a smooth transition from the implant site to the crest without an unusually tall segment of bone between the implants. The round bur then is used to mark the implant locations, which are placed after the caliper measurements have been confirmed.

After the round bur has been used to mark the sites, the initial drill approximately 2 mm in diameter, depending on specific implant system, is used to create the first site. The surgical guide stent, if available, is used for the surgery. A parallel or guide pin is placed into the prepared hole, and the angulation is checked to ensure that the anteroposterior and medial-distal inclinations are appropriate. The surgeon needs to move to view the guide pin's orientation from in front of the patient and from the side to make sure the implants are not canted. The surgical guide, if available, is placed into the mouth to confirm that the implants are within the eventual denture base. If the patient has maxillary teeth or a denture, the mandible is closed gently to ensure that the implants are placed within the contours of the incisive edges of the maxillary teeth, not labially. After the correct angulation of the implant preparation has been confirmed or after any necessary changes have been made, the second site is prepared with the pilot bur in the proper axis.

A second guide pin is placed. Careful examination should confirm that the implants would be satisfactory when placed in these positions at these inclinations. The remaining sequence of burs is used as recommended by the manufacturer. If angulation changes are necessary, the next bur, which typically is 2.7 or 3.2 mm in diameter, can be directed to correct the angulation of the implant.

It is important to place the implant at the correct depth in relation to the alveolar crest. If the implant is placed such that the cover screw is superficial to the adjacent bone, creating a small bulge under the gingiva, incisional dehiscence or mucosal breakdown may occur if the patient chews with a temporary prosthesis. An advantageous technique is to place the implants into the anterior mandible so that they are countersunk sufficiently to allow the height of the cover screw to be considered; this results in a flush relationship with the adjacent alveolar bone. This placement, however, may be contraindicated for specific types of implants. The surgeon should follow the guidelines for the specific implant system. For one-stage implants, temporary healing abutments are placed as recommended by the manufacturer.

The anterior mandible may have a dense cortical plate with abundant marrow space, or it may have minimal marrow with an abundance of cortical bone. A smaller or thinner mandible has more cortical bone and less cancellous bone. When dense bone is encountered, it is important to clean the drills often during the drilling sequence to keep the cutting surfaces clean and unclogged during preparation of the implant site. For placement of implants into dense bone, a thread former (tap) is used to create threads in the bone. For self-tapping implants, the surgeon may need a slightly larger bur than customarily used in other areas of the mouth. For example, rather than using a 3-mm drill before self-tapping a 3.75-mm implant, the surgeon may need to use a 3.25-mm drill to achieve greater ease of implant insertion into dense bone. This is implant system specific.

If a crestal incision has been used, the incision is closed with atraumatic needles. Sutures may be resorbable or nonresorbable, depending on the clinician's choice. If a vestibular incision has been used, the edge of the vestibular mucosa is sutured into the depth of the vestibule on the edge of the periosteum. This leaves a denuded portion of the lip vestibule, which must heal by secondary intention. A resorbable suture can be used. Typically, 4-0 chromic sutures work well in this area and resorb with minimal inflammation.

Four or More Implants. When four or more implants are to be placed into the anterior mandible, the incision design is the same as that used for two implants. The subperiosteal reflection should be sufficient to expose the lingual and labial cortices and the mental foramen bilaterally. With the use of cone-beam scanning, less reflection is necessary because of

the excellent preoperative knowledge of the shape of the mandible. After completion of the periosteal reflection, the surgeon has an excellent view of the operative site, the contours of the bone, and the location of the mental foramen.

The mental foramen is used as the landmark for locating the distal implants. A caliper is used to mark the alveolar ridge no less than 5 mm anterior to the mental foramen. This distance usually is the anterior extent of the nerve as it loops forward in the bone before exiting at the mental foramen. The extent of anterior "looping" can be easily seen by using the axial images from the cone-beam scan. It is critical to examine the radiographs carefully to confirm the extent of the anterior loop of the nerve within the bone. A small nerve probe can be placed into the mental foramen; however, this procedure is reserved for clinicians with experience in handling sensory nerves.

A small, round bur is used to make a depression in the bone to locate the implant site on one side of the mandible. A similar mark is placed on the opposite side of the mandible no less than 5 mm anterior to the mental foramen. The caliper then is set to 7 or 8 mm, and the next implant locations are marked in a similar manner anterior to the two distal locations. If a fifth implant is to be placed, a mark is made in the midline of the mandible. Using the caliper, the surgeon places the implant bodies a sufficient distance apart to ensure adequate space for restoration and hygiene (Figure 1-7; see the companion site for the complete case). For 4-mm-diameter implants, 7 mm of space center to center results in 3 mm of distance between the bodies of the implants.

After the implant locations have been identified, the first drill in the implant drilling sequence is used. If available, a surgical stent is placed to locate the implants correctly in relation to the teeth. For class III mandibles, the implants can be angled slightly lingual; for class II mandibles, the implants can be angled slightly anteriorly; for class I mandibles, the implants are placed vertically in relation to the inferior border of the mandible. Regardless of the angulation of the implants, the crestal location of each is the same: the implants exit the crest midcrestally without excessive labial or lingual location.

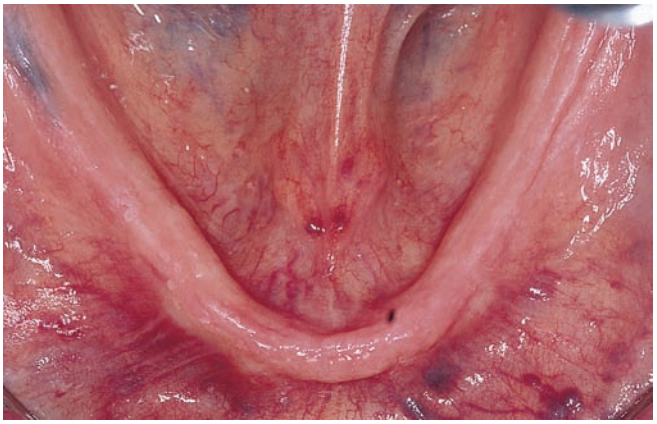


FIGURE 1-7 **A,** Surgical guide directs the placement of five implants for a hybrid denture.

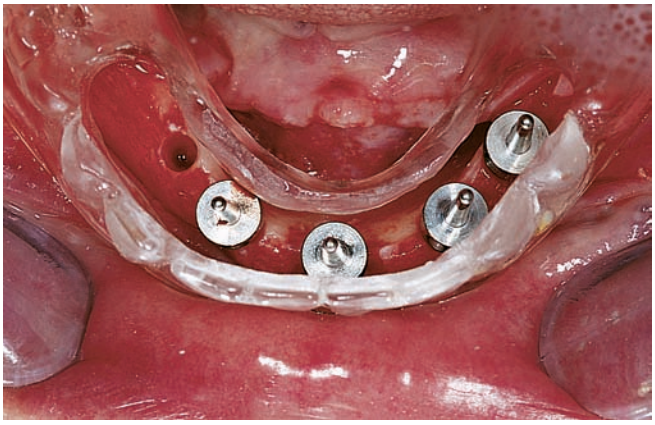


FIGURE 1-7 **B,** Crestal incision is made through the keratinized gingiva (KG). Implant sites are prepared. Guide pins are placed in holes 3 mm in diameter.

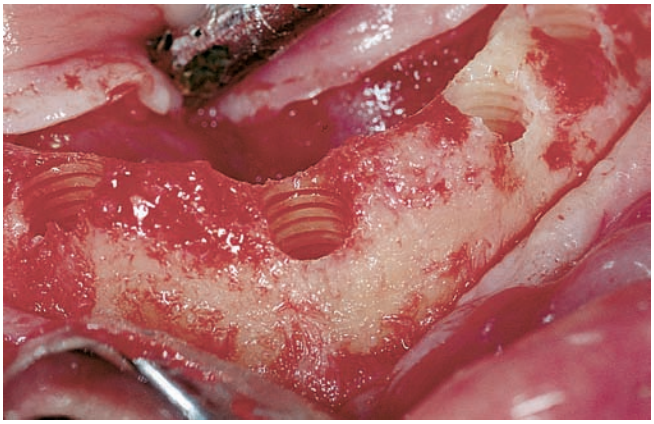


FIGURE 1-7 **C,** A thread former is used to create threads in the bone. This procedure is performed when the bone is quite dense for atraumatic implant insertion.

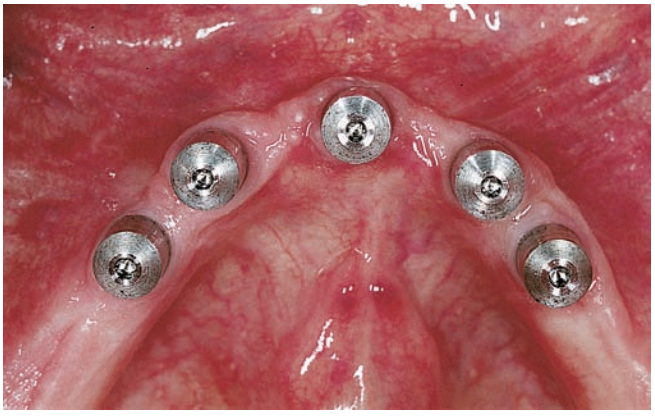


FIGURE 1-7 **E,** After 4 months of healing, the implants are exposed by bisecting the KG and transposing them labially. These healing abutments are shown 3 wefis after exposure.

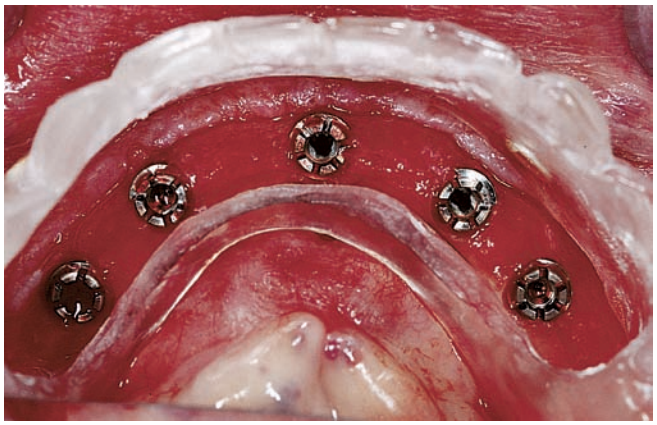


FIGURE 1-7 D, Implants are placed. Driving mounts are removed, showing the implants in position. For a hybrid denture, the implants can be placed in the embrasure spaces because of the nature of the prosthesis. The implants are placed slightly lingual to the crest.

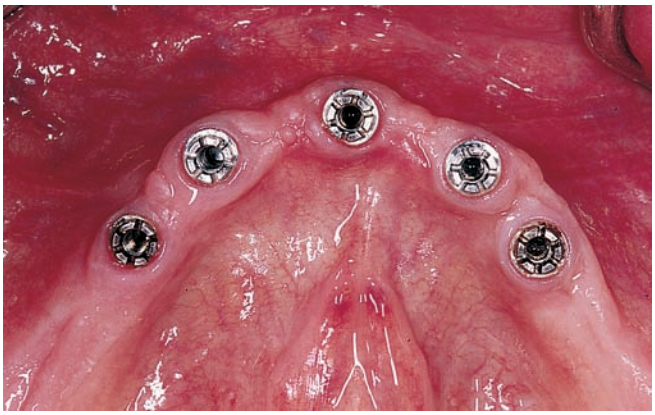


FIGURE 1-7 F, Soft tissue around the implants is ready for final impressions and fabrication of the final prosthesis.

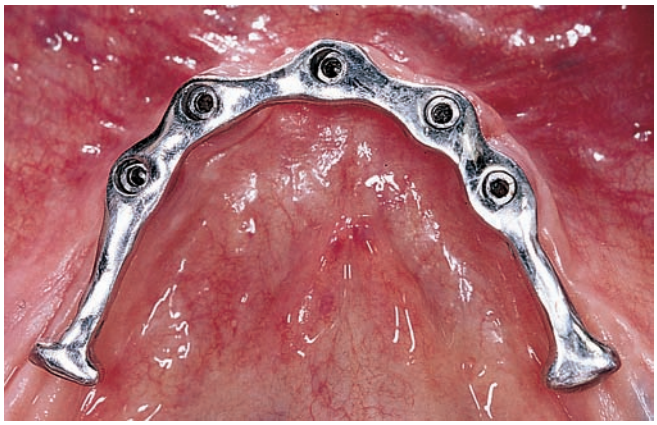


FIGURE 1-7 G, Occlusal view shows the bar that connects the implants and the cross-arch that stabilizes them.

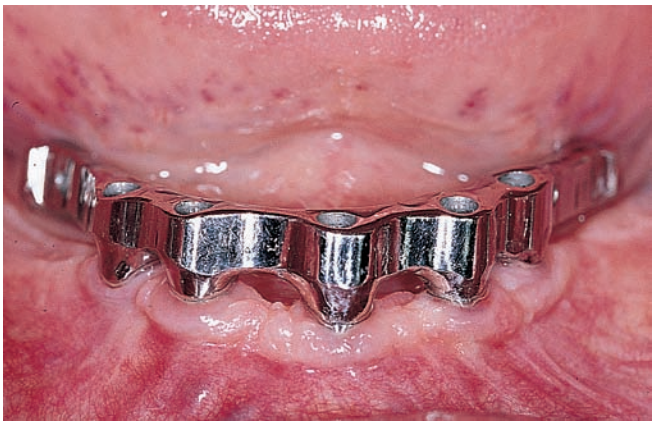


FIGURE 1-7 H, Frontal view of the bar, which is thick and rigid. Posteriorly, small holes are shown in the bar, which will be engaged by a type of plunger-locking mechanism (i.e., SwissLoc NG).

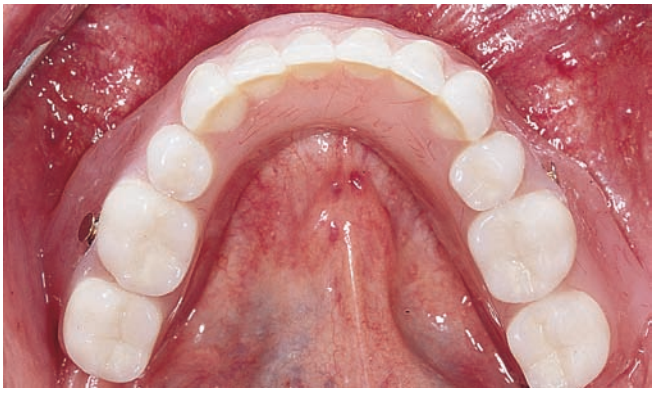


FIGURE 1-7 I, Occlusal view of the restoration; note the natural contour of the restoration.

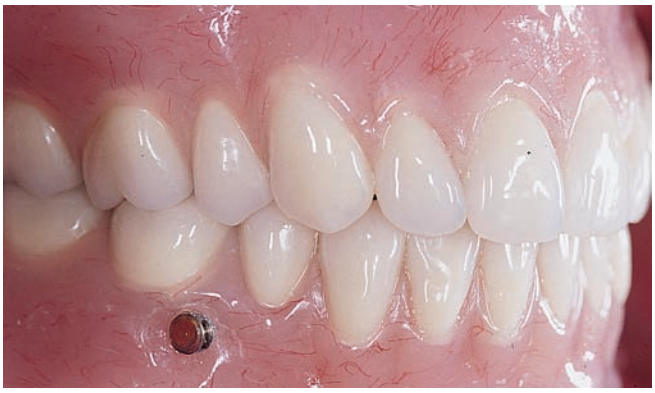


FIGURE 1-7 J, Lateral view shows the final restoration with the SwissLoc NG engaged into the bar, resulting in a restoration that is fixed, removable, and implant borne. (Prosthetics by Dr. Sean McCarthy and Dr. Tom Salinas.)

Parallel, or guide pins are placed after each pilot drill has been used to confirm the angulation of the implants in the anteroposterior and left-to-right planes. Small errors can be handled during the progression to the next-sized drills.

Common Clinical Situations. It is common practice to place implants in the anterior mandible soon after dental extractions. Waiting until the bone has healed within the extraction site is one option. However, patients often prefer to wear a transitional removable denture for the shortest time possible.

If the patient has purulent exudate or significant soft tissue hyperplasia and erythema, then the teeth are removed, the bone smoothed conservatively, and the gingiva closed. After the gingiva heals and there are no signs of infection, implants can be placed as early as 2 wefis after the teeth have been removed. If grafts are placed within the sockets, then 3 to 4 months are allowed for bone consolidation before implant placement. To eliminate or decrease soft tissue pathology, the patient can have an oral prophylaxis performed before tooth extraction. The implants can be placed at the same time as tooth removal if there is no purulent exudate present. If the treatment plan chosen does not include immediate implant-borne fixed provisionalization, then the implants should be countersunk slightly to avoid perforation through the gingiva when the patient wears an immediate denture. The ideal scenario is to have the patient delay denture use for 2 wefis after edentulation. However, because of social concerns, patients will wear an immediate denture, which will require the usual adjustments for 3 to 4 wefis before the patient is comfortable.

Dissection of the periosteum may be tedious wefis when performed after extractions, especially if the extractions involved a few remaining teeth (e.g., only the canines). The soft tissue invaginations into the extraction sites must be carefully elevated without tearing the flap. The crestal bone irregularities are reduced to ensure that all implants exit the crest at the same vertical level. Canine teeth may be larger than the diameter of the implant. In these cases, the bone height may have to be reduced, a larger-diameter implant may need to be placed, or defects between the implant and the remaining bone may need to be grafted. Reducing the bone with a rongeur forceps is a simple method of dealing with this problem. The implants also may need to be countersunk an additional 1 to 2 mm because of expected crestal bone loss from normal remodeling of the extraction site (Figure 1-8; see the companion site for the complete case).

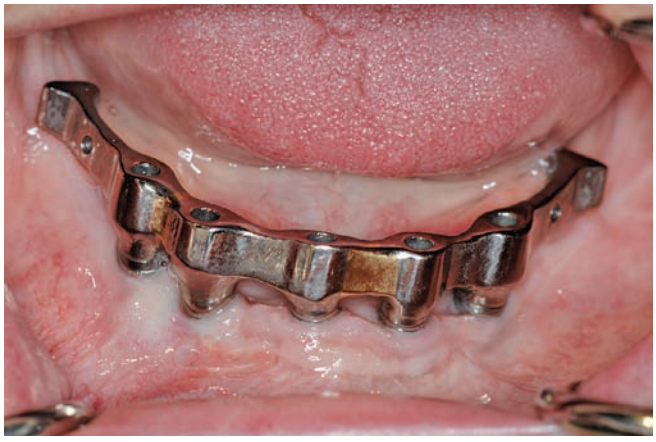


FIGURE 1-8 F, A precision bar is fabricated. This is a different patient with five implants retaining a precision bar with 15 years follow-up.

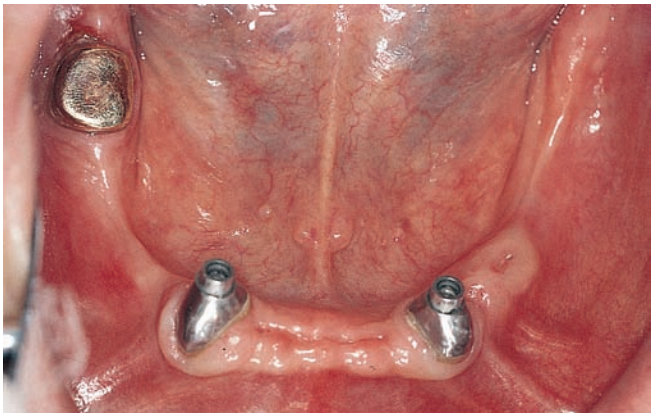


FIGURE 1-8 A, Treatment for this patient includes a four-implant, bar-retained denture. Because the teeth have secondary decay below the crest, the plan includes their extraction and simultaneous placement of four implants in a one-stage approach. The preoperative panoramic radiograph shows sufficient bone for 15-mm implants.

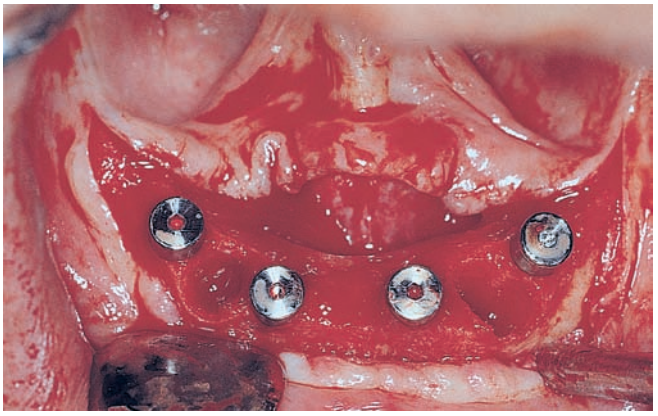


FIGURE 1-8 B, Crestal incision is made, and the teeth are extracted. Because of the size of the root and the large defects after the extraction, four implants are placed, avoiding the extraction sites. Bone removed from the drills is placed into the extraction sites. A healing abutment is placed for a one-stage implant system with closure around the implants without covering them.

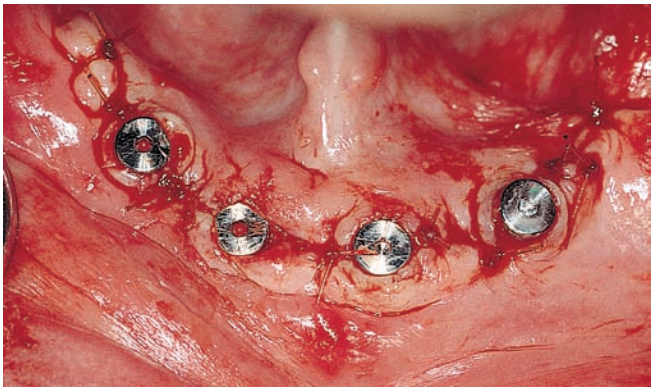


FIGURE 1-8 C, The incision is closed around the implants.

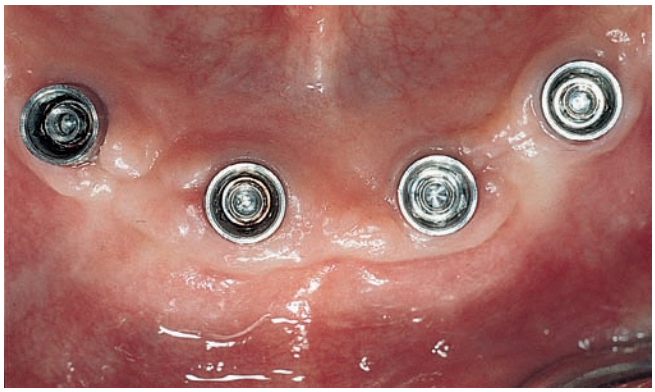


FIGURE 1-8 D, After healing, the prosthetic abutments are placed. Excellent soft tissue contours are shown.

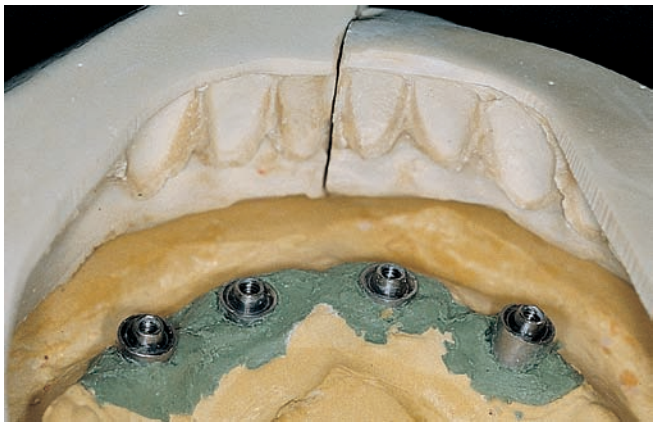


FIGURE 1-8 E, An impression was made and the implants transferred to a master cast. The planned tooth setup as a matrix allows for bar design with the final tooth position guiding the shape of the bar. The bar then is milled.

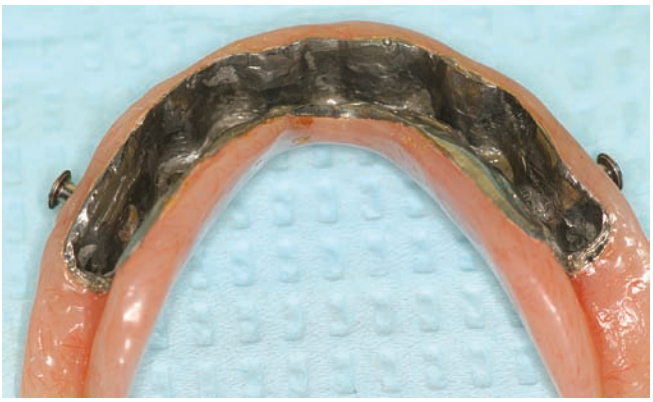


FIGURE 1-8 G, The prosthesis has a metal framework made to mate with the precision bar using retentive Swing-Lock attachments for this fixed-removable prosthesis.

Another common clinical situation is the isolated bone defect secondary to excessive bone loss from periodontal disease on one or more teeth. The flap is raised, and a definitive bone defect is noted. The thin ridge can be reduced in height until sufficient bone width is available, or a small-diameter implant can be placed in an isolated site with wider implants placed in the other sites. Documentation is necessary so that the restorative dentist can understand the unique location of the implant. For an isolated vertical defect, the implant can be placed at the level of the bone defect. The remaining implants also can be placed at that depth, which requires removal of crestal bone. It is advised to avoid placement of one implant several millimeters lower than the remaining implants because this causes difficulty with restorative procedures. The depth difference is limited to 2 mm, which can be easily handled by using abutments of different lengths.

Prior Hydroxylapatite Augmentation. Patients who have had previous hydroxylapatite (HA) augmentation can receive implants (e-Figure 1-2). The preoperative evaluation of these patients should attempt to determine the amount of native bone inferior to the HA. If more than 10 mm of native bone is present, the HA can be removed if it is not impregnated with bone. If the HA ridge augmentation was performed 5 or more years before the proposed implant surgery, the HA ridge may be totally encased in bone. If the HA augmentation is more recent, the HA particles may be removed easily because mostly fibrous tissue will be holding the particles in place.

A crestal incision is made, and the tissues are reflected at the level of the HA augmentation. Care must be taken to avoid branches of the mental nerves that may be within the augmentation in the region of the mental foramen and slightly anterior to it. As necessary, the HA particles can be removed with forceps; if encased with bone, however, the implants are placed through the HA and bone mass into the native mandibular bone. A diamond bur must be used to create the implant sites until the final-diameter drill is needed. After the implant has been placed, a normal or slightly longer healing period is recommended.

Augmentation of the Atrophic Mandible

General Considerations

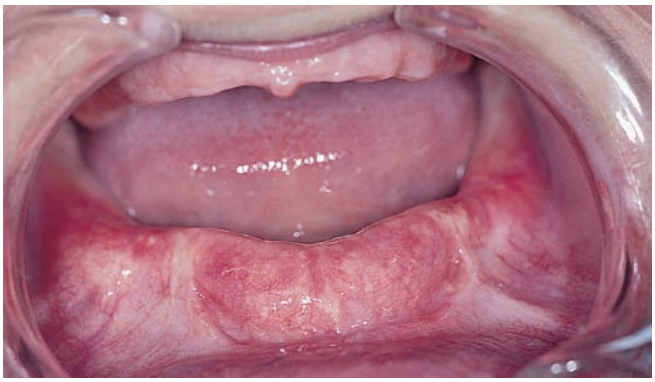
Augmentation of the atrophic mandible for eventual placement of dental implants begins with an assessment of the patient's general health and an accurate assessment of the height of the anterior mandible. Patients who are debilitated and would not do well with bone graft harvesting from the iliac crest should not have the mandible augmented. If the patient is healthy, the procedure of harvesting a bone graft is a reasonable approach when there is less than 8 mm of bone height present in the anterior mandible. Patients with a bone height greater than 8 mm can do well with implants without bone augmentation.

The decision to perform bone augmentation in the patient with 8 to 12 mm of bone height is subject to other factors, such as the patient's age and the opposing dentition. The patient with a long life expectancy is more likely to have a long-term benefit from restoration of the mandible to 15 mm of vertical height. However, this has not been proven by clinical prospective studies. Some clinicians believe that the patient with an intact, natural opposing occlusion may place more force on the mandible than a patient with opposing dentures. Therefore, for a patient with an opposing natural dentition, clinicians may be more prone to perform bone grafting in the atrophic mandible. However, the rationale is anecdotal and not well studied in clinical trials. In general, if the clinician can place 10-mm-long implants, then there are minimal reasons to augment the mandible. There are posttraumatic or postablation patients who when reconstructed with bone, including fibular grafts, may benefit from vertical augmentation to provide a vertical ridge form that can have a ridge extension surgery.

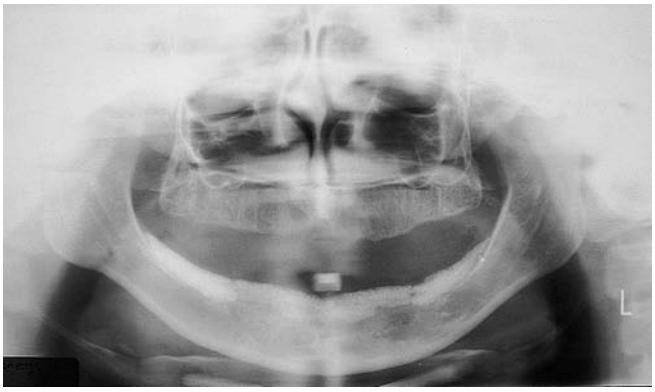
In the past, clinicians were prone to use iliac crest corticocancellous blocks to augment the anterior mandible. A hip graft harvest is now reserved only for the extremely thin mandibles. Otherwise, tenting procedures, the application of mesh to retain a graft, the use of titanium reinforced membranes, all with recombinant bone morphogenetic protein (BMP) combined with allograft, work well.

Intraoral Incision and Placement of Autogenous Corticocancellous Bone Grafts

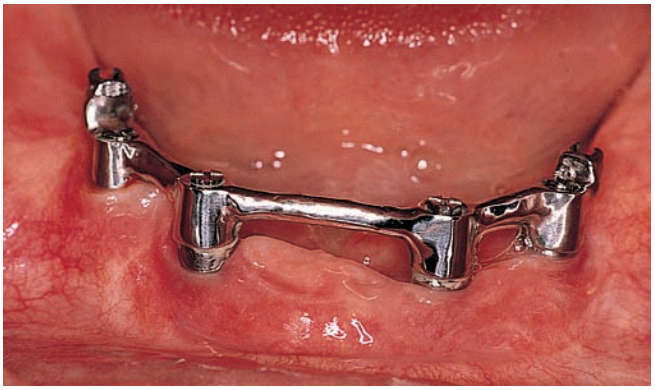
Intraoral incisions for the placement of blocks of bone can be made either crestally or within the vestibule. The crestal incision places the incision over the bone graft, but it also offers the surgeon a better chance of preventing incisional d›iscence secondary to vascular insufficiency. A vestibular incision places the incision away from the bone graft; however, blood supply to the edge of the vestibular incision travels through the dense, fibrous tissue over the crest and thus may be prone to breakdown secondary to vascular insufficiency. Both intraoral incisions and their subsequent release result in obliteration of the vestibule, which then requires secondary soft tissue grafting. It should be noted that



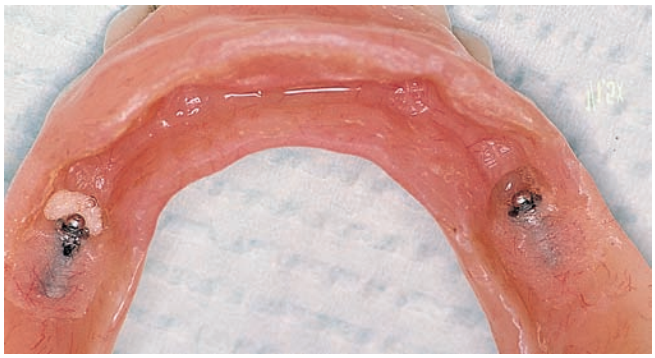
E-FIGURE 1-2 **A,** This 50-year-old woman had a full arch hydroxylapatite (HA) augmentation 4 years before sefiing additional retention of her mandibular denture. The treatment includes removal of the anterior HA augmentation and placement of four implants for a tissue-borne overdenture.



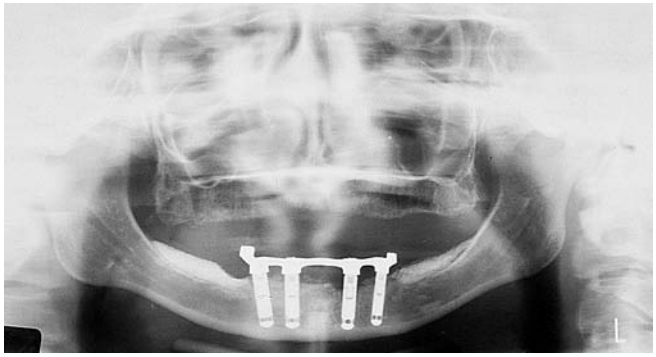
E-FIGURE 1-2 **B,** Preoperative panoramic radiograph shows sufficient bone available without the need to retain the HA augmentation. A crestal incision is made, the HA augmentation is removed with rongeur forceps, and the implants are placed.



E-FIGURE 1-2 **C,** Four months after placement, the implants are exposed, and a bar is made using ASC52 vertical stress-breaking attachments.



E-FIGURE 1-2 **D,** Inner aspect of the denture has the attachments for the ASC52 stress-breaking attachments.



E-FIGURE 1-2 **E,** Patient has complained of difficulty cleaning her implants on the right side. To alleviate this problem, additional HA is removed to provide adequate space for cleaning. The radiograph shows a 15-year follow-up image. (Prosthetics by Dr. Larry McMillen.)

the mental foramen often is palpable on the alveolar crest, with some portion of the inferior alveolar nerve d›isced from the mandible secondary to resorption of the alveolar crest bone. Because of the high incidence of complications with intraoral incisions for placement of onlay grafts to the mandible, an extraoral incision and dissection is recommended, especially when placing autogenous bone harvested from the hip.

Extraoral Incision and Placement of Autogenous Corticocancellous Bone Grafts

The disadvantages of using an extraoral approach are scarring and difficulty placing implants at the time of graft placement. Most implants are flared to the labial when placed into a bone graft performed through an extraoral incision. The advantages of using an extraoral approach to graft the atrophic mandible are (1) prevention of intraoral incision breakdown; (2) prevention of an intraoral communication with the bone graft and potential infection; (3) maintenance of the vestibular attachments, which may eliminate the need for vestibuloplasty; and (4) ease of reflection of the inferior alveolar nerve from the alveolar crest without incising over the nerve (Figure 1-9).

Before general anesthesia is induced, a marking pen is used to mark an esthetic submental crease, preferably with the patient in a sitting position. Most patients with atrophic mandibles have several creases from which to choose. After an adequate level of general anesthesia has been reached, the skin is prepared with an appropriate skin preparation scrub and solution and then draped. The incision is made, after which a blunt and sharp dissection is made to the inferior border of the mandible. The periosteum is incised at the inferior border of the mandible and elevated carefully over the alveolar crest and genial tubercles. The subperiosteal

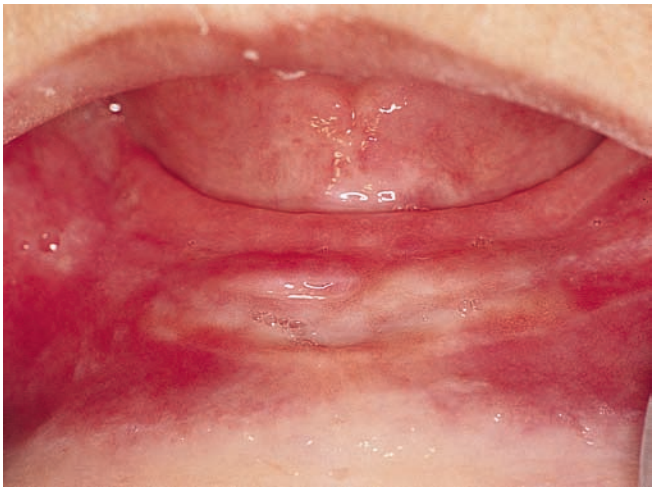


FIGURE 1-9 A, This 50-year-old woman wants added retention for her mandibular denture. Her restorative dentist has asked the surgeon to perform a bone graft because of displacement of the denture from the tongue and floor of the mouth tissues.

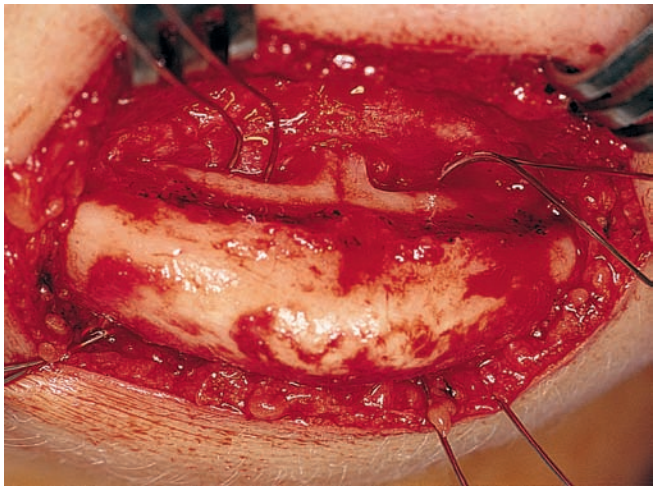


FIGURE 1-9 B, An extraoral approach is used. An incision is made in a submental crease, and the dissection continues to the inferior border of the mandible. The periosteum is raised carefully to avoid intraoral communication. From the extraoral approach, the superior surface of the mandible and the genial tubercles are observed.

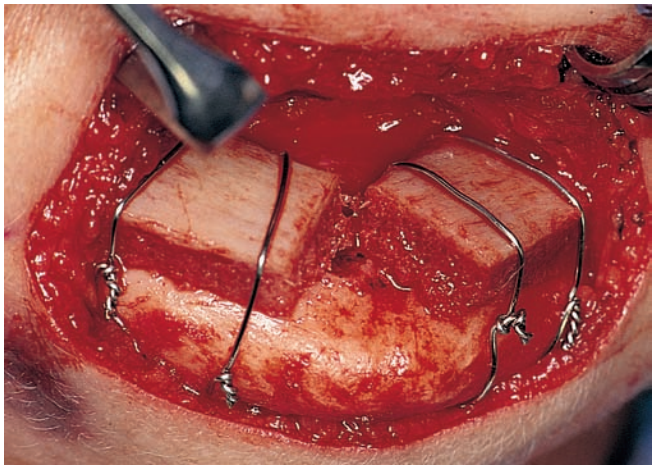


FIGURE 1-9 C, Three blocks of corticocancellous bone are harvested from the iliac crest. Two are trimmed to fit onto the superior surface of the mandible and are held in position by circummandibular wires.

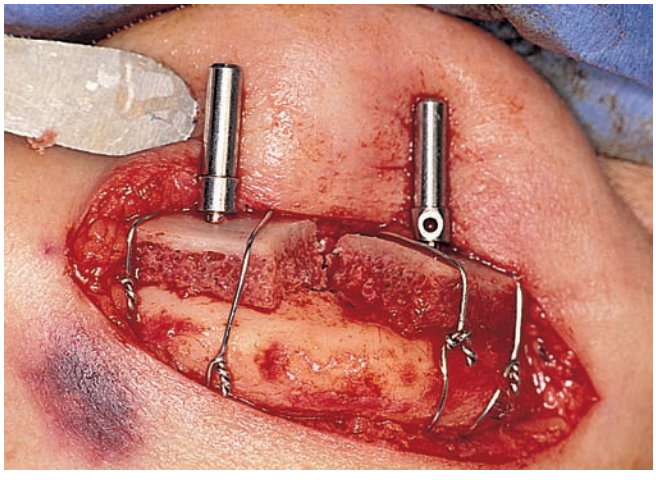


FIGURE 1-9 D, Two threaded implants are to be placed. The parallel guide pins are placed through the extraoral incision with appropriate retraction.

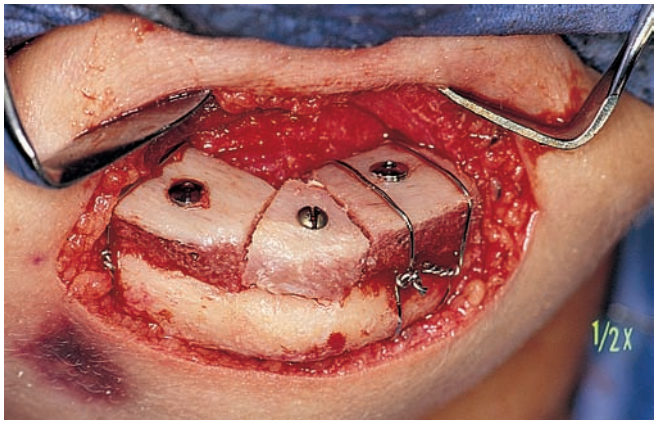


FIGURE 1-9 E, A thread former is used to create threads in the graft and native bone. Two implants are placed. The third block of bone is placed anteriorly. Only one wire is needed to secure one graft.

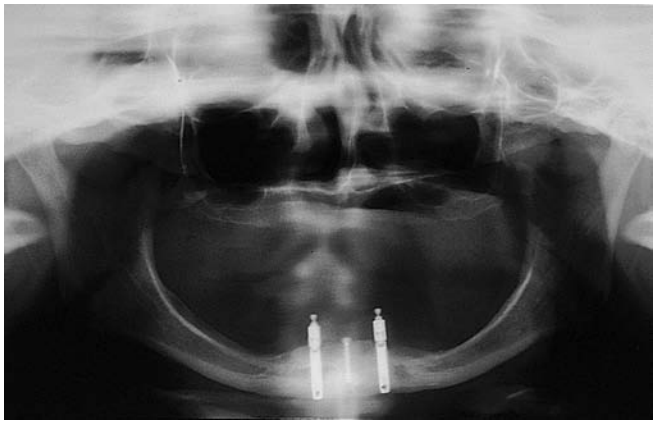


FIGURE 1-9 F, Postoperative panoramic radiograph.

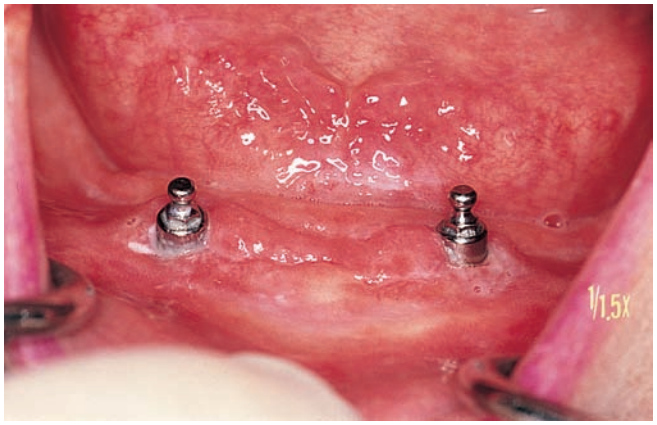


FIGURE 1-9 G, After 6 months, the implants are exposed and restored by O-ring attachments.

dissection is carried posteriorly to expose the superior aspect of the posterior mandible. Great care must be taken to avoid making intraoral perforations while performing the flap elevation. After the periosteum has been elevated, the bone graft is harvested and positioned as previously described. The tissue is relocated to its original position and, if necessary,

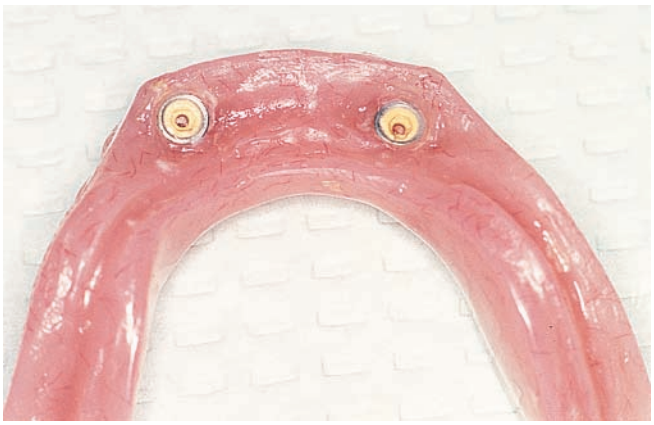


FIGURE 1-9 H, Inner aspect of the denture with the O-ring attachments in place.

released. The incisions are closed in multiple layers, with care taken to perform a plastic closure of the skin. If a tenting procedure is used, the same dissection is used and the implants or tenting screws are placed with the flaps reflected to the lingual, following the same procedure as described.

Implant Placement Into the Augmented Mandible

Most clinicians allow 4 months for healing of the iliac crest corticocancellous bone graft before placing implants. Iliac crest corticocancellous grafts heal well, but they start resorbing after 3 to 4 months. Consequently, the surgeon may need to place the implants at 3 months, depending on consolidation and remodeling of the bone graft, which is determined radiographically. If necessary, a split-thickness dissection can be made intraorally, and a palatal or split-thickness dermis or skin graft can be placed to restore some semblance of a vestibule. At vestibuloplasty, the rigid fixation screws can be removed and implants placed, engaging the inferior border of the mandible. When a vestibuloplasty is performed simultaneously with implant placement, the implants should be countersunk below the level of the periosteum so that the graft can lie flush and is not held off the host tissue bed by the domelike prominences of the implants' cover screws. If meticulous suturing has been performed, a stent may not be necessary; however, if used, the stent should have a soft lining to prevent excessive pressure on the graft and implants.

Placement of Implants Into the Atrophic Mandible without Grafting

Patients with atrophic mandibles with 5 to 6 mm of bone height but less than 10 mm may not be healthy and thus not candidates for bone grafting because of health-related issues. For these patients, four implants can be placed, with 2 mm of the implant through the inferior border of the mandible and, as necessary, 2 mm supracrestal. It is important to prepare the bone gently and to pretap the implant sites because the mandible may be brittle, have minimal blood supply, and are

prone to fracture. The implants should be placed so as to avoid labial protrusion. Long-term follow-up of this method indicates excellent results, with anecdotal evidence that bone formation can occur distal to the implants, presumably in response to tensile and compressive forces on the mandible (Figure 1-10).

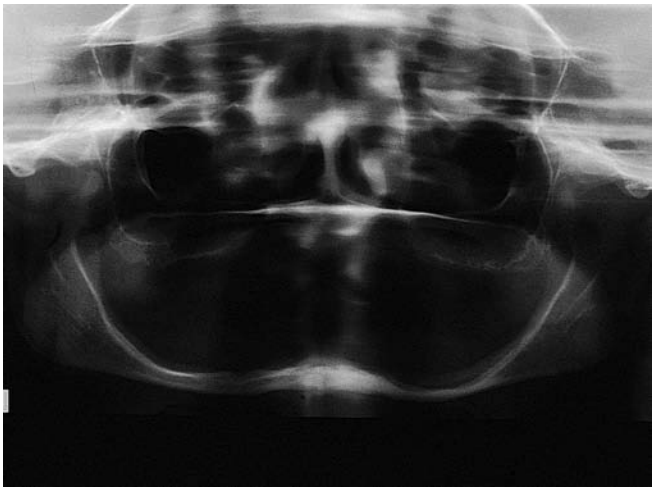


FIGURE 1-10 **A,** This 76-year-old woman has a mandible measuring 7 mm tall. The treatment plan includes four implants and an overdenture.

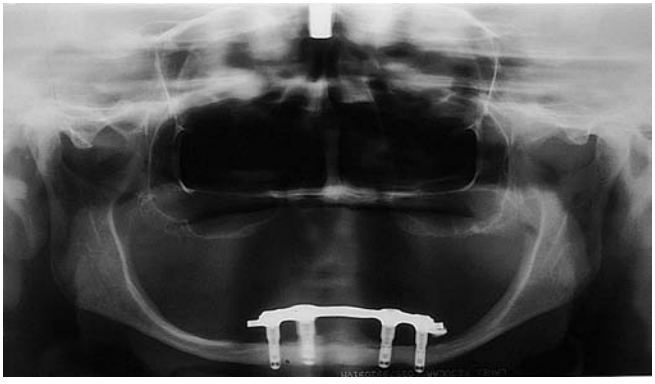


FIGURE 1-10 **B,** Four implants (10 mm long and 3.25 mm wide) are placed with 1 to 2 mm exposed on the inferior border. For two implants, 1-mm implant dehiscence is exposed crestally.

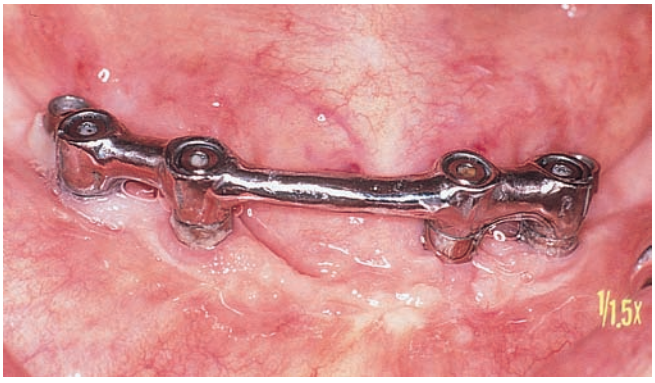


FIGURE 1-10 **C,** Implants have integrated, and a bar has been fabricated for a tissue-borne prosthesis. (Prosthetics by Dr. Larry McMillen.)

Alveolar Ridge Distraction of the Anterior Mandible

Distraction osteogenesis is a method that can be used to augment the vertical height of the anterior mandible. The goal of the procedure is to augment the anterior mandible to an eventual height of 10 to 12 mm to receive implants in a functional location. This procedure is most useful in patients who have had vascularized grafts to restore mandibular continuity where a vascularized fibular graft, for example, restores continuity but because of placement of the fibula along the inferior border a vertical defect results. This is often the situation with the concurrent presence of posterior teeth. If the ridge height is increased, then a more hygienic restoration can be made. This procedure is rarely used because there are other methods using shorter implants and hybrid style prostheses, which result in functional rehabilitation without the morbidity associated with this procedure. Interpositional osteotomy with simultaneous elevation of the superior segment is a method that results in immediate vertical augmentation and is very predictable.

Exposure and the Need for Secondary Soft Tissue Surgery

The patient requiring bone graft augmentation of the atrophic mandible may need vestibular extension or creation of attached KG at the implant sites. A split-thickness dissection can be performed 3 months after the bone graft, and the margins of the dissection can be either sutured to a new position or held inferiorly by circum-mandibular retention sutures. The soft tissue graft may be harvested from the palate or the skin, according to the clinician's preference. The dissection should be limited in depth, resulting in only keratinized tissue on the alveolar crest. Excessive dissection results in a "chin droop," which is not esthetically pleasing.

Immediate Loading of the Edentulous Mandible

Restoration of the edentulous mandible has been achieved with the use of dental implants and a variety of prostheses that are removable by the patient, removable by the dentist, or fixed in position by cement. For dental implants, the traditional two-stage placement with a stress-free healing period and secondary exposure surgery has been well documented.[1-3] When two-stage implant systems are used, with primary gingival closure after implant placement, interim relined dentures are used to restore function for up to 6 months. However, the first several weeks after implant placement are uncomfortable for patients and limit their function during the entire implant integration period. To minimize the patient's discomfort and functional disability, treatment options using immediate implant-borne prostheses have been developed. The decision to provide the patient with improved function immediately after implant placement is

patient driven. The overall success rate for immediate rehabilitation of the edentulous patient is similar to that for the traditional two-stage method.[4-7]

A clinician's decision about whether to rehabilitate an edentulous patient or a patient who requires that all of his or her teeth be removed immediately is made based on evidence that this method is as successful as traditional delayed techniques. Clear evidence has justified immediate loading of implants placed between the foramina of the edentulous mandible.[4-17]

The initial reports on immediate loading of mandibular implants used extra or expendable implants that were placed into function with a temporary fixed restoration at surgery.[18] The immediately loaded implants integrated. Following the same approach, Schnitman et al.[6] later reported failure of four of 28 implants; these four implants were placed in the posterior mandible and were 7 mm long. Tarnow et al.[5] used a provisional approach to restore six mandibles and four maxillas. They reported a high rate of success, with 67 of 69 loaded implants integrating. All of these loaded implants were cross-arch stabilized immediately upon placement to reduce the isolated load on a single implant; the cross-arch connection disperses the load to all the implants.

To minimize treatment time, the final prosthesis can be delivered on the day or within days of the surgery. Brånemark et al.[7] used three implants in the anterior mandible and a screw-retained hybrid prosthesis; they reported a 92% to 98% success rate.

Table 1-1 summarizes classic papers on the immediate loading of mandibular implants; these reports verify that sufficient evidence exists that this procedure is acceptable and no longer should be considered experimental. The 14 authors listed results of 240 mandibles involving more than 1277 implants, all supporting immediate restoration of the mandible. The success rates ranged from 84.7% to 100%, indicating that immediate loading of the edentulous mandible is a viable treatment. The lower success rates from Balshi and Wolfinger[4] and Schnitman et al.[6] have clear explanations for the failures. The remaining references report success rates greater than 95% in the mandible.[5,7-17] The reasons cited for implant failure in immediate loading of the edentulous mandible include placement of short implants into the posterior mandible, bruxism, poorly fitting prostheses, poor surgical technique, and infection of the implants.[18]

A careful review of the references in Table 1-1 reveals certain criteria that are consistently associated with successful patient treatment, including the following:

1. Adequate density of anterior mandibular bone, with insertion torque greater than 20 Newton-centimeters (N-cm), often cited to be greater than 30 N-cm
2. Cross-arch stabilization of the implants with either a rigid metal bar or resin
3. Use of threaded implants at least 10 mm long
4. Sufficient interocclusal space for fabrication of the framework and interim prosthesis
5. Patient dexterity and compliance with hygiene instruction and postdelivery care

When these five criteria are met in the patient, success should be expected if the remaining technical aspects of the implant procedures are performed properly.

The clinician, therefore, has a choice: to deliver an immediate fixed implant–borne provisional prosthesis at the time of implant placement, with the intention of fabricating the final restoration after the implants have integrated or to deliver a traditional removable prosthesis. The delivery of a final definitive prosthesis at the time of implant placement has varied success because of intrinsic errors in computed tomography (CT) guidance in edentulous patients. Table 1-2 compares provisional and final restoration methods.

Using the previously listed criteria can help the clinician determine which treatment modality is optimal for each patient: the traditional two-stage method or one-stage immediate loading. If purulent exudate is present at the time of tooth removal, then the teeth should be removed and the implants placed after the infection has resolved. The next choice is type of immediate and final prosthesis. If the patient is treatment planned for a fixed crown and bridge type prosthesis, then the implants must be placed under the planned teeth locations and not in the embrasures. CT guidance is useful for this type of case. If the plan is for an implant-borne prosthesis with a framework such as a hybrid type design, then the surgeon will need to reduce the ridge to allow for 15 mm of space between the crestal bone and the planned vertical location of the incisive edges of the teeth. Fifteen millimeters is necessary to all for 3 mm of gingival thickness, 2 to 3 mm of clearance to the intaglio surface of the prosthesis, a 7- to 8-mm-tall framework, and the remaining space for acrylic to retain teeth. If bone reduction is not performed, then space limitations will result in a nonhygienic restoration with insufficient acrylic bulk, and teeth separation from the prosthesis will occur.

Several techniques[19-22] can be used to achieve immediate delivery of a final prosthesis. The original "teeth in an hour" procedure[23] used preoperative dentures and accurate mounting of the master casts. CT guidance was used to guide implant placement according to virtual planning, and a final prosthesis was then delivered immediately after implant placement. The procedure relied on the accuracy of the preoperative planning and very accurate models. However, because of small errors, which occur with all CT-guided cases, this method is now rarely used.

If the prosthesis is to be delivered the next day or within a few days, then implant indexing can be used at the time of implant placement. The impression copings are placed into the implants at the time of surgery and connected via dental floss and resin. After the resin connection has cured, the pickup is removed and transferred to a master cast. The prosthesis is then processed during the evening. It can be delivered the next day.

These techniques require excellent laboratory support and preoperative fabrication of parts to facilitate indexing and completion of the final prosthesis within 1 to 2 days after implant placement. In a method described by Tames et al.,[20]

TABLE 1-1 Literature Review of Immediately Loaded Mandibular Implants

Authors (Date)	Implant Location	Number of Implants	Time to Implant Loading	Type of Restoration	Length of Follow-Up	Success Rate (%)
Balshi and Wolfinger[4] (1997)	Mandible	130	Immediate ($n = 40$)	Fixed provisional	N/A	80
Tarnow et al.[5] (1997)	Mandible ($n = 6$) Maxilla ($n = 6$)	107	Immediate ($n = 69$)	Fixed provisional	1–5 years	97.1
Schnitman et al.[6] (1997)	Mandible ($n = 10$)	63	Immediate ($n = 28$)	Fixed provisional	10 years	84.7
Brånemark et al.[7] (1999)	Mandible ($n = 50$)	150	Immediate ($n = 150$)	Fixed final prosthesis	6 months–3 years	98
Randow et al.[8] (1999)	Mandible ($n = 27$)	118	Within 20 days ($n = 88$)	Fixed final prosthesis	18 months	100
Horiuchi et al.[9] (2000)	Mandible ($n = 12$) Maxilla ($n = 5$)	140	Immediate ($n = 140$)	Fixed provisional	8–24 months	97.2
Jaffin et al.[10] (1998)	Mandible ($n = 23$) Maxilla ($n = 4$)	149	Immediate or within 72 hours ($n = 149$)	Fixed provisional	N/A	95
Chow et al.[11] (2001)	Mandible ($n = 27$)	123	Immediate ($n =123$)	Fixed provisional	3–30 months	98.3
Colomina[12] (2001)	Mandible ($n = 13$)	61	24 hours ($n =$ N/A) 10 days ($n =$ N/A)	Fixed provisional	18 months	100 96.7
Ganeles et al.[13] (2001)	Mandible ($n = 27$)	186	Immediate ($n =161$)	Fixed provisional	25 months	99
Grunder[14] (2001)	Mandible ($n = 5$) Maxilla ($n = 5$)	91	Within 24 hours ($n = 91$)	Fixed provisional	2 years	92.3% overall Mandible (97.2%) Maxilla (87.5%)
Cooper et al.[15] (2002)	Mandible ($n = 10$)	54	Immediate ($n = 48$)	Fixed provisional	6–18 months	100
Ibanez and Jalbout[16] (2002)	Mandible ($n = 5$) Maxilla ($n = 5$)	87	Immediate to 48 hours ($n = 87$)	Fixed provisional	1 year	N/A
Testori et al.[17] (2003)	Mandible ($n = 15$)	103	Immediate to 36 hours ($n = 103$)	Fixed provisional or fixed final	4 years	98.9

N/A, Not available.

a premade acrylic template is indexed after implant placement, cast, and finalized within 36 hours as the definitive hybrid prosthesis. Testori and others index the implants and deliver a provisional prosthesis, allowing them to observe the patient and refine the final prosthesis according to patient desires and needs.[19]

Immediate Loading with Provisional Restorations

Fixed Crown and Bridge Type Full Arch Provisional Restorations Adapted to Implants

The restorative dentist may prefer to provide the patient with a fixed, cemented, immediate provisional full arch

TABLE 1-2 Comparison of Methods for Immediate Loading of Mandibular Implants

Method	Preoperative Preparation	Advantages	Disadvantages
Provisional Restoration			
Fixed, hollow-shell crown and bridge adapted to implants	Laboratory fabricates temporary restoration from model Requires surgical guide stent	Easy chairside adaptation of hollow-shell bridge with common materials	Esthetics may not be ideal Chairside time may be excessive Hygiene may be difficult unless embrasures are kept large
Provisional hybrid	Acrylic is added to denture Requires surgical guide stent	Denture easily adapted with common materials Hygiene is easy	Requires constant patient recalls to perform hygiene on lingual side Requires monitoring for overload from chewing May work so well that patient does not return for final prosthesis
Final Restoration			
Use of prefabricated segmented bar and precision attachments	Analogs in model Laboratory-fabricated, segmented final bar for indexing at surgery Requires surgical guide stent	Index easy to perform Patient treatment finished in 2 wefis Minimal adjustments necessary	Laboratory support critical May be difficult to place precision attachments Requires precision surgery
Computed tomography (CT)–generated restorations	Requires: • Final denture for esthetics and tooth position • CT scan • Software virtual surgery • Computer-generated surgical guide stent with absolute accuracy	Final restoration delivered within minutes of placing implants Minimal patient chair time Use of high technology benefits practice's marketing	Final prosthesis may be as good as a delayed final; hybrid method may not be desirable for all Difficult to judge bone quality May require significant occlusal adjustment Early implant failures are difficult to manage

prosthesis. A provisional prosthesis is a temporary set of teeth, not the final, definitive prosthesis. The provisional prosthesis is made from an accurate setup of the planned ideal final restoration. In an edentulous patient, this is a new denture with the teeth ideally setup. In a partially dentate patient, this could be made from a wax-up over the current teeth or from a provisional fixed temporary made on the current teeth. The first step is in the planning process to identify the position of the teeth desired for the final definitive restoration. This is used to accurately plan the implant placement locations.

Use of Computed Tomography Imaging to Plan for a Fixed Prosthesis. The transition from teeth to implants must take into consideration patient-related esthetic concerns. Preoperative planning includes fabrication of a mockup of the planned restoration, which can be used to do the following:

- Confirm the plan with the patient.
- Evaluate the bone under the planned teeth.
- Assess the need for grafting.
- Evaluate the specific locations for the implants.
- Fabricate a provisional prosthesis preoperatively for reduced chair time.

Creation of a Radiopaque Mask Over Existing Teeth: Step-by-Step Method. Models are taken and mounted. Using preoperative clinical recorded landmarks including the exposure of teeth at rest and at smile and the incisive curves, an esthetic wax-up is made over the current teeth. At this point, the esthetic setup needs to be able to be tried into the mouth. An impression can be made of the model with wax-up and poured in stone, and then a duplicate of the wax-up can be processed with tooth-colored material for try in the mouth. When tried in the mouth, the patient can make suggestions, and the setup can be modified as necessary to achieve an approved esthetic plan. The material used for the try-in can be radiopaque or be duplicated in clear acrylic with flanges for CT planning. The try-in is placed into the mouth, and a CT scan is taken with the patient's teeth slightly apart. The CT scan is taken with the patient's mouth slightly open to avoid scatter from the maxilla and interdigitation of the maxillary teeth with the mandibular teeth. Avoidance of interdigitation makes the CT images easier to visualize. The images of each jaw are then available for further surgical planning. The CT scan's DICOM data are loaded into a computer, and virtual implant surgery is performed. The implants are positioned within bone, emerging in a position that is ideal for the planned final prosthesis. Whereas the implants in the incisor regions emerge through the cingulum or incisor edge, the implants in the premolar and molar sites emerge within the fossas.

The try-in can be modified in the laboratory to serve as a guide stent. The model can be used to create an Essix vacuum

form. After the implants are placed, the implants can be indexed and an immediate provisional fabricated. Another option is the fabrication of a hollow shell temporary fixed prosthesis, which can be relined to fit over temporary abutments for either screw or cement retention after picked up in the mouth. The key is the mask that sets up the rest of the treatment and provides all clinicians involved in the patient's care with a very specific understanding of the final goal for the definitive restoration (Figure 1-11). The virtual panoramic reconstructed image is used to confirm placement of the implants within the tooth sockets.

Use of Computed Tomography Guide Stent for Fabrication of a Fixed Provisional

For an edentulous patient, a new denture is made and is approved by the patient regarding tooth size, shape, color, and location. It is used as a radiographic stent for CT planning. A duplicate of the new denture is made, and six to eight 0.5-mm-diameter fiduciary radiopaque markers, typically gutta percha, are placed within the flanges of the duplicated denture. A bite registration is made to secure the duplicated denture in the planned position during the CT scan. The bite registration can be used to remount casts and can be used at the time of surgery. The patient has a CT scan performed with the radiographic stent in place using the radiolucent bite registration. The intaglio surface of the duplicated denture must fit perfectly to the mucosa with no "air" pockets. If the cross-sections of the scan shows space between the mucosa and the stent, then the surgical guide stent will not fit, and the implant placements will be inaccurate. A perfectly fitting

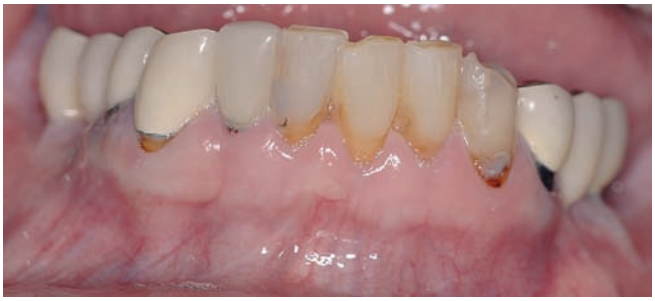


FIGURE 1-11 A, Preoperative appearance of anterior dentition with recurrent decay, bone loss, and mobility. This patient shows her lower teeth when animating, and she wants a fixed restoration that provides function and esthetics. Her dentist and she prefer an implant-supported prosthesis.

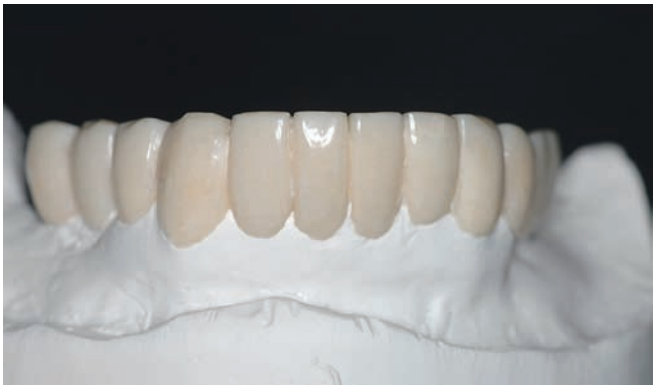


FIGURE 1-11 B, Models were mounted, and a wax-up was created over the current dentition. The wax-up then was converted into a mask, which was made with a combination of barium sulfate (20% by volume) and A2 shade acrylic. This provides the patient and dentist with a visual try-in "mask" that can be adjusted as necessary until all are satisfied.

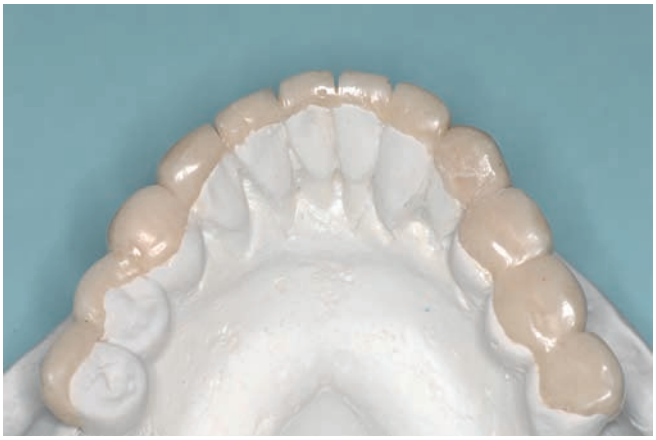


FIGURE 1-11 C, Lingual view shows the mask over the current teeth. Note that the positions of the current teeth are very close to the planned location of the new teeth, with minimal embrasure relocation.

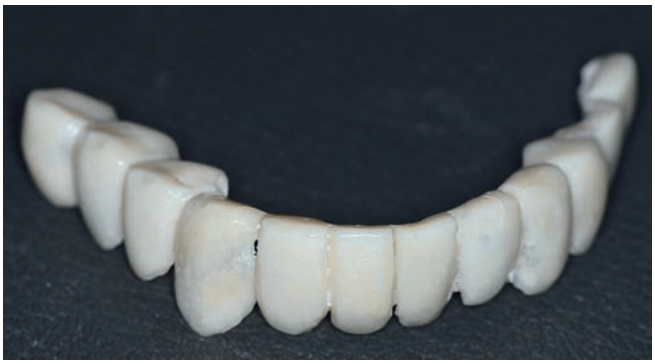


FIGURE 1-11 D, The mask is removed from the model before the computed tomography (CT) scan is taken.

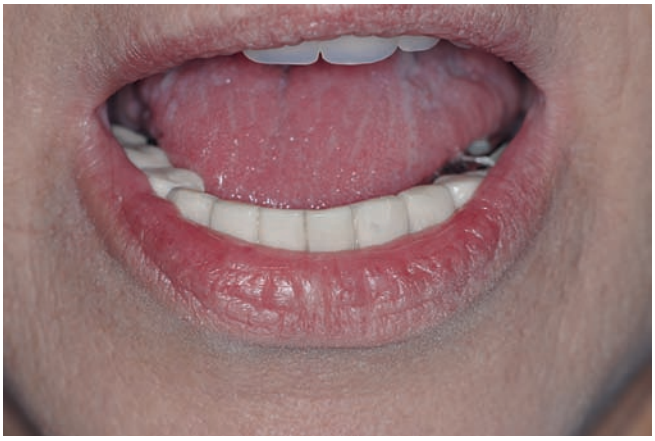


FIGURE 1-11 E, The mask is tried in the mouth to confirm esthetics. The patient is very satisfied with this plan.

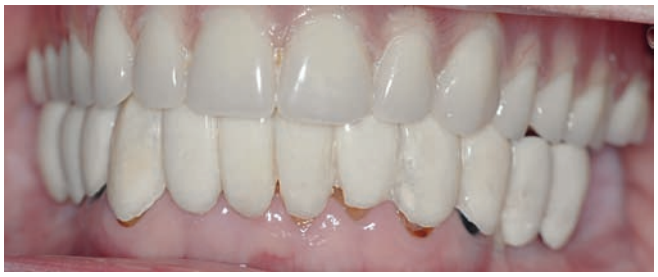


FIGURE 1-11 **F,** The mask is in place, and the patient's teeth are in occlusion. The vertical dimension is confirmed.

FIGURE 1-11 **G,** Before the CT scan is taken, cotton rolls are placed to open the mandible a few millimeters. This provides a scan without the presence of the maxillary teeth over the incisal edges of the lower teeth and mask. The result is less scatter, and CT planning software can be used more easily.

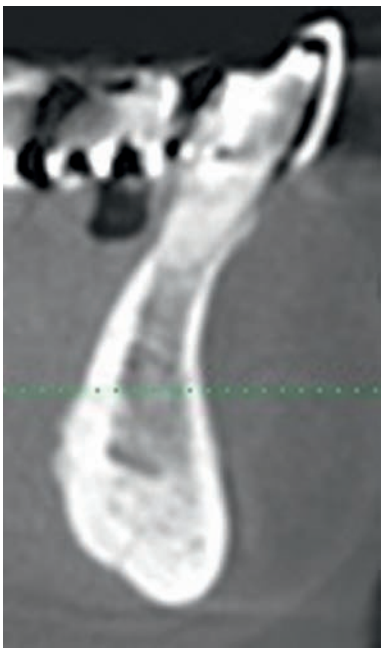


FIGURE 1-11 **H,** Cross-sectional image of the anterior teeth in the left canine region showing the tooth and its relationship to the mask. The barium sulfate–impregnated acrylic is seen as the white line over the incisive edge and labial surface of the tooth.

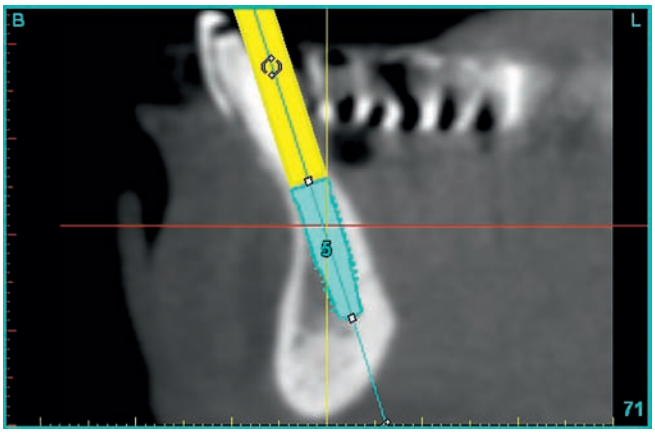


FIGURE 1-11 **I,** Image created with the Simplant CT planning software (Materialise, Brussels, Belgium). The CT scan was loaded and converted to allow for virtual implant placement. The implant can be placed within the bone and easily angled to emerge just lingual to the planned incisive edge of the mask.

radiographic duplicated denture stent will result in less error. A scan is also made of the radiographic stent by itself with the fiduciary markers in the flanges of the denture to allow for a dual scan method to be used.

The CT DICOM files are loaded into an appropriate dual-scan planning software system, and the implants are virtually placed. Attention is given to avoid the neurovascular bundle to orient the implants to emerge slightly lingual to the incisive edges and within the fossas of the posterior teeth. The depth of the implants is considered by using virtual abutments. After the planning completed, a guide stent is fabricated (Figure 1-12; see the companion site for the complete case).

At the time of surgery, the clinician has the guide stent and appropriate drill kit, the implants, the model with the provisional abutments still in place, and the full arch temporary prosthesis. The entire team is present to allow for implant and prosthesis placement in one location. An alternative is for the restorative dentist to index the implants and place the provisional within a few days. However, patients will have a period of time without teeth. Most patients, especially those transitioning from teeth to implants, request the procedure that results in their leaving the office with fixed teeth in their mouth on the same day as tooth removal and implant placement.

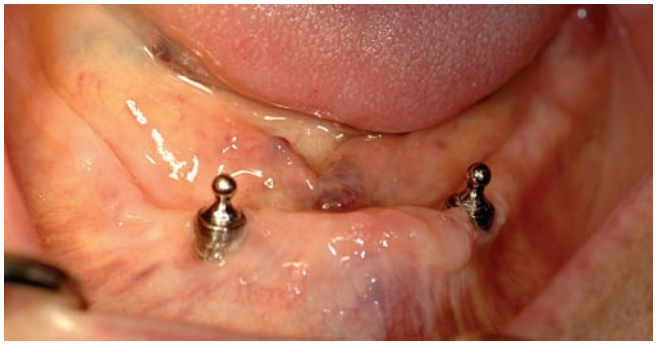


FIGURE 1-12 **A,** Preoperative view of patient with two implants in locations 22 and 27 with overdenture abutments. He was not satisfied and desired a fixed crown and bridge solution.

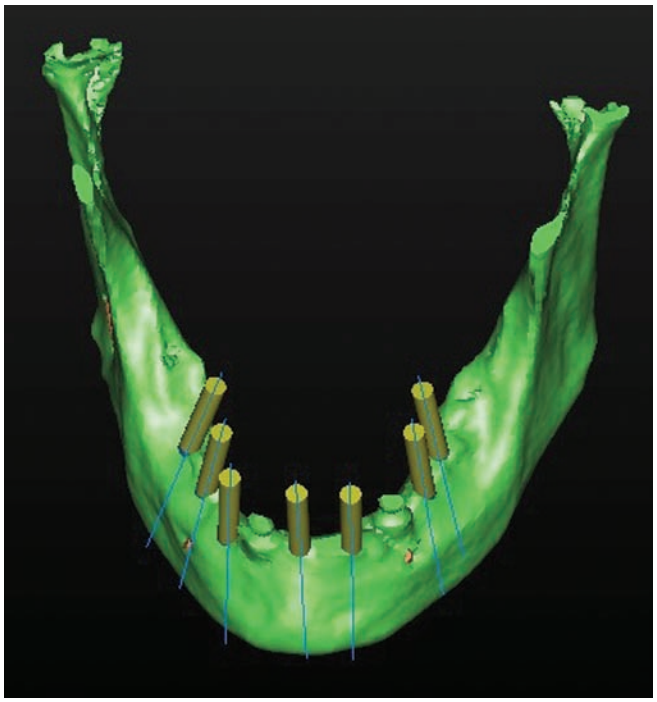


FIGURE 1-12 **H,** View shows the mask of the scanned denture on the mandible with the planned implants. Notice that the implants emerge such that a fixed restoration can be fabricated.

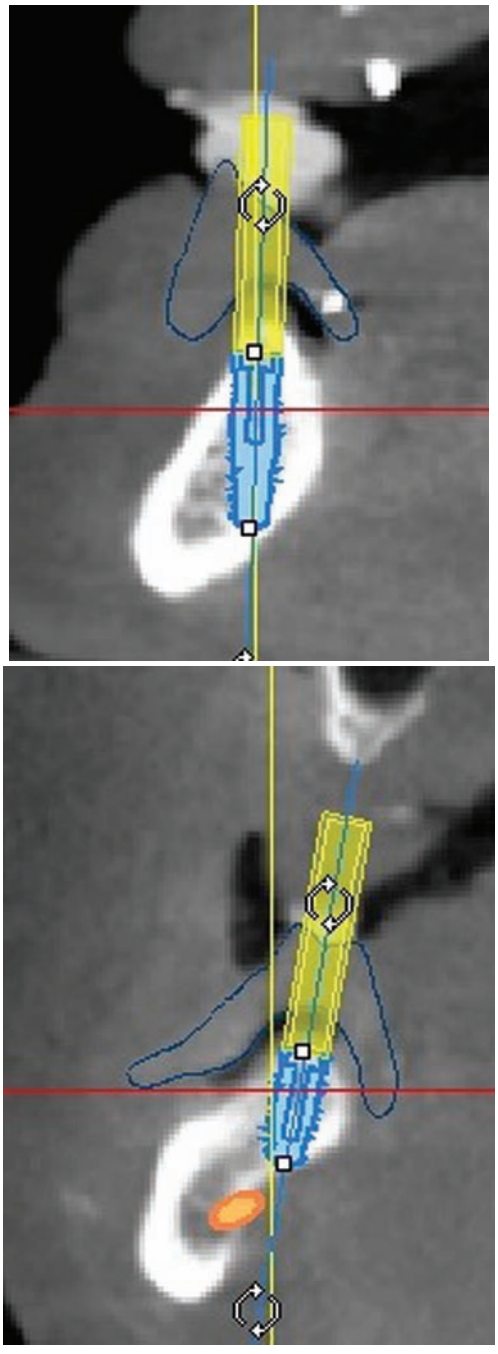


FIGURE 1-12 **K** and **L,** Two cross-sectional images of the planned implant placement in relation to the planned prosthesis. The planned prosthesis is outlined in blue.

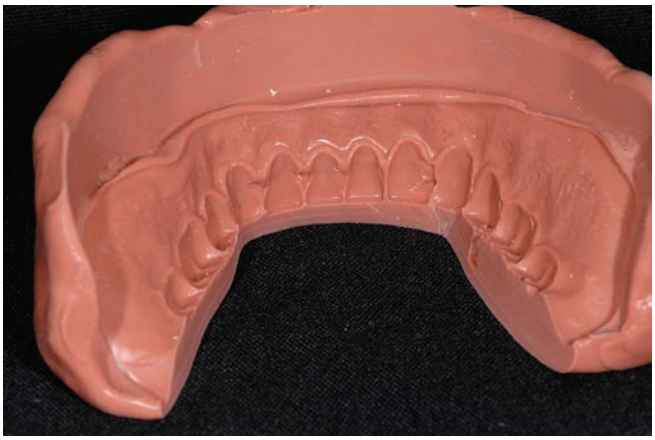


FIGURE 1-12 N, The lower denture that was fabricated was used to make a silicone mask that will guide the laboratory technician when fabricating the lab process full arch provisional prosthesis.

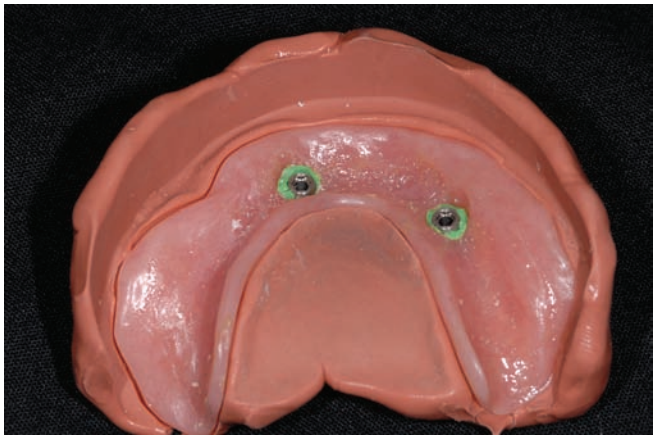


FIGURE 1-12 O, For this patient, the new denture was used to take an implant-level impression of the two implants that had been placed 10 years previously. This allowed for accurate positioning of the provisional prosthesis, and the master cast was poured using this transfer.

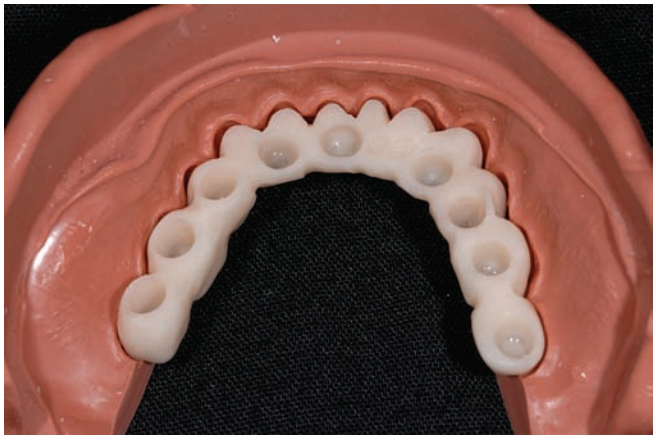


FIGURE 1-12 P, The silicone matrix is seen here with the planned tooth setup easily visible.

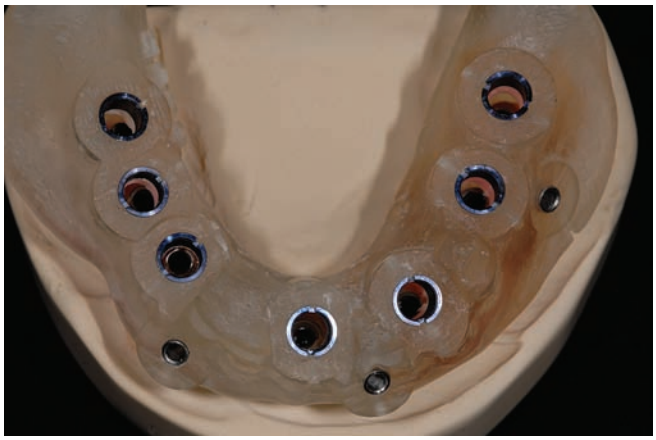


FIGURE 1-12 Q, The surgical guide stent fits perfectly on the master cast because it was designed using the duplicated new denture. All of the pieces meld together because of the accuracy of the virtual system.

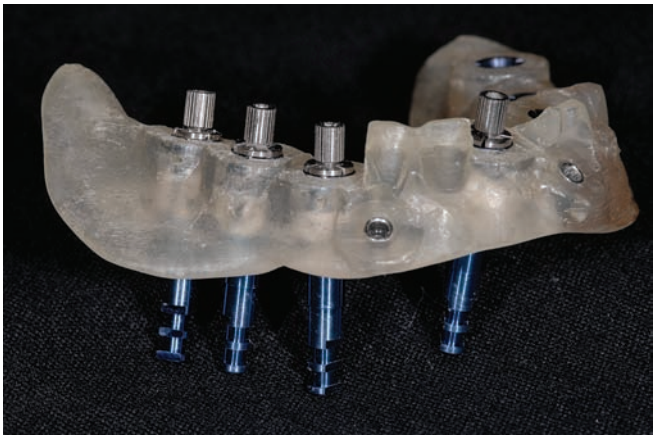
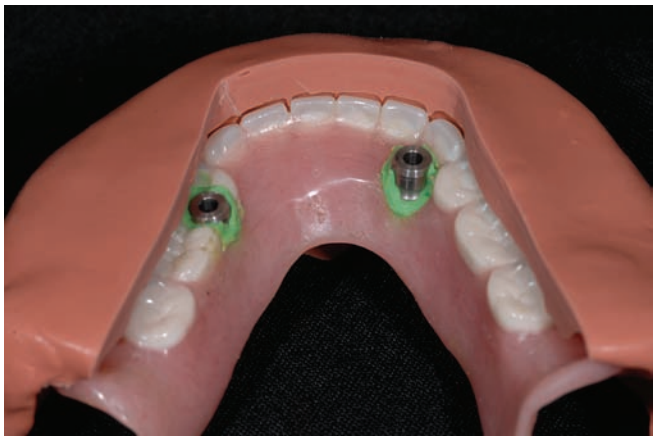


FIGURE 1-12 R and **S,** These two views show the analogs attached to a special prosthetic part that locks the analog to the guide sleeve of the surgical guide stent. The master cast will then be modified to allow for seating of the implant analogs based on their planned virtual positioning, resulting in a master cast with the implant analogs very close to the position that they will placed by using CT-guided surgery.



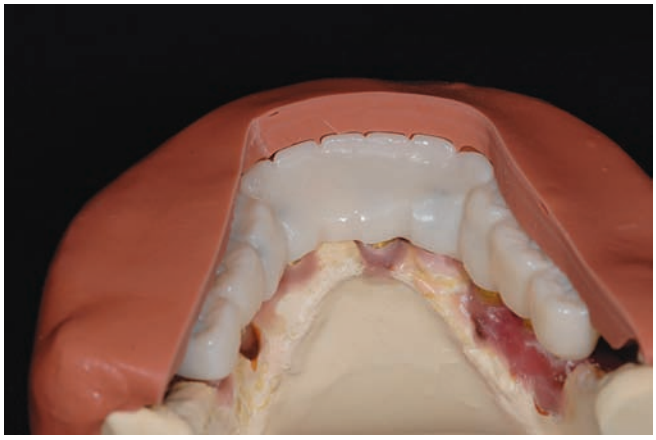


FIGURE 1-12 **X** and **Y,** These views demonstrate how the full arch provisional prosthesis was made using the silicone matrix as a guide. The provisional prosthesis should be very close to the new denture and should be very closely fitted on the abutments.

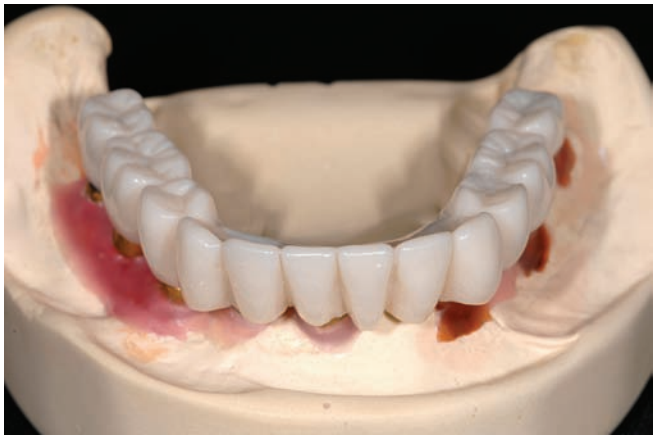


FIGURE 1-12 **Z,** The full arch provisional prosthesis on the master cast. All abutments will be kept on the master cast until they are placed one at a time on the implants at the time of surgery.

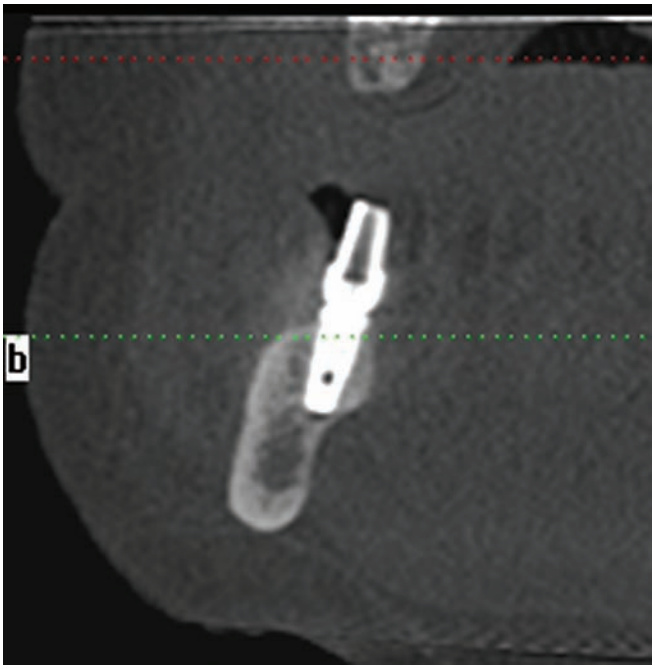


FIGURE 1-12 **ZG,** Cross-sectional image of an implant, which is similar to the virtual plan.

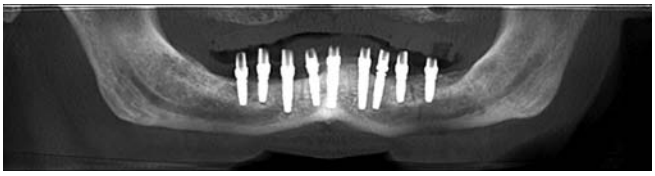


FIGURE 1-12 **ZH,** The postoperative panoramic reconstruction using the cone beam.

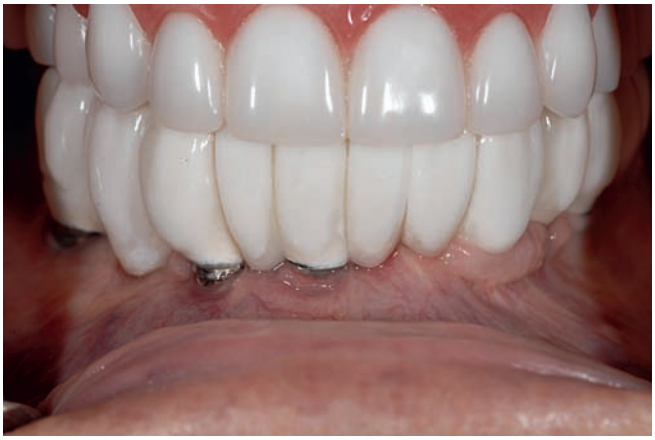


FIGURE 1-12 **ZI,** Final prosthesis screw retained. Prosthetics by Dr. Mary Beilman and Laboratory work by Mr. Lars Hanson.

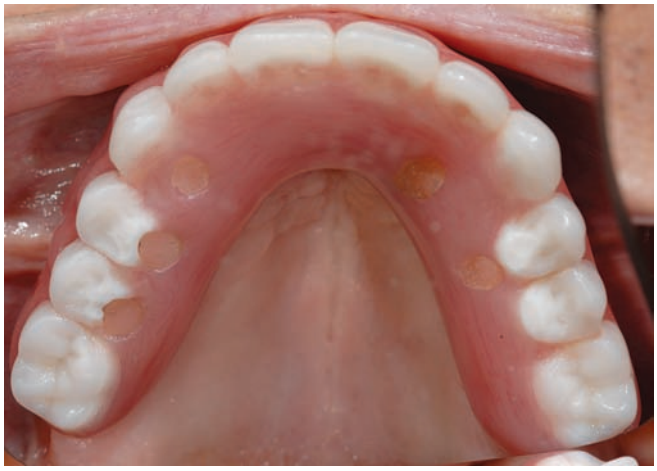


FIGURE 1-12 **ZJ,** The final prosthesis.

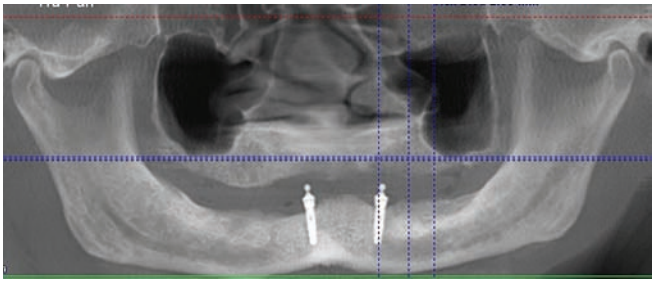


FIGURE 1-12 **B,** Panoramic radiograph taken with cone-beam scanner to document current bone levels.

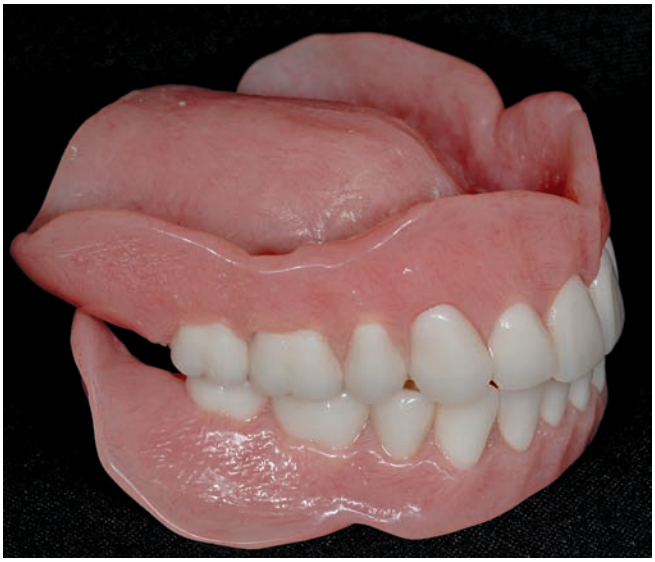


FIGURE 1-12 **C,** New diagnostic dentures were made to provide specific information on where implants need to be placed in relation to the planned final prosthetics.

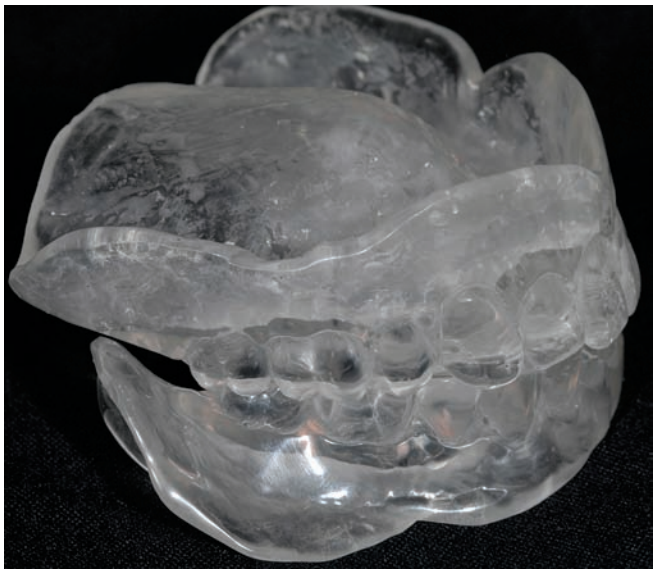


FIGURE 1-12 **D,** The dentures were duplicated in the laboratory into clear acrylic to be used for computed tomography (CT) planning.

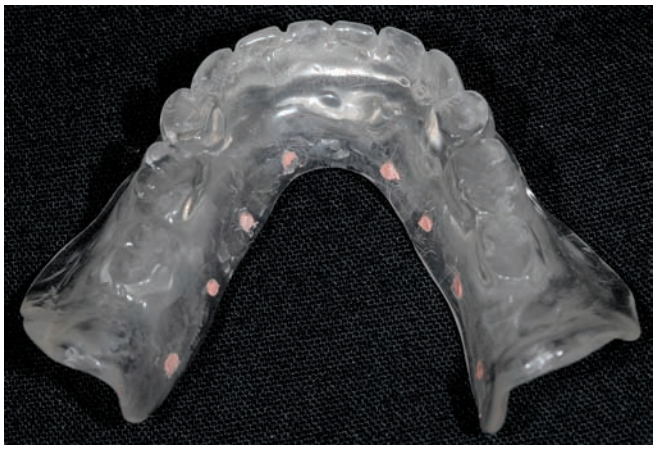


FIGURE 1-12 **E,** The view of the lower duplicated denture shows fiduciary gutta percha 0.5-mm-diameter markers placed in the lingual aspect of the denture flange. This denture is scanned in the patient's mouth and by itself for dual-scan processing and virtual planning.

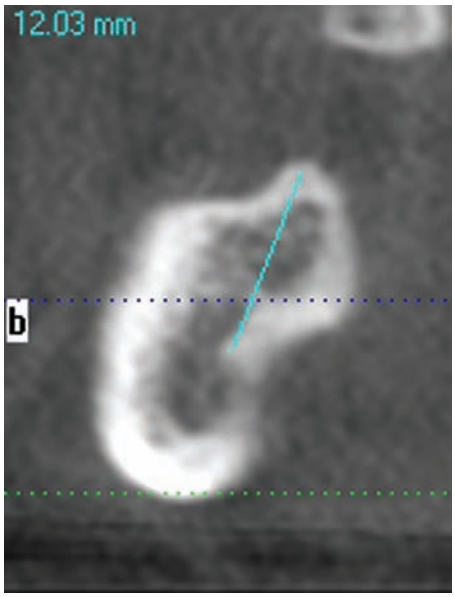


FIGURE 1-12 **F,** Cross-sectional image of the scan showing sufficient posterior mandibular bone in the first molar location for implant placement.

Laboratory Procedures to Place a Full Arch Fixed Crown and Bridge Type Restoration

The planned prosthetics are evidenced by the new denture. The denture or duplicated denture is used to make a master cast. The master cast is articulated to a maxillary model. A silicone matrix of the denture teeth is made for later positioning the provisional teeth over the abutments. The CT-generated surgical guide stent is used to place implant analogs within the master cast. By using the CT-generated surgical guide stent, the position of the implants within the model should be able to be duplicated in surgery, including depth and rotation. After the implant analogs are positioned within the master cast, fixed implant abutments are placed to the analogs within the master cast. Using the silicone matrix and articulated models, the abutments are conservatively

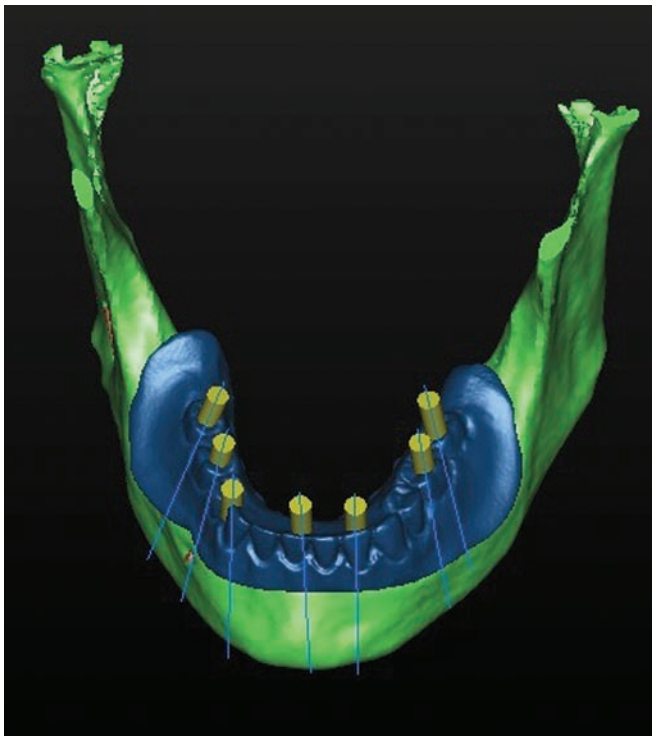


FIGURE 1-12 G, View shows the mask of the scanned denture on the mandible with the planned implants. Notice that the implants emerge such that a fixed restoration can be fabricated.

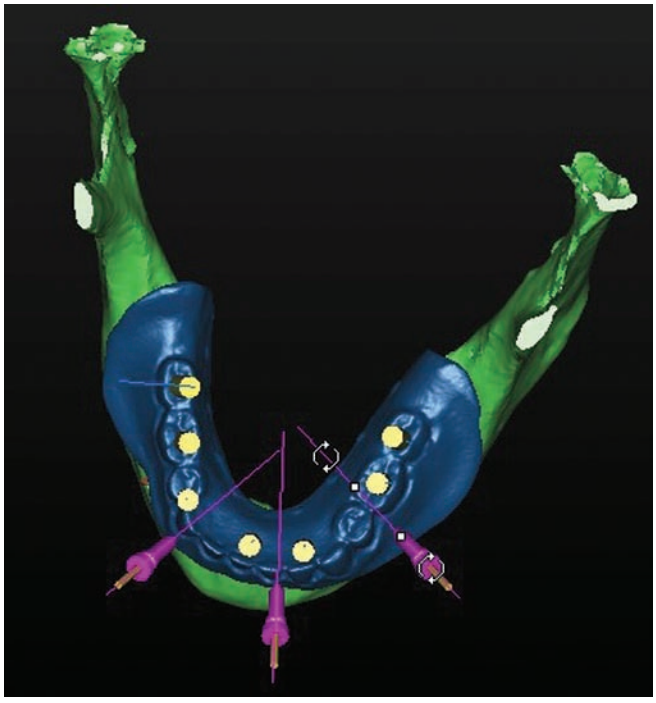


FIGURE 1-12 I, After the planned implant locations were approved by the entire team, pins were positioned on the virtual plan to allow for the surgical guide to incorporate tubes that are used to stabilize the surgical guide stent to the mandible during implant placement.

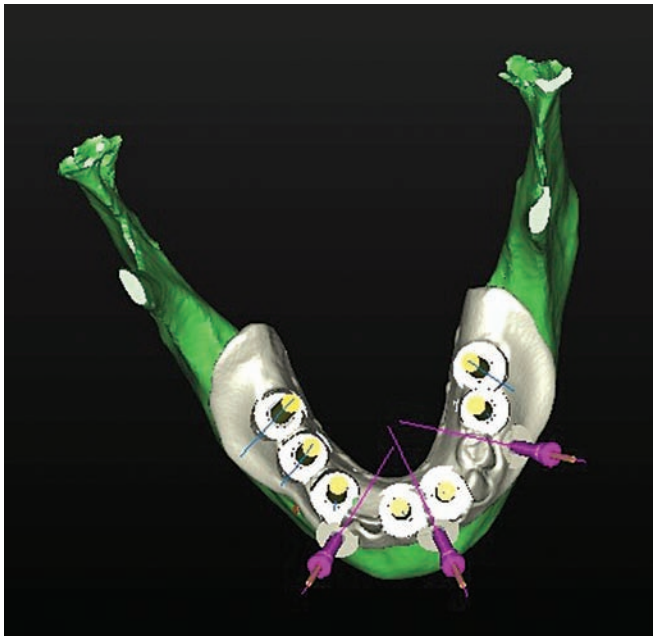


FIGURE 1-12 J, This view shows the surgical guide stent on the virtual plan. The CT planning software provides a view of the proposed guide stent for final review before its fabrication. The sleeves are visible in the planned implant locations as well as the stabilizing pins.

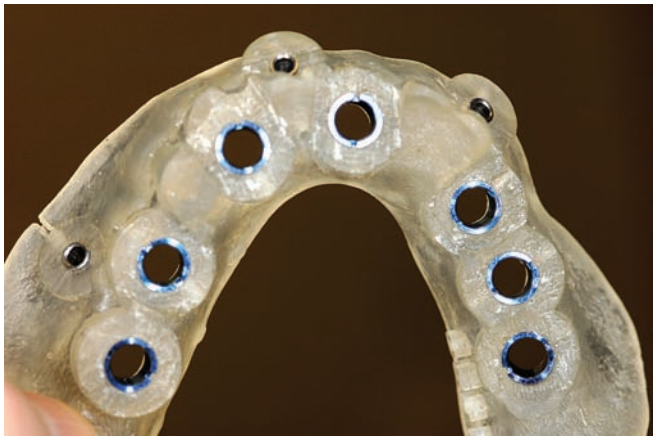


FIGURE 1-12 M, The surgical guide stent has been fabricated and is delivered ready for cold sterilization. (Fabricated by Materialise, Brussels, Belgium.)

prepared and blasted to leave a relatively rough surface for later cement retention. Using the silicone matrix, a full arch provisional restoration is fabricated, trimmed, and polished (see Figure 1-12).

Preoperative Preparation for Full Arch Immediate Provisional Cases

All full arch immediate provisional cases include virtually the same preoperative planning.

The responsibility of the restorative dentist is to create the final prosthetic set of teeth in the form of a denture or hollow shell provisional or a full arch Essix type framework. A new setup is vital to guide accurate placement of the implants.

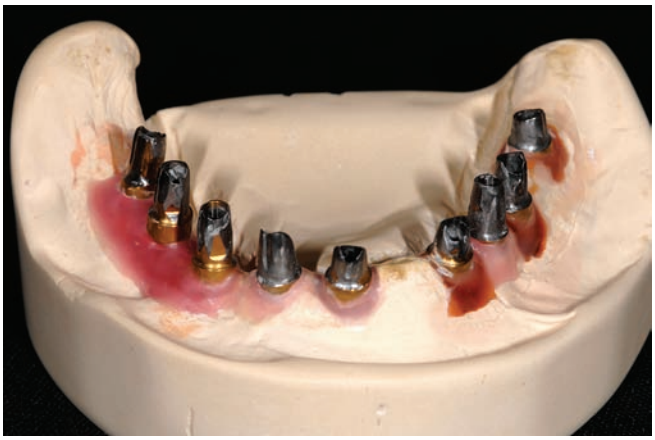


FIGURE 1-12 T, The master cast has the metal fixed abutments placed into each analog and prepared slightly according to space requirements.

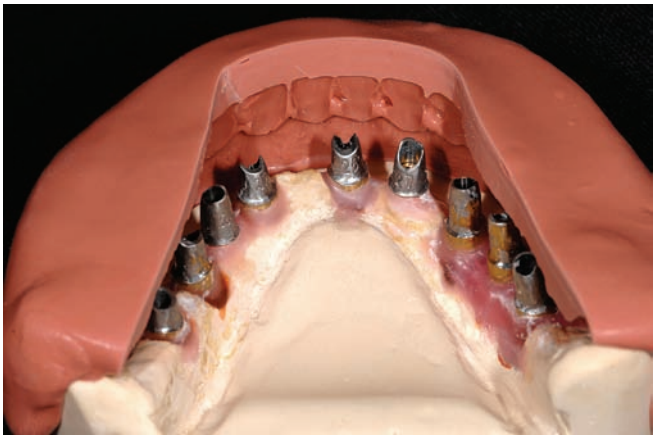


FIGURE 1-12 U, These abutments were modified using the silicone matrix of the planned teeth. By using this method, sufficient thickness of acrylic is ensured, adding to the strength of the provisional.

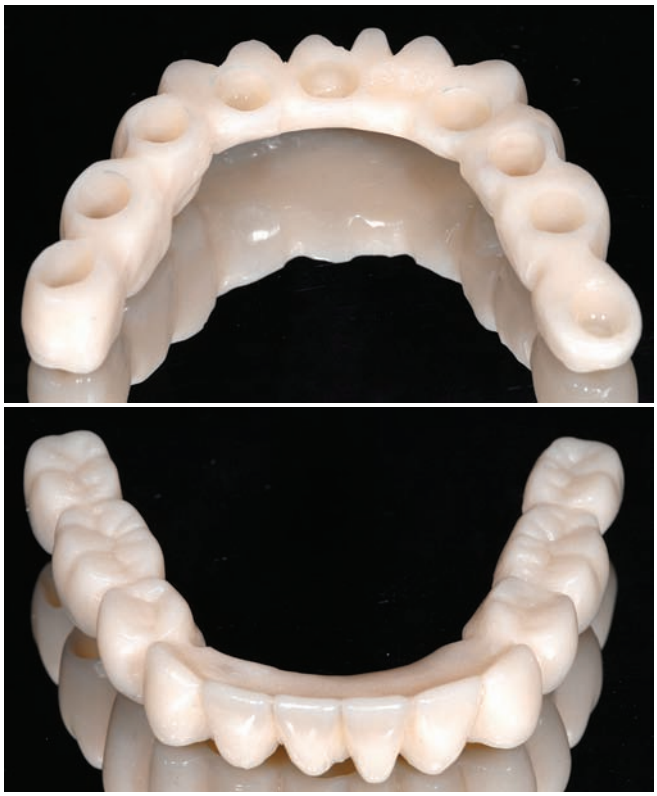


FIGURE 1-12 V and **W,** Two views of the laboratory processed full arch provisional prosthesis made from the master cast with the abutments in place. After the abutments are placed on the implants, a simple reline process will be used to seat the provisional on the day of surgery. (Lab work by Mr. Julio Zahavia.)

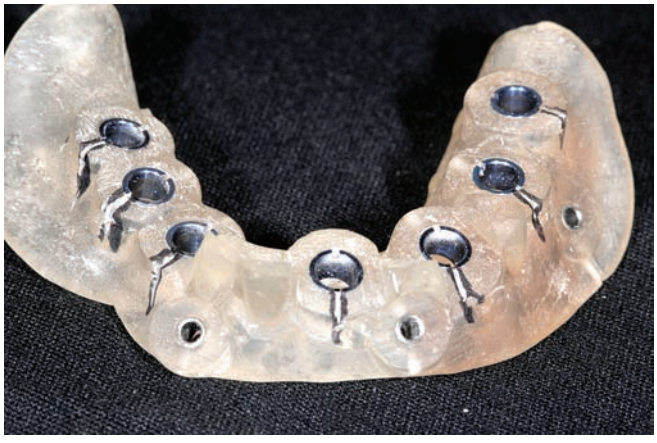


FIGURE 1-12 ZA, Each sleeve within the surgical guide stent has an indentation, which is matched at the time of surgery to the implant insertion mount. For easier visualization, a small groove is made along the stent and marked to identify the groove during surgery. The small grooves with the sleeves can be difficult to see in the mouth.

For an edentulous patient, the new denture is tried in and approved by the patient. In a dentate patient, a mask of the proposed final prosthetics is tried in place. There are partially dentate patients in whom an esthetic preoperative try-in is difficult to achieve. For these patients, the dentist works with the laboratory to incorporate specific landmarks to predict esthetics and function for the provisional prosthesis, with the patient's understanding of the need for revision if necessary.

The new denture is used to generate the surgical guide and, if chosen, a radiographic guide for CT-guided surgery. The new denture is duplicated in clear acrylic and trimmed as shown in this chapter. For dual-scan techniques for CT planning, fiduciary markers are placed into the duplicated denture flanges, and the duplicated denture is CT scanned in the patient's mouth with an occlusal index and the teeth apart and by itself. The scan is taken at the appropriate resolution with the teeth slightly apart at the time of the scan to avoid overlapping of the stent with the opposing dentition. An occlusal bite registration made from radiolucent material is used at the time of the scan. The CT-generated guide stent is made with retention of the original occlusal registrations present to allow for a bite registration to secure the guide stent to the mandible appropriately.

Preoperative planning includes coordination of the team during consultation, preoperative planning, on the day of surgery and provisionalization, and during the postoperative phase of healing. On the day of surgery, it is recommended for the restorative dentist to be present in the surgeon's office.

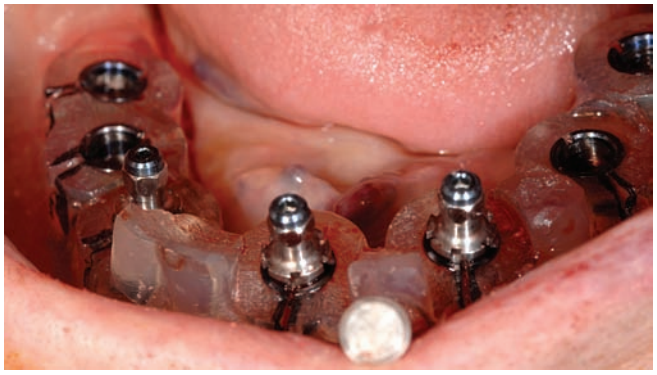


FIGURE 1-12 ZB, At surgery, the surgical guide stent was secured to the mandible with pin fixation and the implant sites prepared in sequence. The implant driver mounts were used to further stabilize the stent in place. After all of the implants were placed the mounts were removed, the pins removed, and the stent removed.

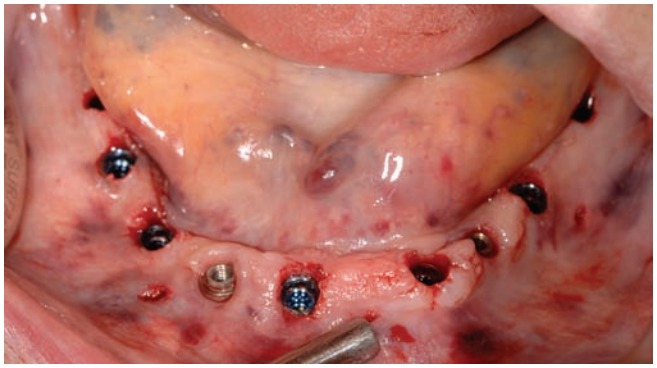


FIGURE 1-12 ZC, Intraoral views after the surgical guide stent was removed. Note the minimal tissue trauma by using this form of guided surgery.

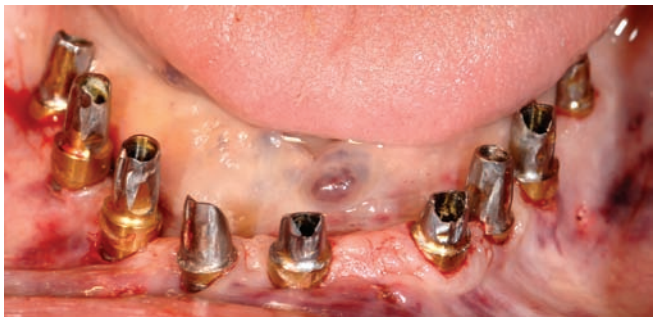


FIGURE 1-12 ZD, Intraoral view of the abutments placed into each implant.

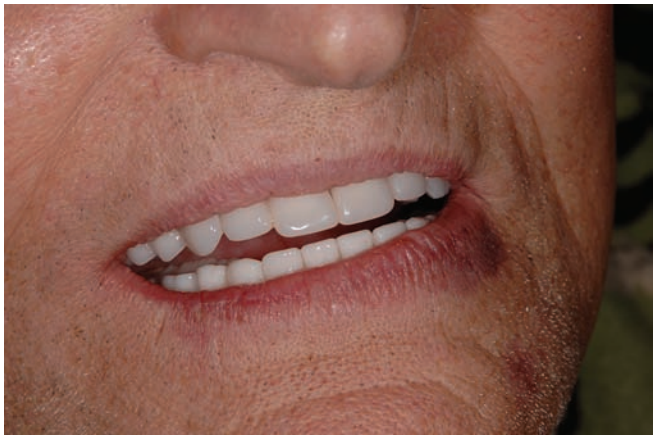


FIGURE 1-12 ZE, Facial photo showing the new mandibular fixed provisional in place showing an esthetic result.

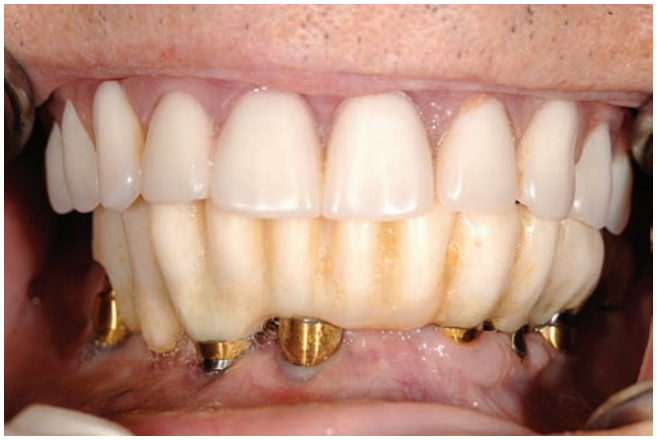


FIGURE 1-12 ZF, The fixed provisional prosthesis in place. Space is available for hygiene and the occlusion has been reestablished. (Prosthetics by Dr. Hunter Charvet, Sr.)

When the surgeon and restorative dentist provide services in the same office, patient inconvenience is decreased, which is appreciated. A laboratory technician can be present to facilitate the laboratory procedures if the restorative dentist requires such. The restorative dentist will need to bring a chairside assistant. The dentist will need to bring materials and assorted burs and drills. The patient will need an escort to bring him or her to and from the office. The use of intravenous sedation may be a nice adjunct for patient comfort; thus, coordination with anesthesia personnel may be necessary. Sedation can be used for the surgical phase but usually is not necessary for the restorative phase. Preoperative consent forms, medication, and postoperative instructions, which include a liquefied diet, must be done before the day of the surgery. Typically, the surgery is performed in the morning to allow for the prosthetic phase to be completed or indexed early in the day.

Preoperative instructions to the patient should include counseling about eating a soft, nontextured diet and the need to perform appropriate hygiene on the temporary prosthesis. A visit with at least one member of the team is necessary the day after surgery so that the occlusion can be checked. The next-day postoperative appointment and the wefily appointments are made in advance to ensure appropriate personal schedule adjustments.

Surgical Guide Preparation

Preoperative Laboratory Procedures. After an immediate hybrid provisional prosthesis has been chosen as the planned treatment, a surgical guide stent must be fabricated by duplication of the patient's existing denture in clear acrylic resin. An alternative is to fabricate the surgical guide stent in clear acrylic resin from the wax try-in or a provisional denture.