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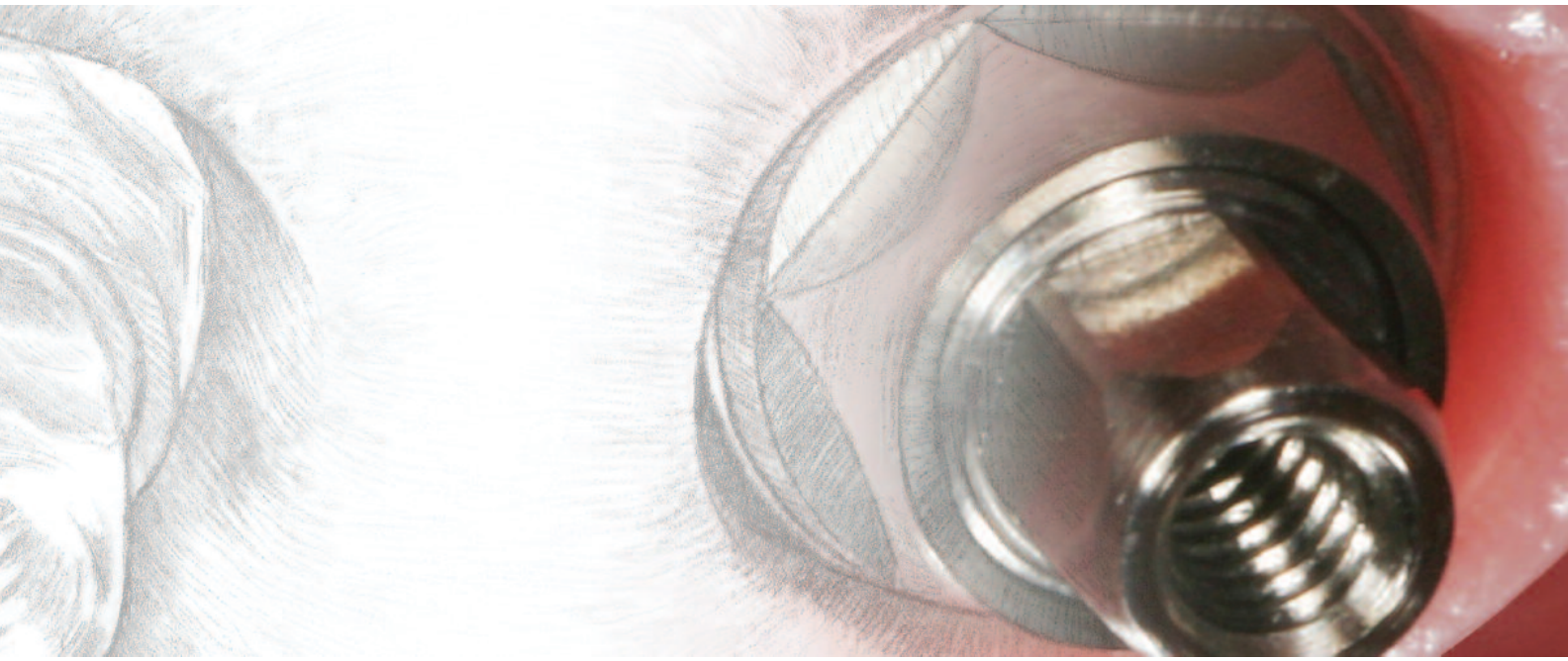

Inside this issue:

2009 Vol. 1 | No. 1

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Introducing The Navigator™ System – Instrumentation For CT Guided Surgery

Many clinicians have a growing interest in dental implant placement utilizing the benefits of computed tomography (CT) and the desire to accelerate patient provisionalization.

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- ***Open Architecture Compatibility That Provides Freedom To Choose Among Leading Planning Software Solutions And Surgical Guide Manufacturers***
- ***Multiple Drill Diameters And Length Options That Offer Surgical Flexibility***
- ***Various Restorative Options Ranging From Single Tooth To Full Arch Provisional Solutions***

Navigator Laboratory Kit

Navigator Surgical Kit

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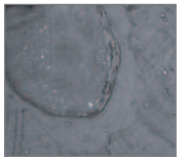
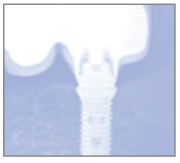
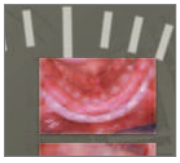
philosophy

The editorial **philosophy** of the *Journal of Implant and Reconstructive Dentistry* (JIRD) is to present **timely**, clinically **relevant** information **focused** on implant and reconstructive therapies in a **practical** format, to **enhance** clinical practice.







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EDITORIAL TEAM

The Journal of Implant and Reconstructive Dentistry (JIRD) is published by BIOMET ***3i*** LLC, 4555 Riverside Drive, Palm Beach Gardens, Florida, USA 33410. Telephone: 561.776.6700.

EDITORIAL ADVISORY BOARD

editorial

Editor Emeritus

Time and again I am impressed with the research and clinical work being carried out daily by my colleagues from around the globe. In so many instances, these efforts are improving patients' lives with cutting edge technology and procedures; facilitating the clinical practice of implant and reconstructive dentistry, and delivering aesthetic and dependable patient solutions in better and faster ways. Such achievements deserve the widest and promptest attention possible. To that end, we are pleased to announce the inaugural issue of the *Journal of Implant and Reconstructive Dentistry* (JIRD).

JIRD will be a platform for spreading the word quickly about new research and technological advancements from around the globe. Articles will cover contemporary topics in implant dentistry and reconstructive therapies. Our goal is to illustrate the principles involved in the delivery of optimal patient care. We'll be doing that by presenting in a lucid, and comprehensible manner, the scientific rationales behind various clinical approaches. However, our focus on the clinical relevance of new scientific evidence will be ongoing, and specific techniques and methods for implementing those approaches will also be highlighted. We believe that new research findings and clinical techniques are best illustrated by clinical example.

In today's world, things change rapidly, yet dissemination of valuable information sometimes lags. JIRD seeks to be a vehicle for updating you about new aspects of implant therapy that will serve both you and your patients.

JIRD will be published two times per year. Reflecting our commitment to the global community and to environmental responsibility, JIRD will also be available electronically via www.JIRD-online.com. The e-JIRD version will contain web-exclusive and expanded content as well as interactive elements such as treatment videos and interviews with leading clinicians in the field of implant and reconstructive dentistry. We look forward to serving readers around the world, and we welcome your feedback and comments.

Sincerely,

Richard J. Lazzara, DMD, MScD

A novel technique for fabrication of immediate provisional restorations

Pär-Olov Östman, DDS, PhD, MD

Prosthetic rehabilitation of the edentulous patient with implant-supported restorations is a commonly provided treatment modality. The original protocol prescribed a healing period of three to six months prior to loading. This meant that the total treatment time could be extensive and that patients were often required to wear removable prostheses during healing and treatment. The use of immediate implant loading protocols offers functional and psychological benefits to the patient and significantly reduces overall treatment time. New implant designs coupled with enhanced surfaces and new drilling guidelines provide an opportunity to successfully employ immediate loading protocols in clinical practice. Importantly, new prosthetic component technology allows for provisional prostheses to be fabricated in a simple chairside procedure, thus offering a predictable and economic means of providing this valuable service to patients.

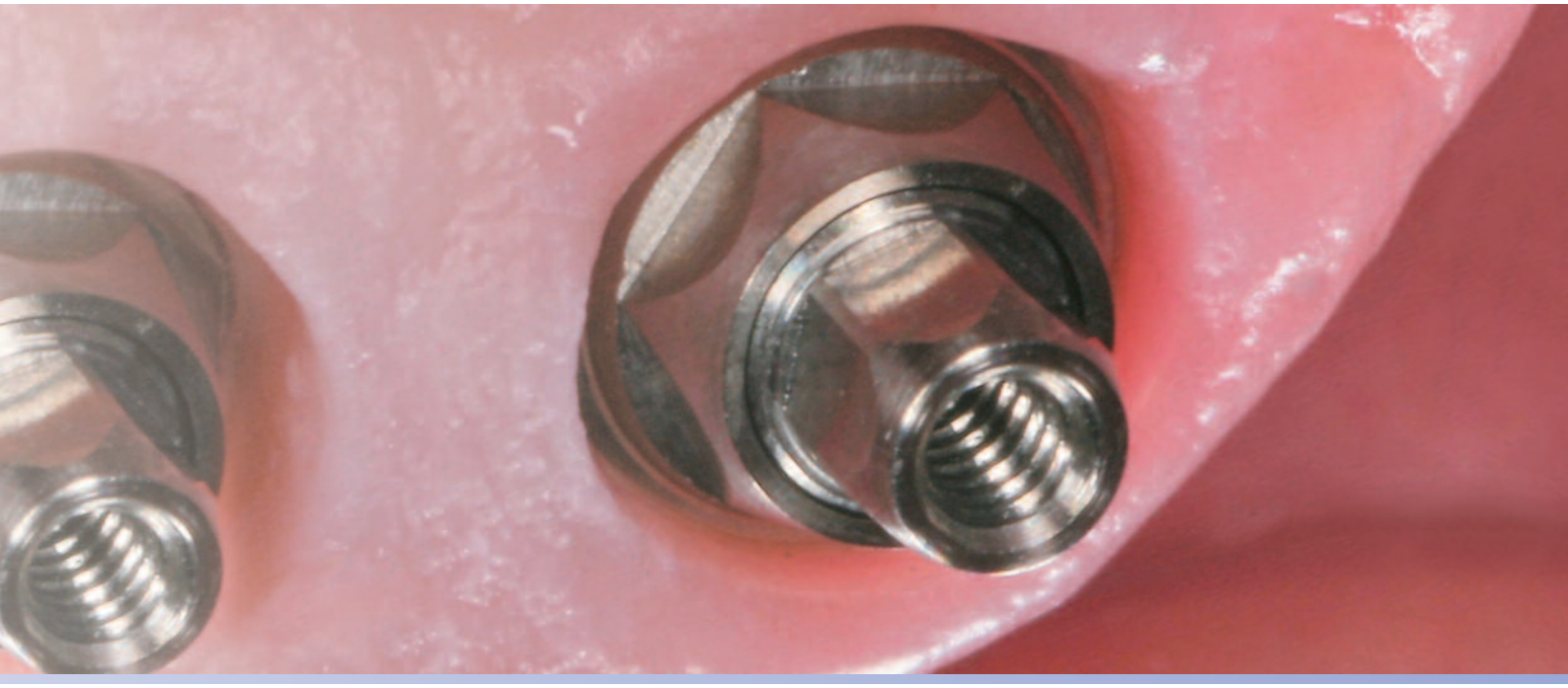
Key Words: dental implants, edentulism, provisional restorations, immediate placement

Introduction

Edentulism is a major public health problem. The World Health Organization (WHO) defines edentulism as a physical impairment because important body parts have been lost. Tooth loss may limit the ability to perform two essential tasks in life—speaking and eating. It thus can be categorized as a disability.[1] Edentulism is also defined as a handicap because significant changes are needed in order to compensate for the deficiencies. Further, elderly patients are at risk of malnutrition as they often have age-related diseases or conditions that can negatively affect the oral cavity.[2-4] These may include neurologic impairment associated with Parkinson's disease, Alzheimer's disease, and stroke, all of which may affect parafunction, mastication, and the ability to swallow. Additionally, these same individuals often take multiple commonly prescribed medications for which xerostomia is a known side effect. For many of these patients, the reduction in saliva flow leads to an increase in cariogenic and perio-pathogenic bacteria and an inability to function with a removable denture.

From a psychological perspective, patients with an oral handicap often silently endure the embarrassment and may withdraw from social situations. In a controlled study, Blomberg et al[5] examined 26 patients before insertion of an implant-supported fixed partial denture and then three months and two years post-operatively. The majority of the patients stated that their quality of life had significantly improved, that they had regained confidence in themselves, and that, in contrast to a conventional denture, they accepted the fixed prosthesis as part of their body.

Our goal as clinicians is to reduce the disability, handicap, and negative psychological impacts of edentulism on our patients' lives by providing them with well-fitting, functional,



aesthetic prostheses. Today, treatment plans that provide patients with immediate function via implant-supported prostheses with minimal downtime are those that are most accepted. Such immediate function is obtainable in a chairside procedure that incorporates new restorative components in immediate fixed-provisional restorations supported by dental implants.[6] Enhanced implant surfaces coupled with macrogeometric designs aimed at increasing initial bone-to-implant contact, may provide the necessary foundation for employing immediate loading protocols.[7]

Prosthetic Considerations

Different approaches to providing patients with provisional prostheses have been presented.[8] Most of these techniques require dental technicians to convert existing dentures and fabricate acrylic resin, fixed partial dentures. Procedures for doing this in the laboratory are well controlled and may offer better margins, polish, and aesthetics than those provided chairside. On the other hand, laboratory-fabricated provisional prostheses require extended logistics, tend to be more expensive, and may take more time to fabricate. Advantages of fabricating provisional restorations chairside may include immediate reduction of the handicap, immediate splinting, and cost effectiveness. Moreover, a provisional restoration made chairside can be delivered while the patient is still anesthetized from the implant-placement surgery. Potential risks include compromised aesthetics and contamination of the newly operated site by provisional restorative materials.

Fabrication of Provisional Prostheses with a Chairside Technique

The chairside provisional concept aims to fabricate a cement-retained provisional prosthesis on abutments that will ultimately be used for a screw-retained definitive prothesis.[6] The provisional components fit onto screw-retained conical shaped abutments and consist of two parts. First, a titanium alloy conical-shaped temporary cylinder (QuickBridge® Titanium Cylinder, BIOMET ***3i***) with an integrated screw is mounted onto the conical-shaped abutment. The second part of the assembly is a plastic cap (QuickBridge Snap Cap) made from PEEK (polyetheretherketone), a biocompatible polymer. The PEEK cap snaps onto the titanium cylinder and is incorporated into the provisional prosthesis. The retention of the PEEK cap to the titanium cylinder is firm, which allows the provisional prosthesis to be retained by only a snap. However, during the healing phase, retention of the provisional prosthesis with temporary cement may be considered.

Patient Presentation

The following clinical case presentation demonstrates the treatment of a 60-year-old male patient who presented to the clinic seeking to replace his missing mandibular dentition and unstable maxillary denture and regain the ability to masticate properly. The treatment plan accepted by the patient included an immediate loading protocol that employed a combined surgical and restorative approach to implant placement and immediate provisionalization.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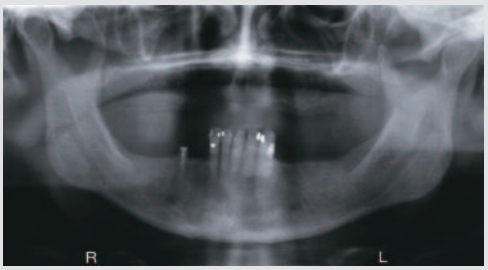

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Fig. 1.3


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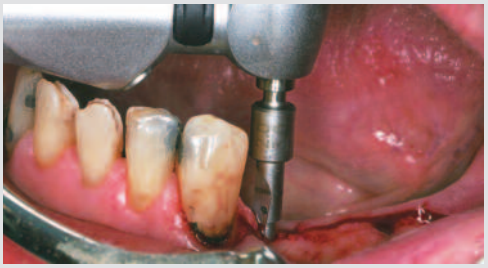
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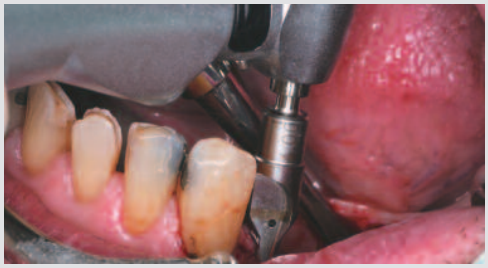
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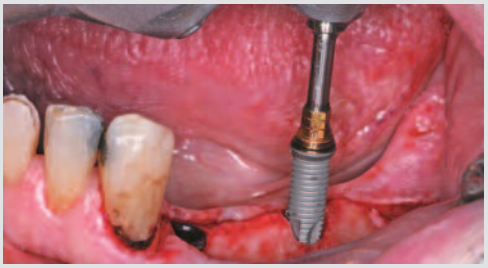
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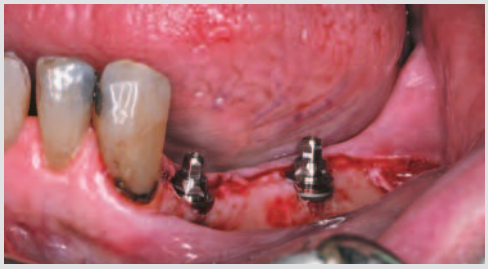
Fig. 1.10


Fig. 1.11


Fig. 1.12

Surgical Treatment

Clinical and radiographic examination revealed sufficient bone volume in both arches for implant placement (Figs. 1.1 and 1.2). Full-thickness mucoperiosteal flaps were raised. Preparation of the osteotomies began with an ACT® Pointed Starter Drill (BIOMET ***3i***) (Fig. 1.3), followed by a 2mm diameter Twist Drill (Fig. 1.4). The bone quality was deemed to be Type IV (soft bone). Preparation of the osteotomies continued with a Pilot Drill (Fig. 1.5) and a 2.75mm Twist Drill, employed according to the recommended drilling guidelines for soft bone (Fig. 1.6). The final drill used was a Countersink Drill (Fig. 1.7). NanoTite™ PREVAIL® Implants (BIOMET ***3i***) were placed (Fig. 1.8) into tooth sites 19, 21, 27, and 30 [34, 36, 43, and 46]. The insertion torque of the implants reached the limit preset on the drilling unit (50Ncm). Implant Stability Quotient (ISQ) readings indicated a high level of initial implant stability (greater than 70). These numbers exceeded the minimum recommendation for employing an immediate loading protocol.[8*] QuickBridge® Provisional Components (BIOMET ***3i***) were chosen for fabrication of immediate fixed-provisional prostheses (Fig 1.9). Conical Screw-Retained Abutments were placed and tightened to 20Ncm (Fig. 1.10). QuickBridge Titanium Cylinders were mounted onto the abutments and hand tightened (Fig. 1.11). Impression copings were snapped onto the titanium cylinders, and the soft-tissue flaps were closed with intermittent sutures. An impression was taken with polyvinylsiloxane impression material. The impression was removed, and the QuickBridge Caps were then snapped onto the titanium cylinders (Fig. 1.12).


Fig. 2.1


Fig. 2.2


Fig. 2.3


Fig. 2.4


Fig. 2.5


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Fig. 2.7


Fig. 2.8

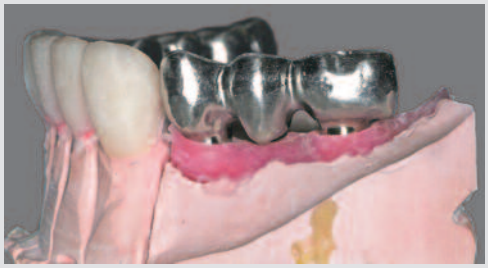


Fig. 2.9


Fig. 2.10


Fig. 2.11


Fig. 2.12

Provisionalization

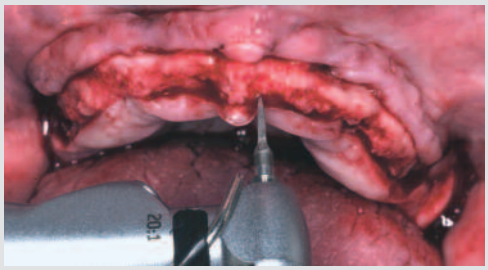
An occlusal registration was made with polyvinylsiloxane occlusal registration material (Fig. 2.1). On the master cast (Fig. 2.2), laboratory-processed provisional restorations that incorporated the QuickBridge® Caps were fabricated (Fig. 2.3). In the operatory, the intaglio surfaces of the QuickBridge Caps were filled with chlorhexidine gel, and the provisional restorations were snapped onto the Titanium Cylinders (Fig. 2.4). Occlusal equilibration was done, and the patient was instructed in proper oral hygiene.

Restorative Treatment

Three months following soft-tissue maturation, the patient was seen for fabrication of the definitive restorations, which were to consist of two implant-supported CAM StructSURE® Copy Milled Frameworks (BIOMET ***3i***) and all-ceramic restorations for the natural dentition (Figs. 2.5 and 2.6).

The framework masters, along with a new maxillary tooth set-up, were fabricated (Fig. 2.7). The framework masters were spray-painted white for optimal scanning (Fig. 2.8). The master casts and the framework master were sent to the BIOMET ***3i*** PSR® Department for scanning and milling of the definitive CAD/CAM frameworks. These were returned to the dental laboratory for porcelain application and completion of the restorations (Figs. 2.9 and 2.10).

The patient returned to the dental clinic. The provisional restorations were removed, and the two CAM StructSURE Copy Milled Prostheses along with the all-ceramic restorations for the natural dentition were placed (Figs. 2.11 and 2.12). The implant-supported, screw-retained prostheses were placed with 10Ncm, and the screw-access openings were restored with composite resin.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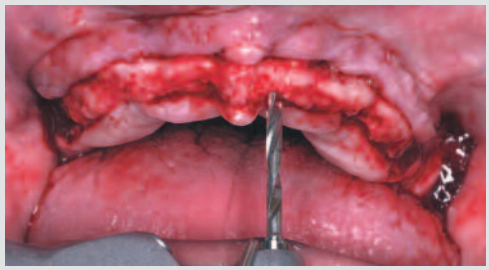
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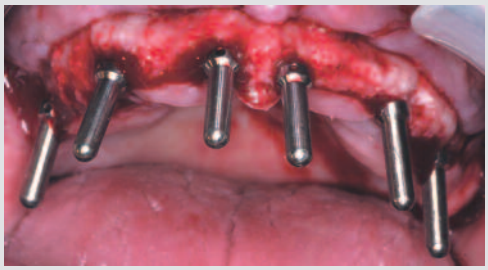
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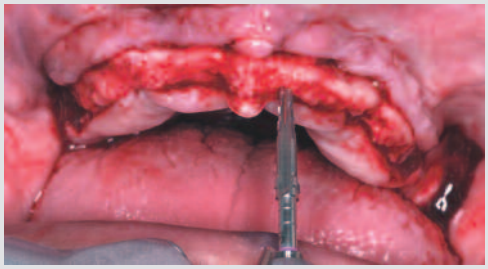
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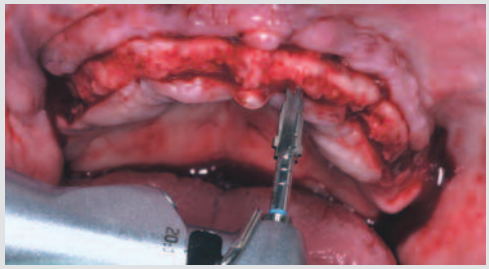
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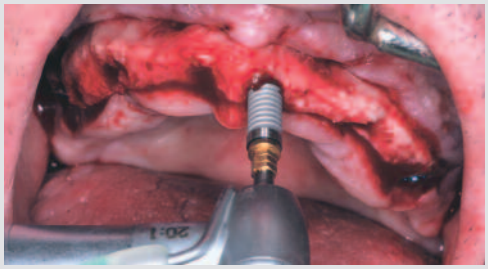
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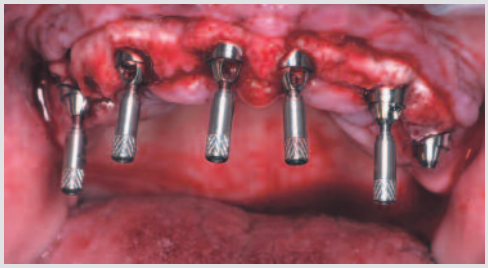
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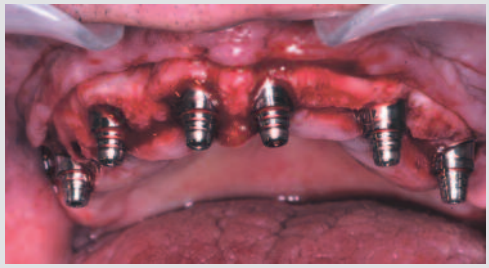
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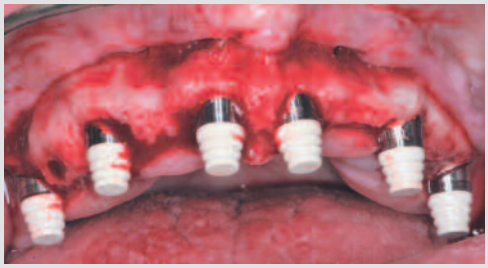
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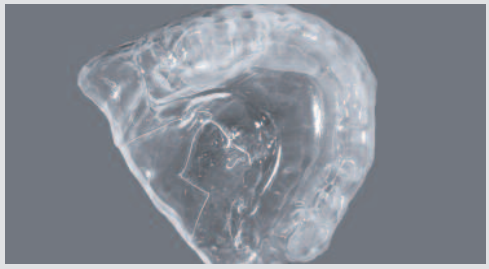


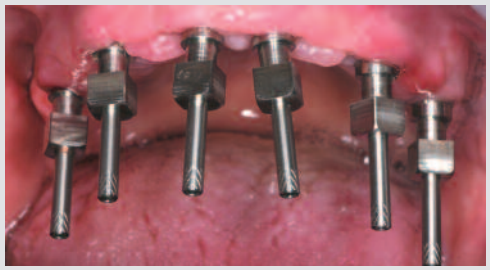
Fig. 3.11


Fig. 3.12

Surgical Treatment in the Maxilla

Rehabilitation of the patient continued a month later with implant therapy in the maxillary arch. A full-thickness mucoperiosteal flap was elevated, and an ACT® Pointed Starter Drill was used to mark the planned implant positions and pierce the cortical plate (Fig. 3.1). Preparation of the osteotomies continued with a 2mm diameter Twist Drill (Fig. 3.2). The bone quality was judged to be Type IV (soft bone). Guide Pins were placed into the osteotomies to verify the optimal position for the implants (Fig. 3.3). A 3.25mm x 15mm QSD Drill was advanced into the osteotomies (Fig. 3.4), followed by a 4mm x 10mm QSD Drill, to widen the cortical aspect of the osteotomies (Fig. 3.5). A combination of NanoTite™ Tapered and NanoTite Tapered PREVAIL® Implants were placed into tooth sites 3, 6, 8, 9, 11, and 13 [16, 13, 11, 21, 23 and 26] (Fig. 3.6). The insertion torque of the implants reached the limit preset on the drilling unit (50Ncm), and ISQ readings were greater than 70. Conical Screw-Retained Abutments were placed and tightened to 20Ncm (Fig. 3.7). QuickBridge® Titanium Cylinders were mounted onto the abutments and hand tightened (Fig. 3.8). QuickBridge Caps were snapped onto the titanium cylinders (Fig. 3.9), and intermittent sutures were placed to close the soft-tissue flaps (Fig. 3.10). From the maxillary tooth set-up, a vacuum-formed template was made (Fig. 3.11). The template was filled with ProTemp™ (3M ESPE, St. Paul, Minnesota, USA) and seated onto the QuickBridge Caps. The material was allowed to set per the manufacturer's instructions, incorporating the QuickBridge Caps into the provisional restoration. The restoration was then snapped off, trimmed, and polished, and replaced with chlorhexidine gel (Fig. 3.12).


Fig. 4.1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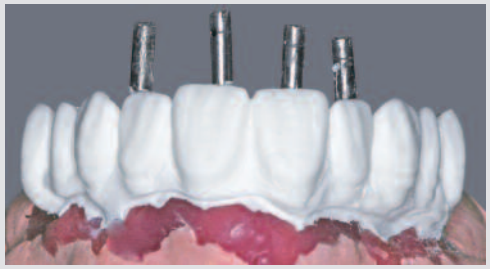
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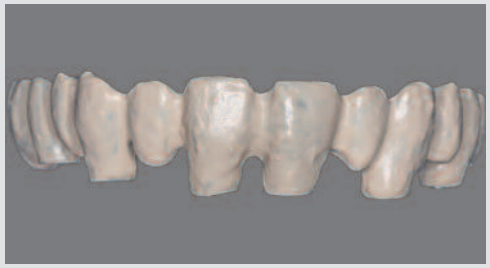
Fig. 4.8


Fig. 4.9


Fig. 4.10


Fig. 4.11


Fig. 4.12

Restorative Treatment

Following three months of soft-tissue maturation, the provisional restoration and QuickBridge® Titanium Cylinders were removed (Fig. 4.1). Pick-up impression copings were placed onto the abutments and hand tightened. An open-tray impression was made with polyvinylsiloxane impression material (Fig. 4.2). The QuickBridge Titanium Cylinders were replaced, and the vacuum-formed template was reused to make an occlusal registration by filling the template with polyvinylsiloxane occlusal registration material (Fig. 4.3). With this technique, information about the interocclusal height, midline, shape of the teeth, etc., is provided to the dental technician for fabrication of the framework master.

In the laboratory, a tooth set-up was fabricated onto the master cast (Fig. 4.4). From the tooth set-up, the framework master was constructed by a cut-back technique (Figs. 4.5 and 4.6). This was sent to the BIOMET ***3i*** PSR® Department for fabrication of a CAM StructSURE® Copy Milled Framework. CAD/CAM frameworks offer advantages as compared to cement-retained conventional cast frameworks, including a passive fit and the precision of CAD/CAM technology. The copy-milled framework was returned to the dental laboratory (Fig. 4.7). Three layers of opaque porcelain were baked onto the titanium framework prior to application of body and incisal porcelains (Fig. 4.8). The definitive full-arch screw-retained prosthesis was completed (Fig. 4.9).

The patient returned to the dental clinic. The provisional prosthesis was removed, and the definitive implant-supported, screw-retained prosthesis was placed with 10Ncm of torque applied to the retaining screws. Occlusal equilibration was done, followed by restoration of the screw-access openings with composite resin (Figs. 4.10-4.12). The patient received oral hygiene instructions and was released.

Follow-Up and Maintenance

When fabricating a provisional restoration according to this protocol, follow-up visits are scheduled for two weeks post-operatively and then once a month. At each visit, oral hygiene status, soft-tissue healing, stability of the provisional prosthesis, and implant status are evaluated. Following placement of the definitive prosthesis, the frequency of follow-up visits is determined based on the health of the soft tissue and the patient's ability to properly maintain the prosthesis.

Clinical Relevance

Patients are more likely to accept implant treatment plans that provide them with immediate function. Patients often present with missing dentition, ill-fitting removable prostheses, and the inability to speak and eat comfortably. The goal of treatment is to limit the disability, the handicap, and the negative psychological impacts of edentulism by providing patients with well fitting, functional, and aesthetic prostheses. While different approaches to providing patients with immediate provisional prostheses have been explored, the simple, chairside procedure presented in this article may offer advantages including reduction of edentulism, immediate splinting, and cost effectiveness.

A treatment video of this case will be coming soon to www.JIRD-online.com.

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Pär-Olov Östman, DDS, PhD, MD

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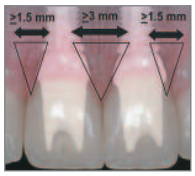
A restorative protocol for implants replacing adjacent maxillary central incisors in a compromised site

George Priest, DMD



Achieving natural sulcular profiles is arguably the most challenging aspect of restoring adjacent implants. Especially when treating patients with visible gingival architecture, clinicians must use all available means to optimize the sulcular and papillary forms. This article describes a protocol for restoring maxillary central incisors when a delayed approach to implant placement is required.

Key Words: implants, aesthetic zone, zirconia abutments

The Surgical Influence on the Restorative Outcome

Implant dentistry is restoratively driven, but the surgical component of treatment is the most critical step because it establishes the aesthetic potential. From the initiation of implant therapy, the restorative endpoint must be the continuous focus of the implant team. Belser and colleagues, after reviewing pertinent literature, noted that soft-tissue anatomy around single-implant restorations is usually acceptable because of tissue support of adjacent teeth, but soft-tissue profiles around multiple implants are often unpredictable.[1] Inevitable interimplant bone resorption following multiple extractions and implant placement is largely responsible for the altered soft tissue.[2] Removal of contiguous teeth often results in flattening of the interproximal osseous scalloping and subsequent collapse of the interproximal papillae.[3] Regarding adjacent implants, Kan et al have observed that site development and an ideal osseous-gingival relationship remain the fundamental components for implant treatment in the aesthetic zone.[4]

The most effective means of ensuring the presence of a papilla between central incisors is to prevent its loss and the loss of the underlying bone at the time of tooth removal (Figs. 1-5).[5] Atraumatic extraction techniques, using periotomes or piezosurgery for example, are becoming standard bone-preserving protocols, but some loss of interseptal bone is still unavoidable (Figs. 6-8).[3] Furthermore, the initial osseous anatomy may be so compromised that it is not possible to place an implant and preserve the interseptal and labial bone. Augmentation of such sites is usually indicated followed by a delayed protocol.


Fig. 1


Fig. 2


Fig. 3


Fig. 4

Implant Placement

Implant placement must be both restoratively and biologically driven. Placement is directed by the position of the anticipated restoration(s) but is also influenced by the goal of preserving osseous levels and soft-tissue profiles.[6] In this case, the author selected implants designed to aid in crestal bone preservation (NanoTite™ PREVAIL® Implants, BIOMET ***3i***).[7] The surgeon must use caution to avoid encroachment on the interseptal bone between the central and lateral incisors when attempting to procure at least 3mm between central incisor implants. Otherwise, the papillae both mesial and distal to the central incisors may be jeopardized (Figs. 9-11).

Recent data from Magne et al[8] indicate that central incisors range in width from 8.5mm to 11.1mm, and Chu's data show slightly smaller dimensions of 7.1mm to 10.1mm.[9] These data indicate that even when replacing the narrowest central incisors, use of standard implants should allow for maintenance of 3mm between the central incisor implants and at least 1.5mm between the implant and the adjacent teeth.

Implant placement becomes more complex when replacing a central and lateral incisor, or a lateral incisor and canine. Maxillary lateral incisors range in width from 5.5mm to 8.2mm according to Magne et al,[8] and from 6.0mm to 8.0mm according to Chu.[9] Replacement of narrow maxillary lateral incisors adjacent to central incisors or canines can result in compromise of interseptal bone even when reduced diameter implants are utilized. Two additional factors also make the aesthetic potential of two adjacent central incisor implants greater than that of a central and lateral incisor or a lateral incisor and canine (Table 1).[10] While there is only one papilla between central incisors and no contralateral papilla for comparison, that is not the case with lateral incisors.[11] Furthermore, a remnant of the nasopalatine papilla often remains between central incisors that can be supported to help form the papilla.

If teeth adjacent to potential implant sites require full-coverage restorations, a processed provisional restoration may be made prior to implant placement and seated on the adjacent teeth (Figs. 4 and 5). The surgeon can easily remove the prosthesis and reseat it. Healing and implant integration may not be compromised because grafted sites can be maintained without any pressure being placed on gingival tissues. Minimal effort is required to remove the acrylic prosthesis when alterations are necessary to adapt to the evolving anatomy of the implant site. The restorative dentist then has the luxury of choosing when to develop the soft tissue. The provisional restoration may undergo a transformation during the course of treatment as healing progresses and/or if multiple surgical procedures are necessary.

Soft-Tissue Development with Provisional Restorations

Grunder[12] has noted that three factors determine peri-implant soft-tissue levels: (1) the level of bone, (2) the volume of the connective tissue, and (3) proximal support of the implant crowns. The bone is the limiting factor. If a site is properly developed, the potential for optimal soft tissue is high. Once the implant is placed, it is then the responsibility of the restorative dentist to maximize the soft-tissue potential established by the implant surgeon.

Implant-retained provisional restorations have been demonstrated to be effective tools for developing the soft tissue prior to fabrication of the definitive restoration.[13] A well-contoured, implant-level provisional restoration may redirect the existing volume of soft tissue to optimal levels.[14]


Fig. 5

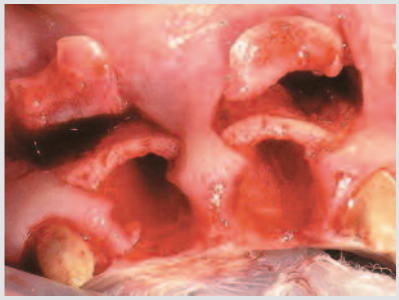


Fig. 6


Fig. 7


Fig. 8

The sulcular profile may ultimately be the same when placing a provisional restoration or definitive crown,[15] but developing it in the provisional stage provides a guide to the soft-tissue form before the definitive restoration is made.[16]

Peri-implant sulcular development of adjacent central incisor implants with a provisional restoration accomplishes several objectives: (1) the restorative dentist and implant surgeon can observe tissue levels and determine if further tissue refinement is necessary, (2) patient expectations can be evaluated early, (3) the patient receives the benefits of a fixed restoration during interim treatment,[17] (4) the developed soft tissue can be accurately communicated to the laboratory technician using varied impression techniques, and (5) the definitive prosthesis easily slips into a previously developed sulcus. Alternatively, the soft tissue can be developed solely by using the definitive restoration, but this process is subjective, requiring the laboratory technician to estimate contours.

Delivery of a provisional restoration can be accomplished as follows: immediately following implant placement, or upon second-stage uncovering, provisional implant abutments are secured to the implants. Provisional abutments made from a polymer, such as PreFormance® Provisional Components (BIOMET ***3i***) can be prepared more quickly and easily than those made of metal alloys. The white color of the polymer material (PEEK) is easier to mask beneath resin provisional restorations, and it provides a warmer hue to the gingival tissues. The provisional cylinders are quickly reduced, and chairside or laboratory-processed provisional restorations are fabricated. If provisional restorations have been made previously, these may be hollowed out, relined, and attached directly to the temporary cylinders.

Fig. 1 Due to trauma at a young age, the maxillary central incisors of a 35-year-old patient were treated endodontically, and all four incisors received metal-ceramic crowns.

Fig. 2 The papilla between the two central incisors was relatively intact, but the height was compromised between the central and lateral incisors as a result of the accident.

Fig. 3 Upon clinical and radiographic examination, the symptomatic teeth were diagnosed with a vertical root fracture of the right central incisor and non-restorable caries of the left central incisor.

Fig. 4 The old crowns were removed from the incisors and the teeth reprepared.

Fig. 5 Processed, splinted provisional crowns were relined and cemented with temporary cement.

Fig. 6 At the surgical appointment, the provisional restoration was removed, and the central incisors were atraumatically extracted.

Fig. 7 The provisional restoration was recemented after site augmentation and remained undisturbed for several months prior to implant placement.

Fig. 8 Removal of the provisional prosthesis revealed the flat architecture of the augmented ridge.

The author prefers screw-retained as compared to cement-retained implant-level provisional restorations for soft-tissue development. During adjustment procedures, it is more convenient to remove the crown and temporary cylinder as a single unit as opposed to removing a provisional crown and a separate abutment. It is also easier to develop the subgingival contours beginning at the level of the implant with a screw-retained provisional restoration; most temporary posts for cement retention are straight in profile and do not mimic the subgingival contours of teeth. If an abutment for cement retention is prepared subgingivally for optimum contours, it can be difficult to capture the margins during modifications. Use of a screw-retained provisional restoration also eliminates the need for cement-margin clean-up. The only disadvantage is that the screw-access opening must be masked, particularly if the implant is angled through the facial aspect of the restoration.

Fig. 9

Fig. 10

Fig. 11

Fig. 12

Fig. 13

Fig. 14

Fig. 15

Fig. 16

Fig. 17

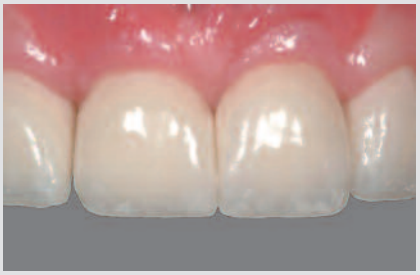


Fig. 18

Fig. 19

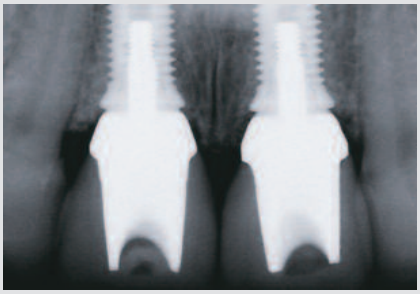


Fig. 20

Fig. 9 Implants were placed into the central incisor positions with ideal mesiodistal spacing, and healing abutments were seated.

Fig. 10 The provisional restorations were modified for passive seating over the implants and remained in place during integration.

Fig. 11 A radiograph demonstrated preservation of osseous levels.

Fig. 12 The provisional restoration was again removed, temporary cylinders were attached to the integrated implants, and the restoration was modified to support the remaining peri-implant soft tissue.

Fig. 13 Over a few weeks, the sulcular implant tissue reformed to the altered provisional restoration.

Fig. 14 Prefabricated zirconia abutments displaying straight and abrupt emergence profiles (ZiReal® Posts, BIOMET *3i*) were marked for reduction and contour refinements.

Fig. 15 Zirconia preparation diamonds (Komet USA, Rock Hill, South Carolina, USA) were used to prepare gradual emergence profiles and finish lines that followed the gingival scallop.

Fig. 16 Both abutments were reseated on the master cast for crown fabrication.

Fig. 17 Ceramic crowns for the central incisors transitioned smoothly from the customized zirconia abutments.

Fig. 18 Four aspects of crown fabrication on adjacent implants include: (1) optimal subgingival abutment support, (2) a long contact area, (3) elimination of black triangles, and (4) bright ceramics in proximal aspects.

Fig. 19 The patient's revitalized smile demonstrated balanced sulcular levels and crown contours and colors that blended naturally with the remaining dentition.

Fig. 20 Marginal bone levels that are critical to soft-tissue form remained stable following implant placement and restoration.

Fig. 21 Soft-tissue profiles developed with the provisional restorations were preserved by the subgingival contours of the abutments and crowns.

Soft-tissue support with the provisional restoration should begin at the level of the implant and progress coronally from the cylindrical form of the implant to the trigonal shape of a tooth as it emerges through the gingival sulcus (Fig. 12).[18] Subgingival contours are gently adjusted by adding or subtracting flowable composite resin until the soft-tissue profile is optimal.[19] Increasing or decreasing pressure on the fixed amount of soft tissue present will subtly influence the sulcular and papillary levels.[12] The provisional and definitive restoration must still closely match the contours of the adjacent or contralateral teeth for aesthetic continuity. Once the sulcular levels have been optimized, the provisional restoration should be left in place until the tissues have matured and are ready for impression making (Fig. 13). Continued removal, modification, and reseating should be avoided as these processes may actually lead to loss of bone and soft tissue.[20]

Definitive Crowns and Abutment Contours

Once the restorative dentist or prosthodontist has maximized the potential of the sulcular contours around adjacent central incisor implants with provisional restorations, these contours must be replicated within the definitive abutments and crowns. The laboratory can use the provisional restoration as a blueprint for the subgingival and supragingival contours that must be achieved.[21] This information can be relayed to the laboratory by several methods: the provisional restoration itself can be impressed,[22] impression copings can be modified to duplicate the subgingival contours of the provisional restorations,[23] digital images of the soft-tissue profiles can be sent to the laboratory, or soft-tissue casts can be contoured with burs specifically designed for reduction of silicone materials. A custom or prefabricated definitive abutment may be used, although prefabricated abutments may require slight modifications (Fig. 14). For example, a prefabricated abutment with a stepped emergence profile between the abutment and the definitive crown may require modification to make it more closely mimic the natural tooth/root contours (Figs. 15-17).

To compensate for the inevitable loss of papillary height between maxillary incisor implants, four aspects of abutment and crown fabrication require special consideration (Fig. 18): (1) the subgingival abutment form must optimally support the available soft tissue, (2) proximal contact areas must be extended gingivally, (3) unsightly black triangles must be completely closed, and (4) fluorescent or high chroma ceramics should be applied in the gingival proximal aspects between the crowns to minimize the shadow effect.[24]

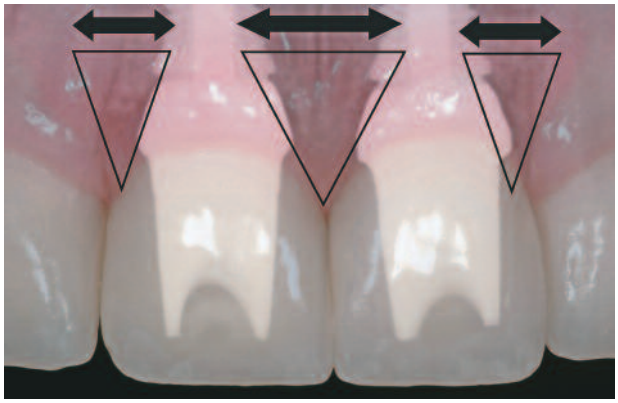


Fig. 21

Central Incisor Central Incisor	Lateral Incisor Central Incisor/Canine
Symmetrical	Asymmetrical
Nasopalatine papilla	No papilla
Larger tooth	Smaller tooth
Greater interseptal space	Less interseptal space

Table 1
The soft-tissue potential of implants replacing adjacent maxillary anterior teeth

The definitive restorations should easily slip into the previously developed sulci, and the reformed peri-implant gingiva will be supported by the subgingival contours of the definitive abutments and crowns (Figs. 19-21).

Clinical Relevance

Although restitution of soft-tissue levels around adjacent implants is not consistently achievable, protocols predicated on preservation and restoration of osseous architecture may result in clinically acceptable aesthetics for many patients. Optimal placement of implants in well-developed sites provides the restorative dentist with the potential to redevelop the soft-tissue to normal sulcular form with implant-level provisional restorations. The support established with the provisional prostheses are then duplicated in the subgingival form of the implant abutments and crowns to preserve the peri-implant anatomy and can provide naturally appearing restorations for adjacent implants.

George Priest, DMD (continued)

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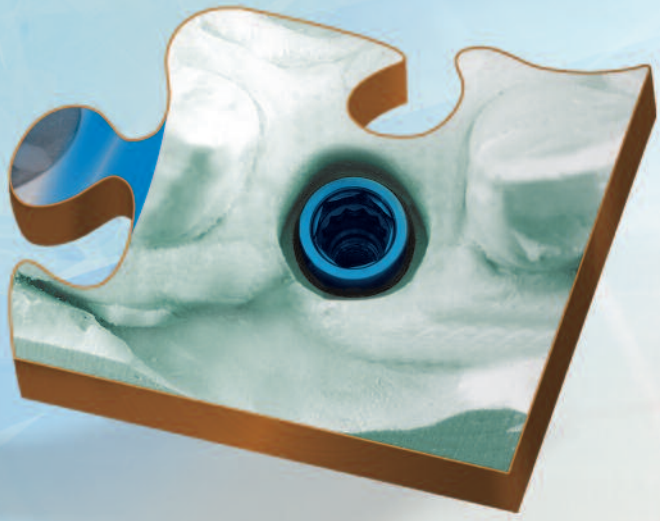

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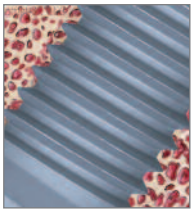
comparison

Histologic comparison of biologic width around teeth versus implants: The effect on bone preservation

Kazuto Makigusa DDS, PhD



Histological analysis of the biological width surrounding primate teeth offers insights into why the blood supply is reduced after tooth extraction and implant placement. This occurs because of the reduction of ridge width and height. The reduction in blood supply tends to be exacerbated as development of a new biologic width after implant placement causes facial bone to be lost both vertically and horizontally. Evaluation of patient biotypes, combined with use of an implant designed to reduce crestal bone loss, can help to achieve optimal aesthetics.

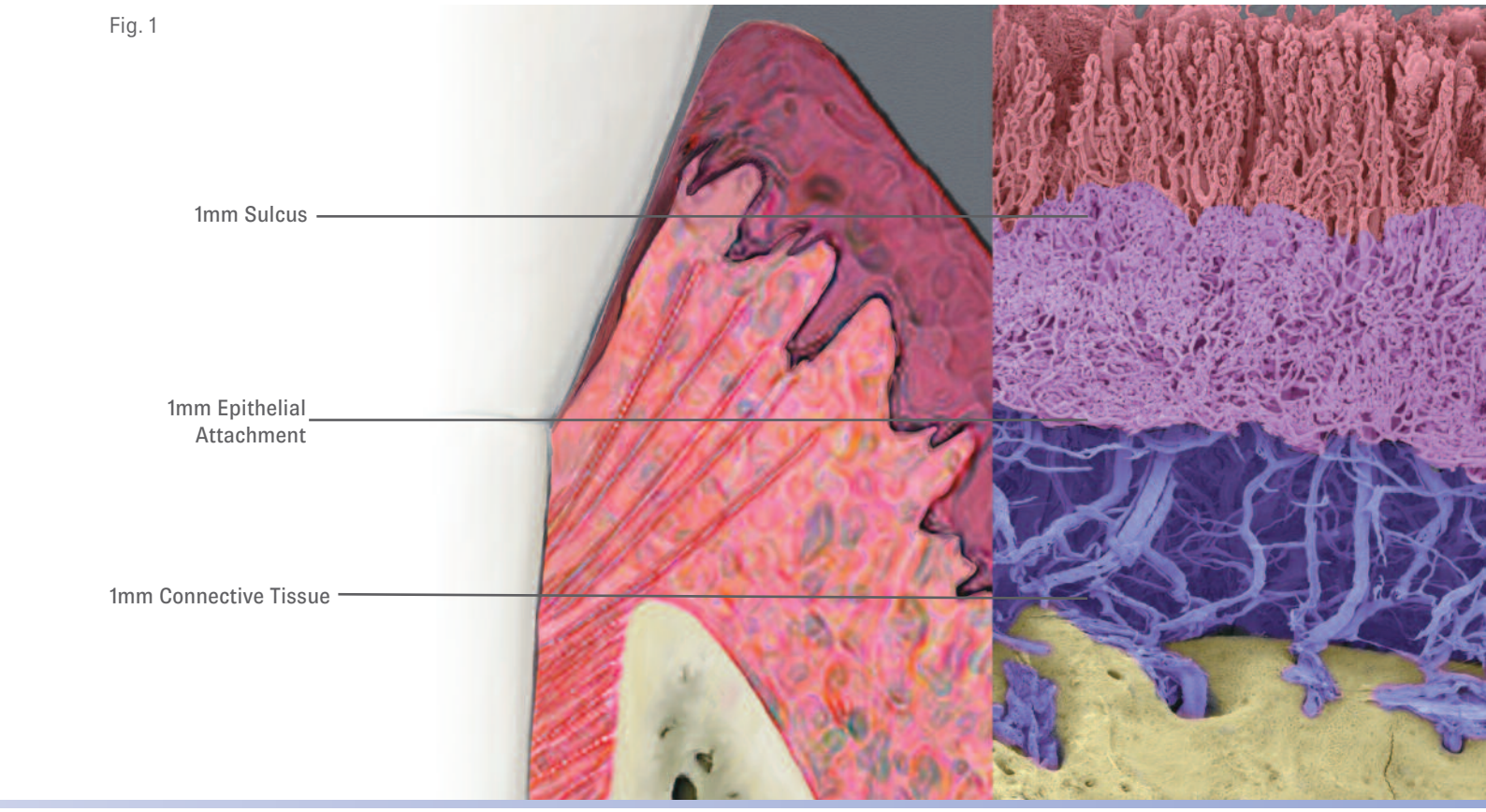
Key Words: biologic width, microvasculature, platform switching, crestal bone preservation

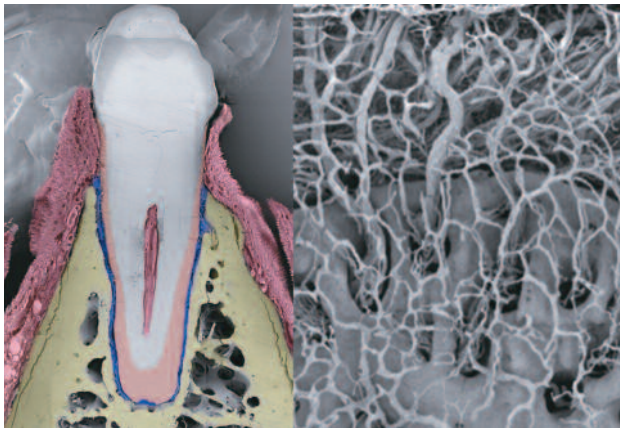
Introduction

In the human body, ectodermal tissue serves to protect against invasion from bacteria and other foreign materials. However, both teeth and dental implants must penetrate this defensive barrier. The natural seal that develops around both, protecting the alveolar bone from infection and disease, is known as the biologic width. Around natural teeth, the biologic width has been shown to consist of approximately 1mm of connective tissue, 1mm of epithelium, and 1mm or more of sulcular depth (Fig. 1).[1] The biologic width that develops around implants at the time of abutment connection has been demonstrated to incorporate tissue zones of similar dimensions.[2] However, figures 2 and 3 demonstrate some morphologic differences in the distribution of the vascular network.

Although previous researchers have histologically examined the blood supply to the tissues of the biologic width, this work primarily has been conducted utilizing rats and dogs.[3] To assess the microvasculature of the biologic width in primates, the author worked with Japanese snow

Fig. 1





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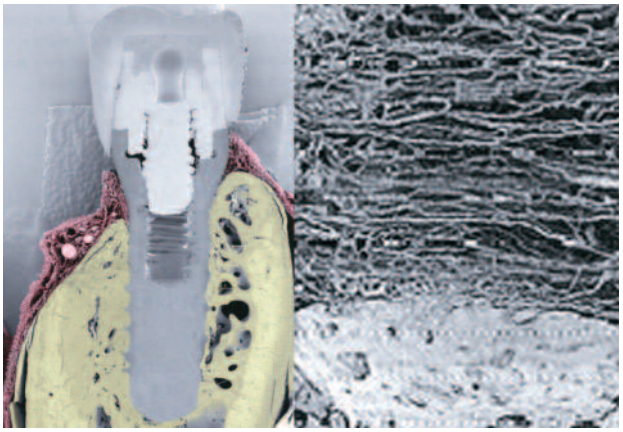


Fig. 3

monkeys *(Macaca fuscata)*, whose masticatory function and mandibular morphology closely resembles that of humans.[4] Three animals were placed on a controlled regimen of oral care, then euthanized and injected with acrylic resin. After the resin hardened, the mandible was sliced at the first premolar and bone-microvasculature cast specimens were prepared for observation under an SEM (JSM-5500, JEOL, Tokyo, Japan). Subsequently, the tooth was extracted and clear morphological differences were observed between the gingival area of the alveolus, the alveolar mucosa, and the body of the mandible. Furthermore, three different blood supply routes to the gingival connective tissue attachment site were identified.

The origins of these blood supply routes are as follows: from the periodontal ligament to the connective tissue, from the alveolar process to the periodontal ligament and then to the connective tissue, and from the alveolar process directly to the connective tissue (Fig. 4).

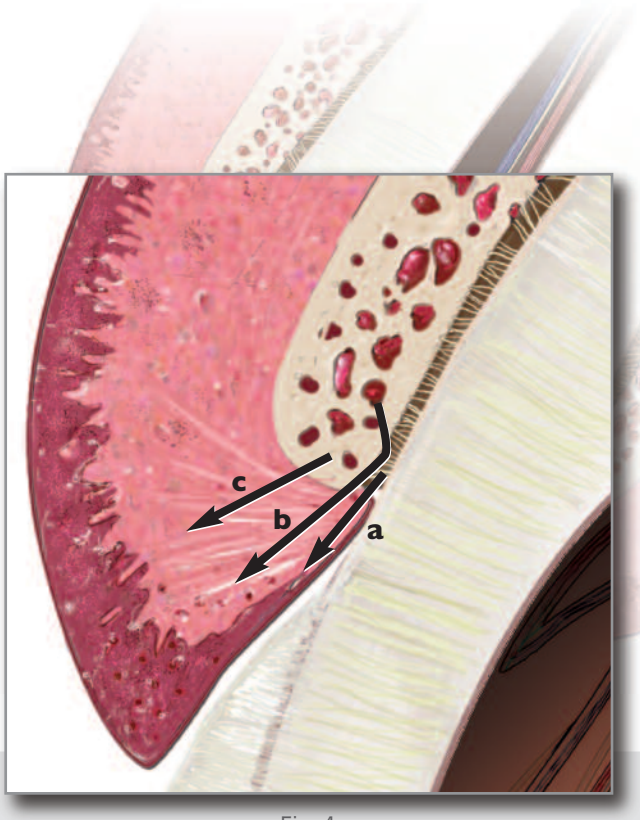


Fig. 4

Fig. 5

Fig. 4 Around teeth, blood supply support originates from the periodontal ligament (PDL) to the connective tissue (CT) (arrow a); from the alveolar process to the PDL and then to the CT (arrow b); and from the alveolar process to the CT (arrow c).

Fig. 5 Illustration depicting the inherent thinning of the ridge following the development of the biologic width around standard two-stage implants. Note the increase in cortical bone and the reduction in cancellous bone.

In contrast, when implants replace teeth that have been lost, and a new biologic width develops after connection of conventional two-stage implants to abutments, the overall blood supply to the gingival connective tissue is reduced, due to the absence of a periodontal ligament. This has important implications for clinicians considering placement of implants, particularly in the aesthetic zone, where recession of buccal gingival tissue is a common occurrence.[5,6] The reduction in blood supply that occurs first after extraction and then after implant placement may predispose this loss of soft-tissue volume and increase the risk of implant and/or abutment exposure. Evaluation of the patient's tissue biotype and bone thickness should thus be conducted at the time of treatment planning, with expectations for the clinical outcome adjusted accordingly. The thicker the native hard and soft tissue, the more abundant the blood supply that can be expected after implant placement, with correspondingly heightened expectations for aesthetic success.

Besides the absence of the periodontal ligament, blood supply around dental implants is less than that around natural dentition as the result of a dynamic process of bone remodeling. After implant placement, the biological width must be reestablished. As this occurs, circumferential bone loss typically occurs around the implant's coronal aspect up to the first implant thread (Fig 5). Also, resorption in a palatal direction following tooth loss results in ridge thinning. The thin bone remaining on the facial aspect of the implant tends to be

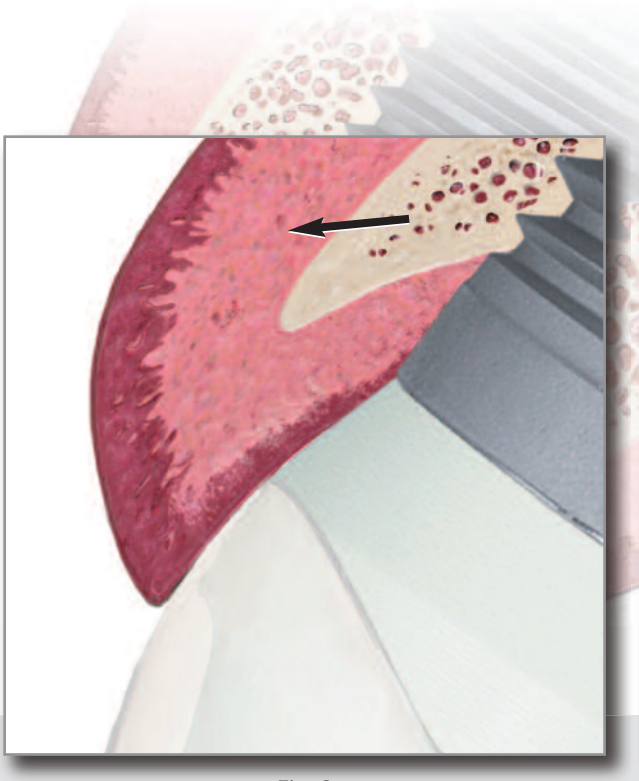


Fig. 6

Fig. 6 Illustration depicting increased presence of cortical bone and the subsequent reduction in the available blood supply following development of the biologic width around standard two-stage implants.

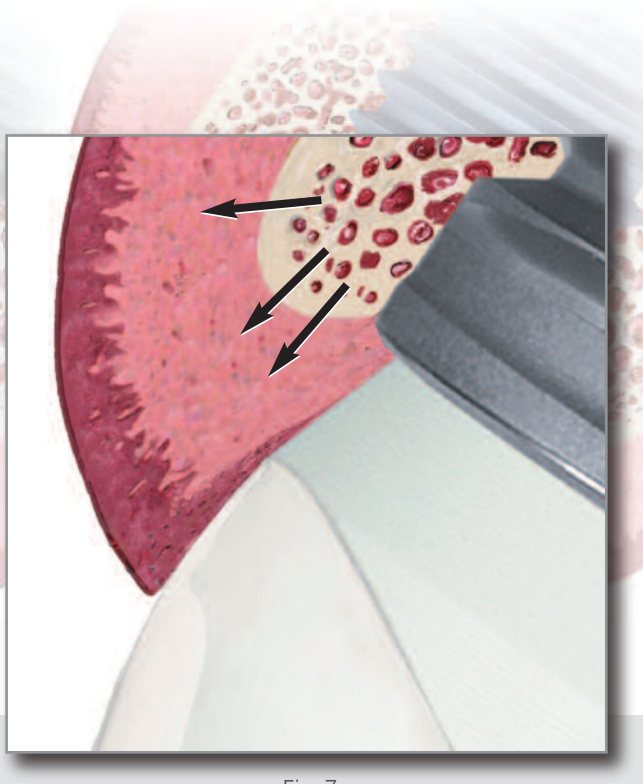
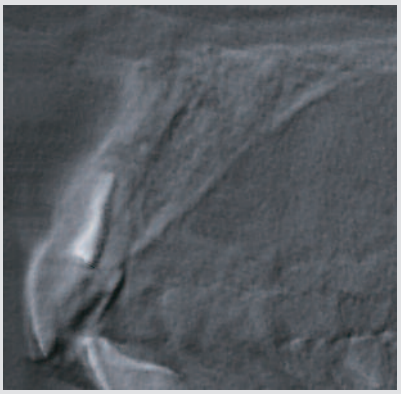


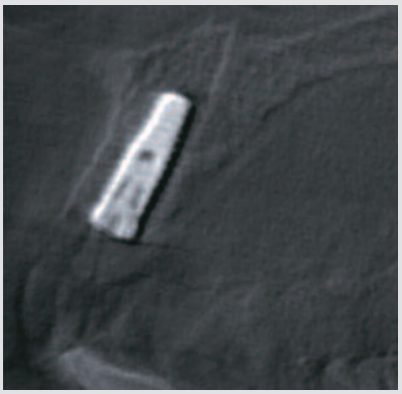
Fig. 7

Fig. 7 Illustration depicting an implant design with built-in platform switching, which is designed to aid in crestal bone preservation.

cortical, with significantly less vascularity. Furthermore, in a thin ridge, there is rapid drop off (sloping) of the buccal aspect of the crest, resulting in more of the blood supply being positioned apically, where the bone crest is wider and more cancellous (Fig. 6).

The microgap that occurs at the junction of the implant and abutment in traditional two-stage implant systems has been implicated as a cause of the vertical and horizontal bone loss occurring after abutment connection.[7] Bacterial contamination of this microgap has been associated with formation of an inflammatory cell infiltrate[8,9] that, in turn, may trigger circumferential bone resorption. The concept of platform-switching[10] suggests that shifting the implant-abutment junction inward and away from the peri-implant bone can help to shield the bone from inflammatory cell infiltrate and reduce crestal bone resorption. Use of an implant design that incorporates the platform-switching concept, e.g., a PREVAIL® Implant (BIOMET ***3i***), may aid in the preservation of crestal bone. In theory, if bone is preserved, it will support soft tissue that may impact the aesthetic outcome. Greater bone volume can also increase blood supply for the health and maintenance of soft tissues (Fig. 7). Cross sectional axial slices (Figs. 8-10) demonstrate a clinical situation where a failed maxillary central incisor was extracted and replaced immediately with a straight collar PREVAIL Implant. This implant design was chosen due to its built-in platform switching.





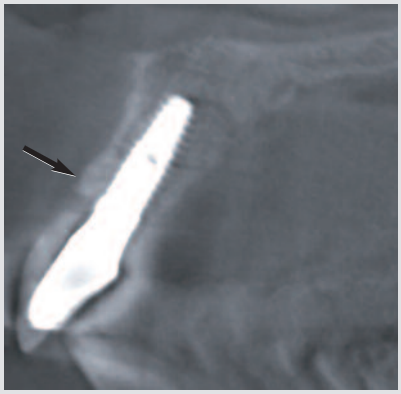


Fig. 8 Cross sectional axial slice showing the adjacent central incisor as a reference.

Fig. 9 Cross sectional axial slice of a straight collar NanoTite™ PREVAIL® Implant on the day of placement in tooth position 8 [11].

Fig. 10 Cross sectional axial slice taken at 14 months post-implant placement and six months post-restoration in tooth position 8 [11]. Note the preservation of the facial bone (see arrow).

Clinical Relevance

The lack of a periodontal ligament and consequently reduced microvasculature surrounding dental implants may jeopardize the maintenance of optimal aesthetics over time. For this reason, candidates with thick biotypes are better candidates for implants in the aesthetic zone. The PREVAIL Implant was used, which is an implant designed to aid in crestal bone preservation. Such bone preservation may include crestal bone on the facial aspect of the implant. During development of the biologic width following implant exposure, attempts to preserve the facial bone may improve outcomes in aesthetic areas or areas of thin biotypes.

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Technical Tips

Technical Tips for the Encode® Complete Restorative System

Meeting aesthetic demands and increasing productivity can be achieved with the Encode Complete Restorative System. Due to technology developed at BIOMET ***3i***, a simple impression of an Encode Healing Abutment replaces the need for an implant-level impression. The result is a CAD/CAM patient specific abutment with marginal height and natural emergence contours to meet the needs of each individual case. Technical Tips have been developed to provide practical use of this exciting new technology.*

*For more information on the Encode Complete Restorative System, refer to ART1079, 1080 and 1087.

1 Technical Tip

Full-Contour Wax Patterns

The use of full-contour wax patterns can be helpful in order to visualize the definitive restoration and to communicate these contours to the commercial dental laboratory. With the Encode® Complete Restorative System, wax patterns provide the same information to the BIOMET ***3i*** PSR® Technician for developing the proper anatomic contours to support the soft tissue. The definitive Encode Abutment is designed to accommodate the optimal contours of the wax pattern.

At the time of implant placement or second stage surgery, the proper diameter and height Encode Healing Abutment is placed into the implant. Following osseointegration and soft-tissue maturation, the clinician makes an impression of the Encode Healing Abutment. The case is sent to the commercial dental laboratory for fabrication of a master cast (Fig. 1). In the laboratory, a removable wax pattern is made over the stone die of the Encode Healing Abutment (Fig. 2). The wax pattern must be removable and have a matte finish for proper scanning. The articulated casts, wax pattern and Encode Complete Laboratory Work Order Form are forwarded to the BIOMET ***3i*** PSR Department.

The PSR Technician scans the master cast (Fig. 3) and the wax pattern, transferring the three-dimensional information necessary to design the definitive abutment and fabricate a Robocast (a cast fabricated via robotic analog placement) (Fig. 4).

The definitive Encode Abutment and the Robocast are returned to the commercial dental laboratory for fabrication of the definitive restoration (Fig. 5).

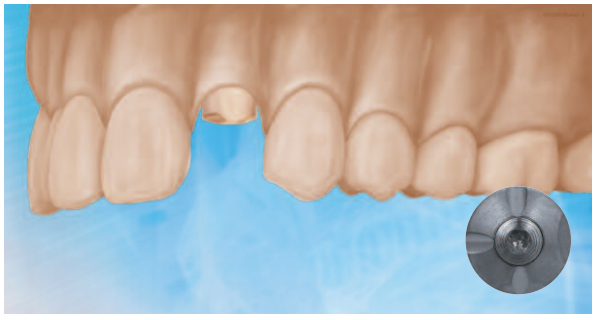


Fig. 1

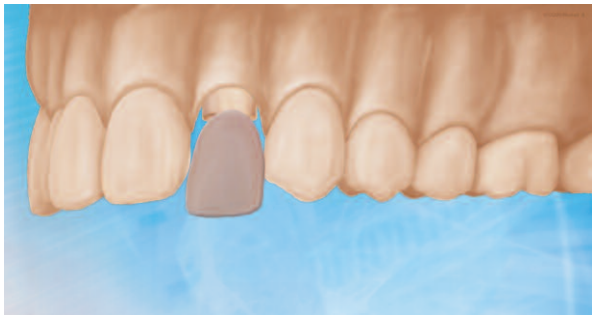
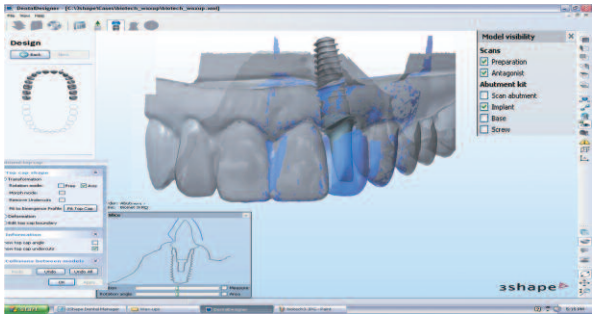


Fig. 2



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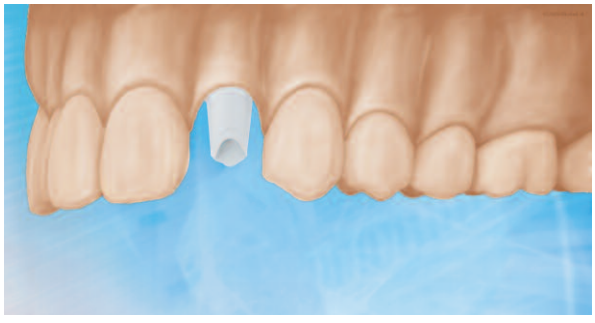


Fig. 4

Fig. 5

Fig. 1

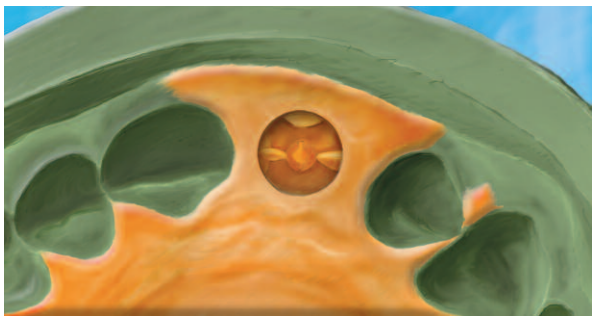


Fig. 2

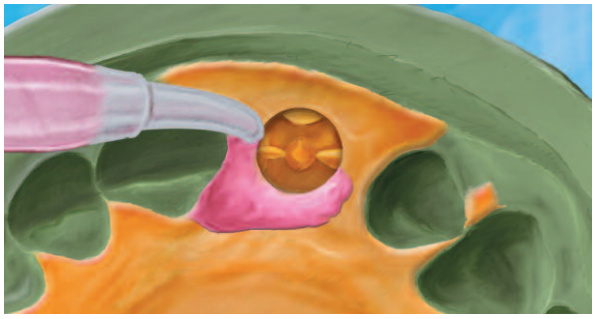


Fig. 3

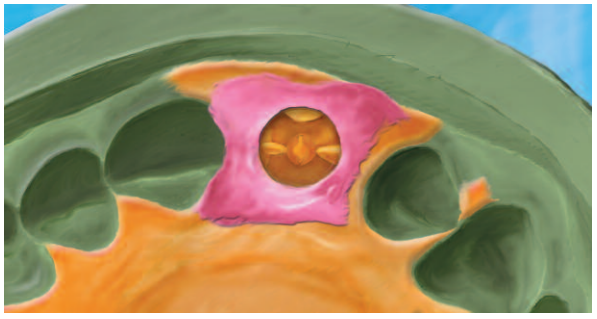


Fig. 4

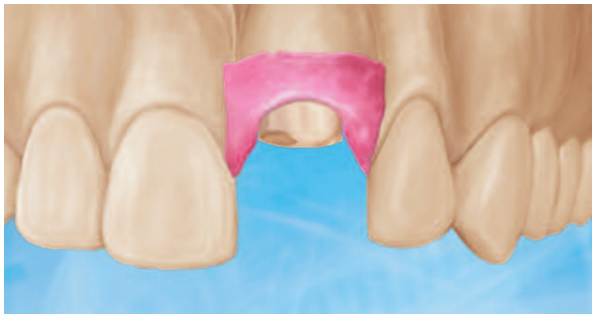
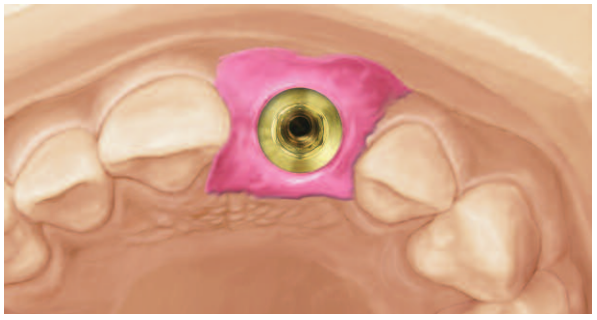


Fig. 5



Technical Tip 2

Soft-Tissue Models

As an alternative, with the Encode® Complete Restorative System, soft-tissue models may be fabricated to facilitate construction of anatomically contoured abutments/restorations. Soft-tissue models are fabricated to transfer the clinical peri-implant soft-tissue contours to the master cast.

At the time of implant placement or second stage surgery, the proper diameter and height Encode Healing Abutment is placed into the implant. Following osseointegration and soft-tissue maturation, the clinician makes an impression of the Encode Healing Abutment (Fig. 1).

The case is sent to the commercial dental laboratory for fabrication of a master cast. If a soft-tissue model is desired, the commercial dental laboratory technician injects soft-tissue material onto the intaglio surface of the Encode Healing Abutment impression (Fig. 2). Care must be taken to avoid flowing the material into the impression of the Encode Healing Abutment. Trim as necessary (Fig. 3).

Low expansion die stone is used to create the master cast (Fig. 4). The master cast is sent to the BIOMET ***3i*** PSR® Department for fabrication of the definitive abutment and Robocast. An analog is placed into the master cast robotically, thus creating the Robocast (Fig. 5). The definitive Encode Abutment and the Robocast are returned to the commercial dental laboratory for fabrication of the definitive restoration.

3 Technical Tip

Multiple-Unit Cases: Framework Try-in

In conventional dentistry, framework try-ins are a valuable and common step used in fabricating definitive restorations. With multiple-unit cases using the Encode® Complete Restorative System, framework try-ins are necessary to ensure an accurate fit.

Following osseointegration of the implants and soft-tissue maturation, an impression is made of the Encode Healing Abutments (Fig. 1). The case is sent to the commercial dental laboratory for processing and is then forwarded to the BIOMET *3i* PSR® Department. The PSR Technicians scan, design, and fabricate the definitive abutments as well as a Robocast. The definitive Encode Abutments and Robocast are returned to the laboratory, for fabrication of the metal framework.

At the restorative office, the Encode Healing Abutments are removed, the definitive Encode Abutments are placed (Fig. 2), and verification radiographs of complete abutment seating are taken. The metal framework is tried-in on the abutments (Fig. 3). Following verification of a passive fit on all of the abutments, the framework and abutments are removed, the Encode Healing Abutments are replaced into the implants, and the case is returned to the laboratory (Fig. 4) for fabrication of the definitive restoration.

The Encode Healing Abutments are removed and the definitive abutments are placed. Verification radiographs of complete abutment seating are taken and the definitive restoration is seated (Fig. 5).

Clinical Tip: If the framework does not fit passively onto the Encode Abutments, it must be sectioned, evaluated for fit and luted together with a self-curing acrylic-resin die material. Once a passive fit is obtained, a pick-up impression of the framework is made, the definitive Encode Abutments are removed, and the Encode Healing Abutments are replaced intraorally. In the laboratory, the framework is soldered, porcelain is applied, and the prosthesis is completed.

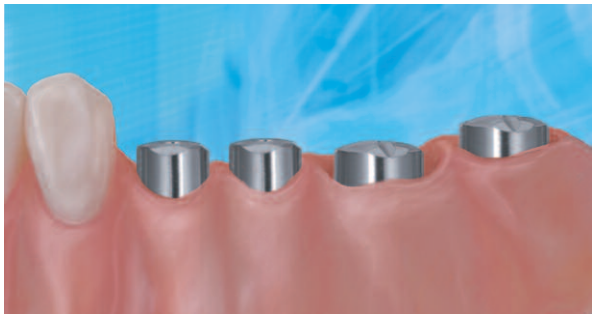


Fig. 1

Fig. 2

Fig. 3

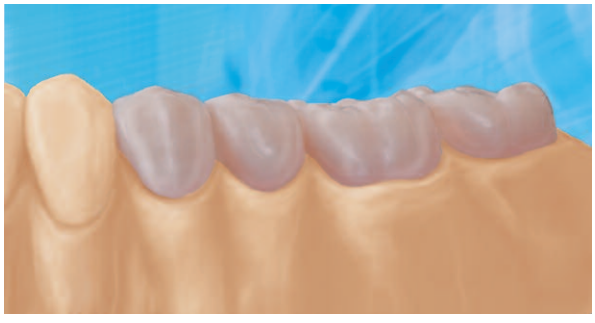


Fig. 4

Fig. 5

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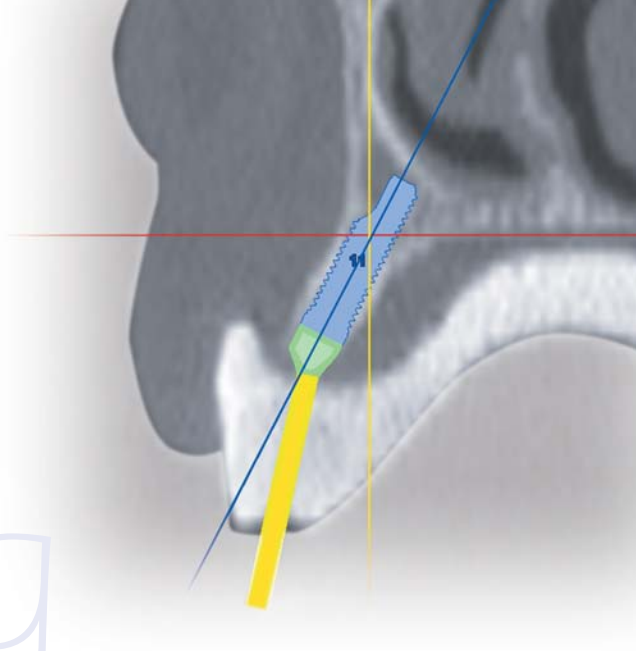
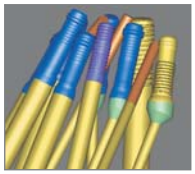


planning

CT guided implant treatment: Techniques for successful planning and execution

Harold S. Baumgarten, DMD



As the immediate loading of dental implants has been demonstrated to yield functional and aesthetic results, computed tomography (CT) technology and software have improved clinicians' abilities to plan and implement implant placement. Accurate surgical guides can be fabricated, and using precise surgical instrumentation, implants can often be placed without raising a flap.[1-3] Patients can leave the office with aesthetic, fixed provisional restorations. This article presents a case in which CT technology and planning software were utilized to restore an edentulous maxilla.

Key Words: computed tomography (CT), planning, immediate provisionalization

Introduction

Patients today demand aesthetic replacements for their missing teeth, with shorter treatment times and minimal downtime or inconvenience. They often are not satisfied with treatment plans that include the use of removable prostheses; even briefly.

In the realm of implant dentistry, the immediate placement of a prefabricated, aesthetic provisional restoration can enable clinicians to meet these heightened expectations. But meticulous pretreatment planning by the entire implant team is essential, with the surgeon, restorative dentist, and laboratory technician each providing input during the planning stage to avoid many potential pitfalls. Furthermore, a number of requisites must be fulfilled in order to predictably facilitate this type of therapy.

The single most important predictor of success for immediately placed implants is high primary stability. Factors that enable the surgeon to achieve this include the patient's bone quality, the drilling protocol employed, the precision with which osteotomy sites are prepared, the macro-geometry of the implant design, and the micro-geometry of the implant surface.

When implants are placed optimally with high initial mechanical stability, that stability quickly begins to decrease as a result of bone relaxation and remodeling.[4]

Minimizing this effect can protect the implants from overloading in the early phase of healing. In this case, the author selected implants (NanoTite™ Implants, BIOMET ***3i***) with a complex surface topography, which renders the implant a bone-bonding surface by the interlocking of the newly formed cement line matrix of bone with the implant surface.[5,6]

Conventionally restored two-stage implants exhibit remodeling of crestal bone to about the level of the first thread. This decreases the amount of supporting bone around the implant. Platform switching may help to minimize this remodeling and provide bone and soft-tissue support.

Once the team has planned for high primary stability, rapid osseointegration, and minimal crestal bone loss, the number and location of each implant can be precisely determined by using computed tomography (CT) planning software. However, studies have revealed discrepancies between the actual size of the jaw and its depiction in CT scans.[9,10] Potential technique errors in the surgical procedure may also cause implants to be placed in locations different from what was planned.[7,8,11]

The following clinical presentation demonstrates the step-by-step process for planning an accurate, minimally invasive, CT guided surgery with the immediate placement of a fixed prefabricated provisional restoration.

Fig. 1.1

Fig. 1.2

Fig. 2.1

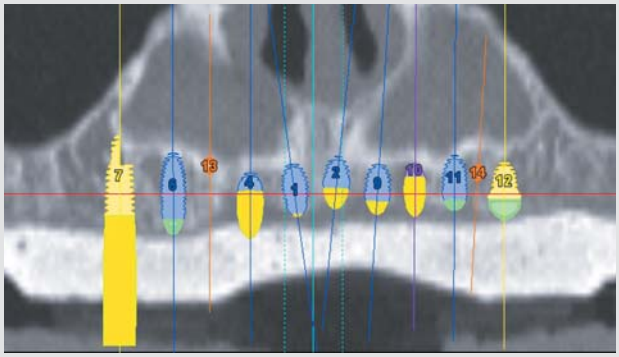


Fig. 2.2

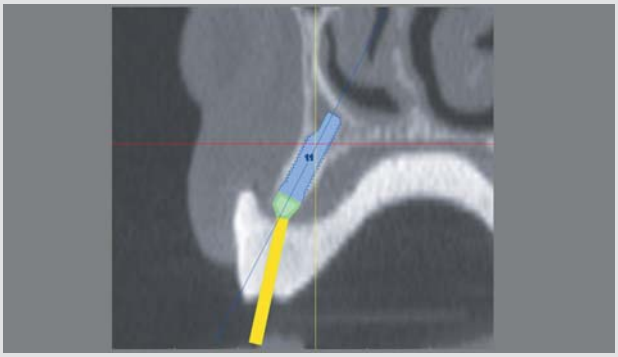


Fig. 3.1

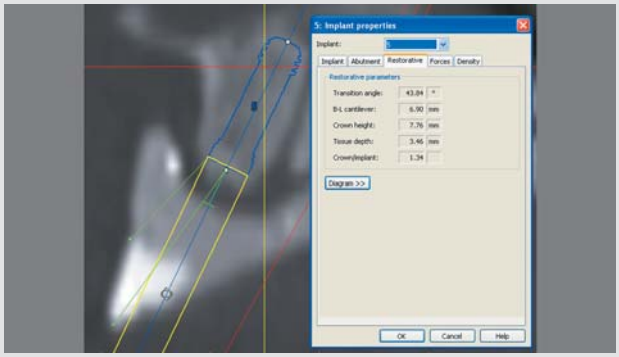


Fig. 3.2

Fig. 4.1

Fig. 4.2

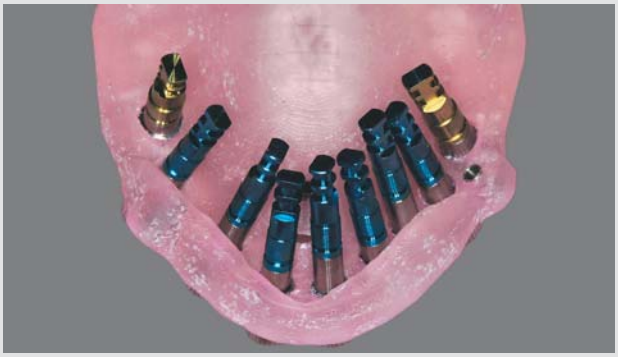


Fig. 5.1

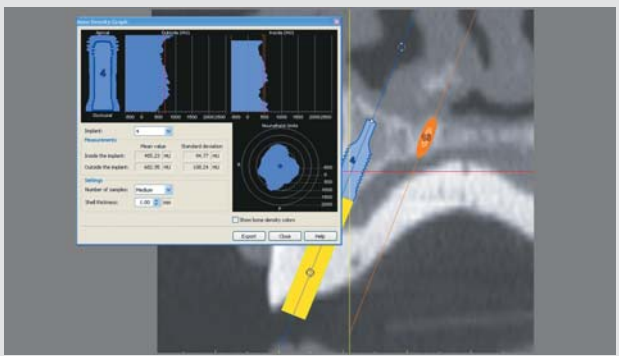


Fig. 5.2

Fig. 1.3

Fig. 2.3

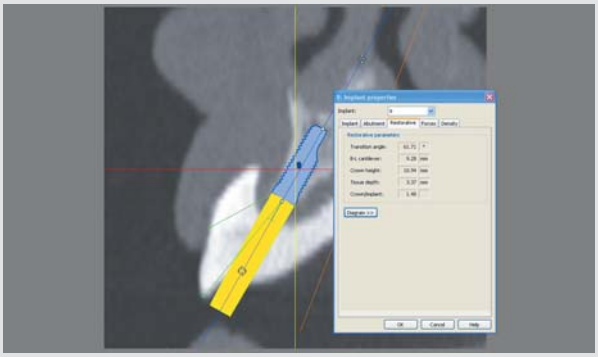


Fig. 3.3

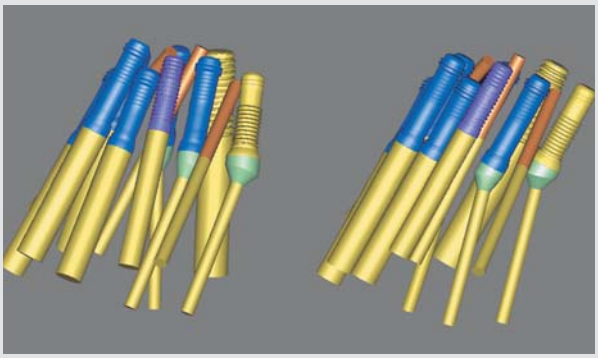


Fig. 4.3

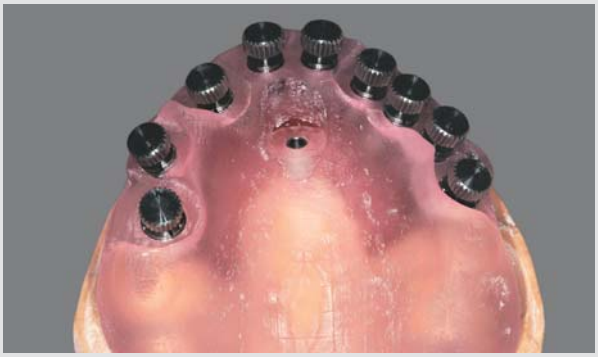
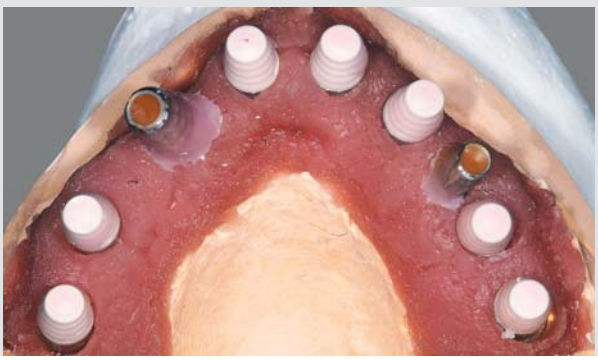


Fig. 5.3



Clinical Presentation

[Figs. 1.1-1.3] The diagnosis for this 58-year-old male patient included failing maxillary dentition with significant alveolar resorption. After extraction of the hopeless teeth in the maxilla, socket preservation was performed to preserve ridge width and height (Fig. 1.1). The complete denture that was satisfactory with regards to fit, aesthetics, and phonetics was duplicated in a mixture of 30% barium sulfate and cold-cure acrylic resin (Fig. 1.2). At the CT scanning appointment, this duplicate denture/scanning appliance was placed intraorally with the intaglio surface of the denture in intimate contact with the soft tissues of the edentulous ridge. The accurate placement of the scanning appliance is critical to capturing an image that can be used to generate a surgical guide. Figure 1.3 illustrates a scanning appliance that was dislodged during the scanning process. Note the presence of an air space between the scanning appliance and the soft tissues of the maxilla.

[Figs. 2.1-2.3] An occlusal registration was made that later allowed the master cast to be poured into the guide to be articulated against the lower cast, using the scanning appliance. The CT scan was obtained, and data from the scan was processed using SimPlant Master Software (Materialise Dental, Inc., Glen Burnie, Maryland, USA). Virtual implants were then placed into the reformatted images. The relationship of the planned implant/abutment positions to the bone of the edentulous ridge can be seen in the panoramic view (Fig. 2.1). An oblique section illustrates the use of a 17-degree Angled Conical Abutment to redirect the screw access hole so that it passes through the occlusal surface of the planned restoration (Fig. 2.2). The relationship of the prosthetic seating surface of each implant to the gingival margin was also planned. Using the SimPlant Planner's Restorative screen, the transition angle, buccolingual cantilever, crown height, tissue depth, and crown-to-implant ratio were determined (Fig. 2.3).

[Figs. 3.1-3.3] Changing the implant view from "Opaque" to "Outline" made it easier to locate critical landmarks (Fig. 3.1). Failure to properly plan the ideal subgingival position of the restorative seating surface of the implant can result in the unaesthetic display of titanium components in the provisional phase of treatment (Fig. 3.2). It is possible to plan implant locations that will adequately fit into the existing alveolar bone while not allowing for a common path of insertion of a fixed restoration. To avoid this, the implants can be digitally paralleled (Fig. 3.3).

[Figs. 4.1-4.3] The treatment plan was sent to Materialise electronically, and a surgical guide incorporating Master Tubes designed specifically for the Navigator™ System (BIOMET ***3i***), was fabricated (Fig. 4.1). Appropriate diameter and length Implant Analog Mounts were then selected from the Navigator Laboratory Kit. These correspond to the Implant Mounts used to place the implants through the Master Tubes in the surgical guide. The Implant Analog Mounts were mated with the appropriate analog and inserted into the Master Tube. Great care was taken to ensure that the rotational positioning pins on the Analog Mounts were engaged with the notches of the Master Tubes to enable the transfer of alignment of the analog and implant hexes from the cast to the oral cavity (Fig. 4.2). Once all the analogs were positioned within the surgical guide, the guide was beaded and boxed, and a soft-tissue cast was poured (Fig. 4.3).

[Figs. 5.1-5.3] The soft-tissue cast was placed into the CT Scanning Appliance and articulated with the occlusal registration that was previously obtained. The prescribed straight and angulated Conical Abutments were then placed in the appropriate positions on the master cast. Screw retention was planned for two of the implant locations, while the remaining implant positions were to receive QuickBridge® Components[12] as retentive elements. The decision as to which implants would have screw retention was based on a digital bone-density analysis. Using the SimPlant Planner Software, a bone-density graph is displayed that includes the mean and standard deviation of Hounsfield Units around each implant. As one moves the implant in the software to idealize its position, the bone density graph updates itself in real time (Fig. 5.1). The QuickBridge Titanium Cylinders were placed onto the Conical Abutments and tightened (Fig. 5.2). QuickBridge Caps were snapped onto the QuickBridge Titanium Cylinders. Undercuts in the Caps and the Temporary Cylinders were waxed out, and the cast was then duplicated and articulated (Fig. 5.3).

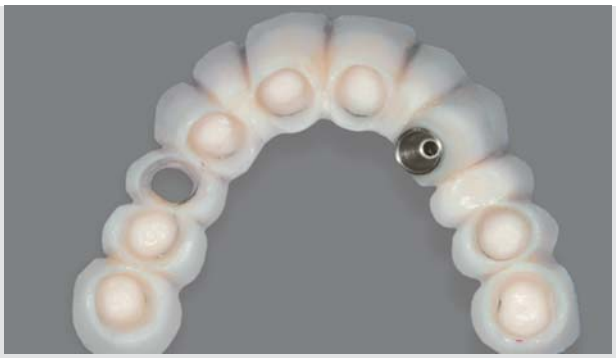


Fig. 6.1

Fig. 6.2

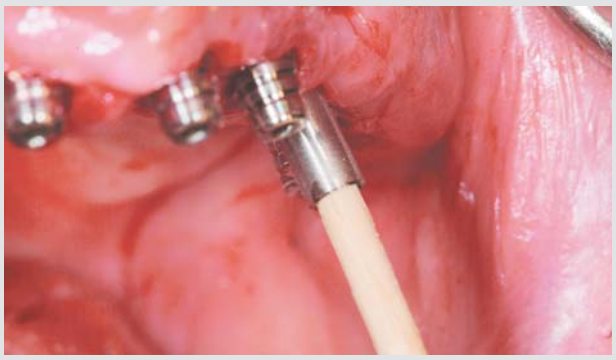


Fig. 7.1

Fig. 7.2

Fig. 8.1

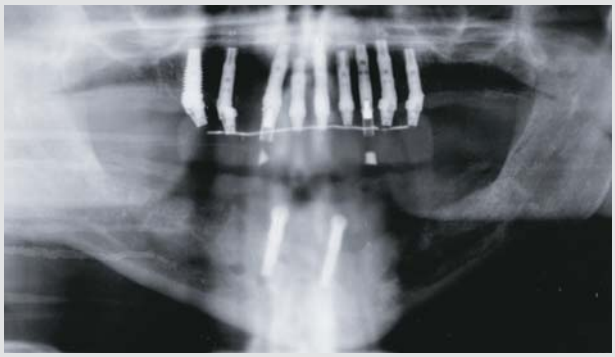


Fig. 8.2

[Figs. 6.1-6.2] The provisional restoration was then waxed on the duplicate cast, invested, and processed. One Conical Abutment Temporary Cylinder was incorporated into the provisional restoration in the laboratory using cold-cure acrylic resin (Fig. 6.1). To compensate for any technique or scanning error and ensure a completely passive fit of the provisional restoration, the second Conical Abutment Temporary Cylinder was to be incorporated into the provisional restoration intraorally after implant placement and before the pick-up of the QuickBridge® Caps. At the time of surgery, local anesthetic was administered and the surgical guide was placed and secured using 2mm-diameter bone screws (BIOMET Microfixation, Jacksonville, Florida, USA). The osteotomies were prepared with Tissue Punches, a Starter Drill, depth-specific twist drills of increasing diameters, and manual bone profilers. Note that the tissue punch is more easily used through the Master Tubes prior to fixating the surgical guide. This allows for easy removal of the soft-tissue plugs without having to pull these through the Master Tubes. The implants were then placed through the Master Tubes using the appropriate Navigator™ System Implant Mounts. Final positioning of each implant was accomplished using a hand ratchet to ensure the precise positioning of the timing notch on the Implant Mount relative to the timing notch in the Master Tube (Fig. 6.2).

[Figs. 7.1-7.2] The surgical guide was removed, and Conical Abutments were seated into the internal interfaces of the implants and tightened to 20Ncm of torque with a torque driver. QuickBridge Titanium Cylinders were placed onto each abutment and hand tightened. After being placed and secured with a retaining screw, the remaining Conical Abutment Temporary Cylinder was then luted intraorally to the prefabricated provisional restoration with cold-cure acrylic resin, using the wooden handle of the cotton-tipped applicator to keep the screw hole patent during the luting process (Fig. 7.1). This resulted in a perfectly passive restoration retained by two screws. The provisional restoration was then removed, and the QuickBridge Caps were snapped onto the QuickBridge Titanium Cylinders and picked up into the intaglio surface of the provisional restoration with cold-cure acrylic resin. Since all of the abutments employed fixed margins, the provisional restoration was trimmed and polished extraorally without the clinician having to remove abutments from the oral cavity (Fig. 7.2).

[Figs. 8.1-8.2] The completed provisional restoration was then snapped into position, retained with two retaining screws, and evaluated for even occlusal contacts and lack of occlusal interferences. The screw access openings were filled with cotton and Cavit (Fig. 8.1), and the patient was dismissed with post-operative and oral hygiene instructions. The position of the implants is seen in the post-operative panoramic radiograph (Fig. 8.2).

Using the Navigator™ System for CT Guided Surgery in this case made it possible to place multiple implants using a minimally invasive, flapless surgical protocol and then immediately deliver a prefabricated, laboratory-processed, provisional restoration with QuickBridge® Provisional Components. Planning the location of each implant in the SimPlant Planner Software enabled the team not only to identify where each implant should be placed but also to determine each implant's width, length, angulation, and subgingival position. Although the apices of the implants were in close proximity, the planning software and precision of the Navigator System's surgical instrumentation helped to prevent any impingement among them. Incorporating angulated abutments in the plan allowed for a common path of insertion and ensured that screw-access openings were appropriately located. The entire implant team worked in concert before surgery to decide the best strategy for the patient.

Clinical Relevance

Visualizing and planning a patient's implant therapy in three dimensions can make it possible for the implant team to place implants precisely using minimally invasive implant surgery, with reduced morbidity. When immediate loading is indicated, the computerized surgical plan may allow for delivery of a passive, precise, and aesthetic provisional restoration at the time of surgery.

Surgical Colleague: Alan M. Meltzer, DMD, MScD, Voorhees, New Jersey, USA.

Laboratory Colleague: Alfred D. Nelson, CDT, Amsterdam Dental Laboratory, Philadelphia, Pennsylvania, USA.

A treatment video of this case will be coming soon to www.JIRD-online.com.

Harold S. Baumgarten, DMD

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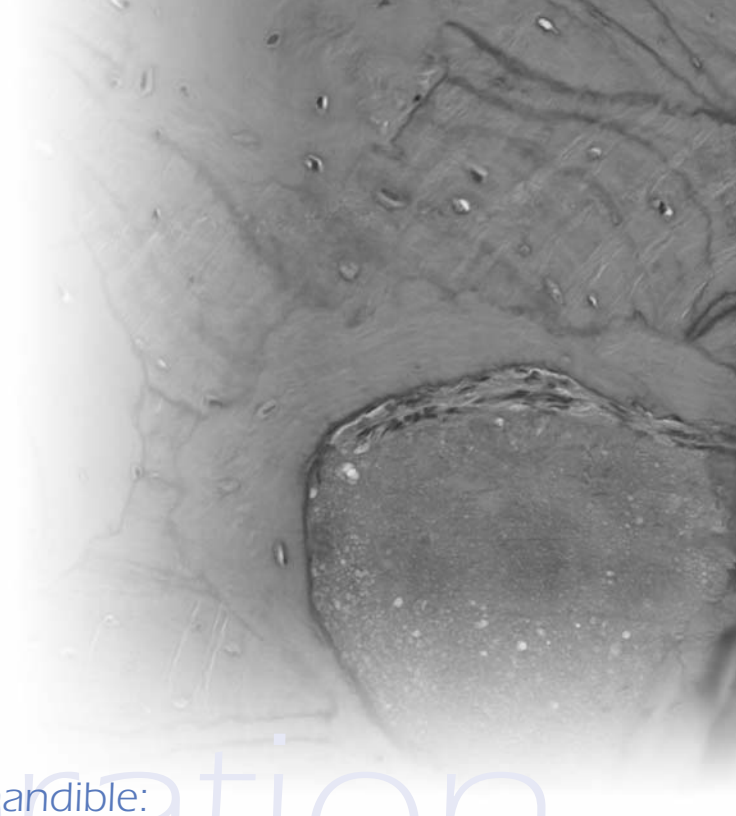

regeneration

Regeneration of the anterior mandible: A clinical case presentation

John Lupovici, DDS

Although autogenous bone has long been considered to be the gold standard for restoring deficient alveolar bone, a number of drawbacks have been associated with its use. Alternative grafting materials have developed, along with techniques for maintaining existing soft tissue and bone. This article briefly reviews these developments. A clinical treatment is also presented in which a new xenograft material was used in combination with a cross-linked, cell-occlusive membrane to restore a severely resorbed edentulous mandible in preparation for placement of dental implants.

Key Words: regeneration, bone grafting, grafting materials, xenograft

Introduction

An estimated 1,260,000 dental bone-grafting procedures were performed in the United States in 2006, and that number is expected to grow by more than 15% annually.[1] As hard-tissue reconstruction has become an increasingly routine part of dental surgical care, demand for suitable grafting materials has increased. Such materials must satisfy various regulatory requirements and meet clinicians' expectations for safety and effectiveness. Ideally, they should be biocompatible, easy to procure, resorbable, osseoconductive, osseoinductive, and cost-effective.

In response to these considerations, autografts, allografts, alloplasts, and xenografts have all become acceptable alternatives for filling and regenerating bone defects. However, autograft material may be difficult to obtain in sufficient quantity, and its harvest poses risks of pain, complications, and morbidity.[2-7] Moreover, high resorption rates and limited viability have been reported.[8-11] Allograft bone, while more easily obtainable, may lack osseoinductivity (depending upon its source and processing).[12-14] Alloplasts typically lack osseoinductivity, and may have variable resorption rates.

Xenografts constitute the fourth category of commonly used bone-grafting materials, with porous bovine-derived material—the most popular xenograft variety. This biocompatible material may eliminate the need for a second surgical site and may serve as an effective regenerative matrix for a variety of indications prior to implant placement. Numerous researchers have reported a high degree of osseoconductivity,[15-22] and bovine bone particles are well incorporated within newly regenerated grafted bone, according to histological findings. It has been argued that the slow resorption profile of bovine-derived bone may contribute to increased stability of the regenerated bone.[23]

Traditionally most xenograft used in oral regenerative procedures has been unsintered. Such material undergoes a multi-step process of annealing (up to 300 degrees Celcius), followed by treatment with organic solvents such as sodium hydroxide.[24] However, a second type of bovine-derived bone, used since 1989 as a bone-replacement material in the fields of orthopedic and skull surgery, has recently been introduced into the field of oral regeneration. This material uses a process known as sintering to remove all pathogenic components and organic components from the bovine bone. The bovine bone is heated to more than 1200 degrees Celcius, yielding a highly crystalline material containing small amounts of calcium oxide resulting from decomposition of the original carbon content. The sintered bovine bone incorporates its native macroporosities, as well as preserves its microposity of the original bone.

The following clinical case presentation illustrates the use of sintered xenograft particles in combination with a resorbable collagen membrane to regenerate an edentulous mandible.

The patient was a 72-year-old female who presented with an ill-fitting denture following long-standing mandibular edentulism. Clinical and radiographic examination revealed a narrow alveolar ridge with significant apical undercuts (Figs. 1 and 2). The patient required pre-operative ridge regeneration to accommodate a future implant-supported overdenture.

Sintered bovine bone particles were chosen as the graft material due to their biologic and physical properties. Biologic properties include the ability to function as an osteoconductive regenerative material. The physical characteristics of bovine bone offer the additional advantage of increased compressive resistance, due to the material's inherent native structure. Regenerative attempts with other graft materials may be compromised by their inability to contend with the compressive forces delivered by an overlying denture.

Following treatment-plan acceptance, the patient was anesthetized, and a full-thickness mucoperiosteal flap was reflected (Fig. 3). Upon identification of the mental foramina, distal releasing incisions were made. Measurement of the existing ridge indicated that the width was 2-3mm wide (Fig. 4).

Fig. 1

Fig. 2

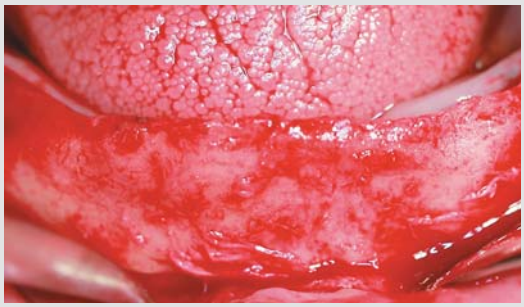

Fig. 3

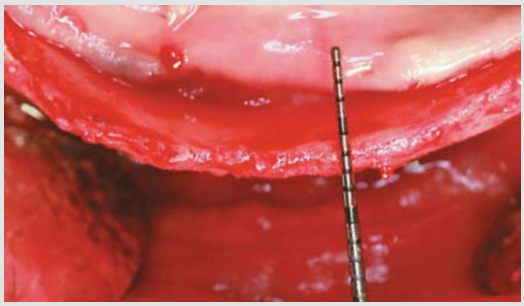

Fig. 4

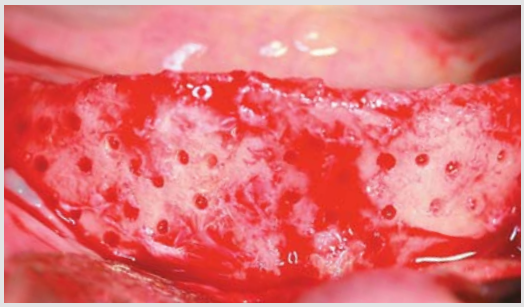

Fig. 5

Fig. 6

Fig. 7

Fig. 8

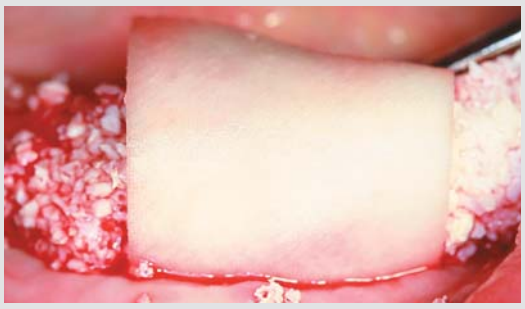

Fig. 9

Fig.10

Fig.11

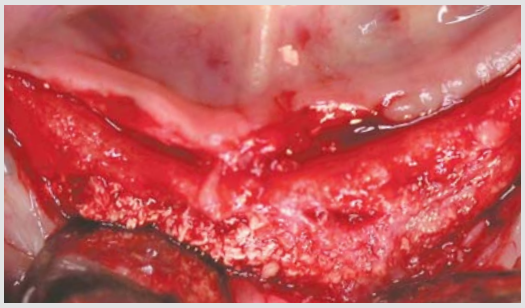

Fig.12

The residual periosteum was carefully debrided with hand instruments, and the ridge was decorticated using a high speed round carbide bur with copious irrigation (Fig. 5).

After hydration in sterile saline for five minutes, Endobon® Xenograft Granules (BIOMET ***3i***) were molded over the decorticated ridge. Excess graft material was applied to allow for the characteristic shrinkage associated with guided bone regeneration and the unavoidable compression by the denture (Figs. 6 and 7).

Graft containment was achieved by tucking cross-linked OsseoGuard® Resorbable Collagen Membranes (BIOMET ***3i***) under the facial flap and draping them over the graft (Fig. 8). Extensive periosteal releasing incisions of the buccal flap in conjunction with the initial lingual flap reflection to the floor of the mouth enabled passive primary closure. Continuous locking 4.0 Gore-Tex® Sutures (W.L. Gore & Associates, Flagstaff, Arizona, USA) secured the soft-tissue flaps (Fig. 9).

The intaglio surface of the existing denture was relieved and relined to reduce the potential compressive forces on the regenerated area, as well as to maintain primary closure. The patient was then released with analgesics and antibiotics.

Post-operative healing was uneventful, and primary closure of the regenerated site was maintained throughout the healing period. Six months later, the patient was seen for evaluation and placement of dental implants (Fig. 10). A crestal incision was made, and full-thickness periosteal flaps were reflected to reveal a sufficient gain in ridge width to support implant placement (Fig. 11).

Following the manufacturer's recommended protocol, osteotomies were performed in the two cuspid sites for placement of 4mm diameter NanoTite™ Certain® Implants (BIOMET ***3i***) (Fig. 12). Cover screws were placed into the internal interfaces of the implants and tightened by hand. A 2mm trephine core was harvested from the central incisor location, and histological evaluation revealed excellent incorporation of the Endobon Xenograft Granules. The soft-tissue flaps were closed with continuous locking sutures, and the intaglio surface of the existing denture was relieved and relined. The patient was then released with analgesics and antibiotics.

Three months later, after uneventful healing, a tissue punch was used to expose the implants. The cover screws were removed, and EP® Healing Abutments (BIOMET ***3i***) were placed. The denture was relieved over the healing abutments, and the patient was dismissed with oral hygiene instructions.

Following soft-tissue maturation at eight weeks, the patient was seen by the restorative clinician for impressions and fabrication of the definitive prosthesis. The mandibular overdenture will be retained by Locator® Abutments (BIOMET ***3i***) processed directly into the overdenture base.

Clinical Relevance

For many severely resorbed edentulous patients, being unable to wear a removable denture during healing may be a significant impediment to accepting treatment with dental implants. Treatment plans that acknowledge this psychological reality are likely to enjoy higher acceptance rates. Sintered bovine-derived bone particles used in combination with cross-linked, cell-occlusive membranes may enable clinicians to obtain successful regenerative outcomes in cases where compressive forces imposed by dentures might otherwise compromise the success of the augmentation or lead to questionable regenerative gain.

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John Lupovici, DDS

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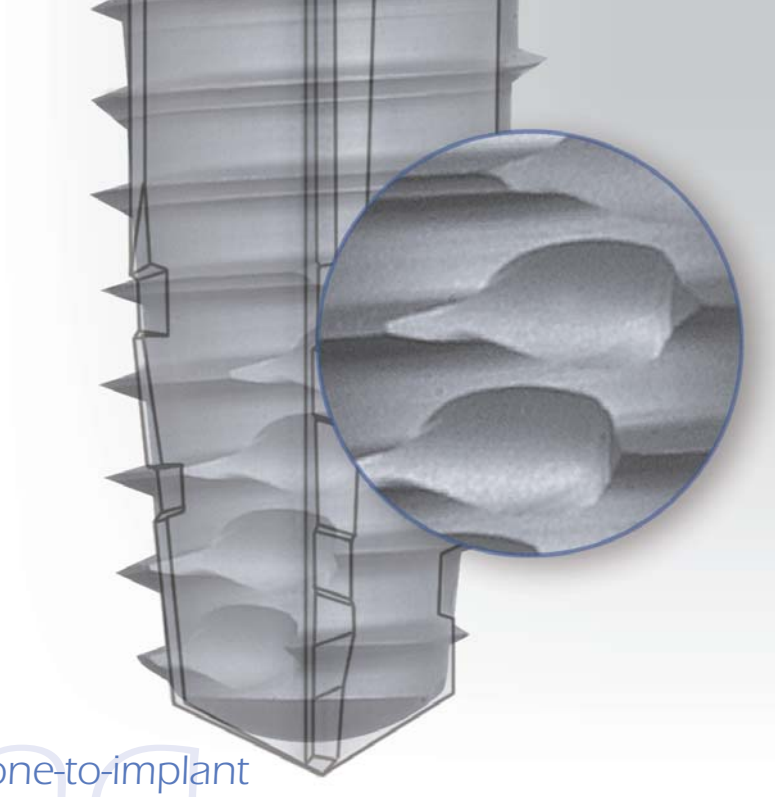
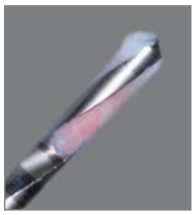


planning

Primary stability and initial bone-to-implant contact: The effects on immediate placement and restoration of dental implants

Alan M. Meltzer, DMD, MScD



With the growing popularity of immediate implant placement and provisionalization, the achievement of primary implant stability has become more important than ever. An intimate contact between the implant and the bone at the placement site provides the mechanical support that makes primary implant stability possible. Moreover, if the greatest possible surface area of the implant is in contact with bone, osseointegration may occur more rapidly and completely.

A variety of measures can enable clinicians to improve initial bone-to-implant contact (IBIC). These include the use of implants with improved designs, both macrogeometric and topographical. New drilling protocols also help to create an intimate implant-to-osteotomy fit.

Key Words: primary stability, IBIC, immediate placement

Introduction

Implant dentistry has evolved rapidly over the past 40 years, and technological advancements have been so dramatic that it is sometimes possible to lose sight of the remarkable ways in which patient expectations regarding implant dentistry have also changed. In fact, the latter often have been the primary driver of the former.

The earliest implant patients were grateful simply to recover something approaching normal masticatory function and speech. But as implants began to move into the clinical mainstream, patients understandably expressed a desire for more natural-looking restorations. In response, implant practitioners developed a remarkable arsenal of knowledge and technology for delivering highly aesthetic implant-supported prosthetic solutions. As this has occurred, the speed with which those restorations can be delivered has moved to the forefront of patient concerns.

Patients with failing dentition understandably want teeth that look like the ones with which they were born. Yet for a long time, potential implant recipients had been told that the only way to achieve this was to wear removable teeth for an extended period. This protocol furthermore required a complex series of surgical and restorative visits during which the removable provisional restorations were relined and adjusted and refined–only to ultimately be discarded.

Fig. 1

Increasingly, prospective implant patients have been demanding treatment protocols that:

- Take less time
- Require fewer surgeries and office visits
- Eliminate the need for any removable prosthesis
- Deliver superior function and aesthetics

In response, clinicians have accelerated the implant treatment process, provisionalizing implants earlier and in some cases providing early or immediate restoration for implants placed in fresh extraction sites.[1] While the pool of patients who are candidates for such accelerated treatment continues to expand, not all cases fulfill the biomechanical requirements necessary to achieve high levels of success. To this end, the principles of wound healing must still be respected and not violated. At the same time, heightened patient demands have posed this question for implant practitioners: Are there innovative biomechanical approaches to immediate implant placement and provisionalization that may expand the number of suitable cases, even in immediate extraction sites and poorer quality bone?

Improving Implant Stability

For any immediately placed implant to succeed, primary (mechanical) stability must be sufficient to enable the implant to resist micromovement until sufficient biologic stability (secondary stability) is adequately established.[2] In a review of the literature focusing on early wound healing adjacent to endosseous dental implants, Raghavendra et al[3] point out that a critical period occurs after implant placement, when osteoclastic activity has decreased the initial mechanical stability of the implant, but not enough new bone has been produced to provide an equivalent or greater amount of compensatory biological stability.

During this period of transition between primary and secondary stability, the implant faces the greatest risk of micromotion and potential consequent failure. Extrapolating from research in dogs, it is estimated that this period in humans occurs roughly two to three weeks after implant placement.

This work suggests that a pathway to increasing the number of cases suitable for immediate placement and provisionalization is to improve both the initial mechanical stability and the rate and speed of osseointegration. Hypothetically, if the level of primary stability can be increased and the rate of osseointegration at the same time can be accelerated, then the dip in total stability described by Raghavendra et al can be reduced, and the implant is made less susceptible to micromovement and potential failure.

Historically, numerous researchers have documented high success rates with the immediate loading of implants placed in the edentulous mandible.[4-10] These high success rates have been achieved even with machined surface implants. Retrospective analysis has led the author to believe that these high success rates are related to high primary stability. The level of primary stability may be maintained for longer periods due to the fact that these cases represent the placement of multiple implants in dense bone with the concomitant splinting of the implants around a curve. This approach represents a pure mechanical solution to the findings of Raghavendra et al.

Histomorphometric studies conducted by Mendes and Davies[11] shed light on how the rate of osseointegration may be increased. By implanting T-shaped bone in-growth chambers in rat femora (Fig. 1), they found that osteoconduction occurs earlier when the bone and implant surface start out in close proximity. Conversely, the further away from the surface the bone is, the longer it takes the implant to achieve biologic stability regardless of the surface topography.

Mendes et al also found that osteoconduction on both etched and commercially pure titanium surfaces was significantly increased when the surfaces were modified with nano-scale deposits of calcium phosphate crystals.[11, 12]

IBIC

The concept of initially placing more bone within the immediate vicinity of the implant surface has been termed Initial Bone-to-Implant Contact (IBIC) by the author. Maximizing IBIC has two major benefits: 1) the greater the IBIC, the greater the mechanical stability, thus enhancing the implant's ability to withstand micromovement while secondary stability develops. 2) Reducing the osteogenic migration distance decreases the time for osteoconduction to occur.

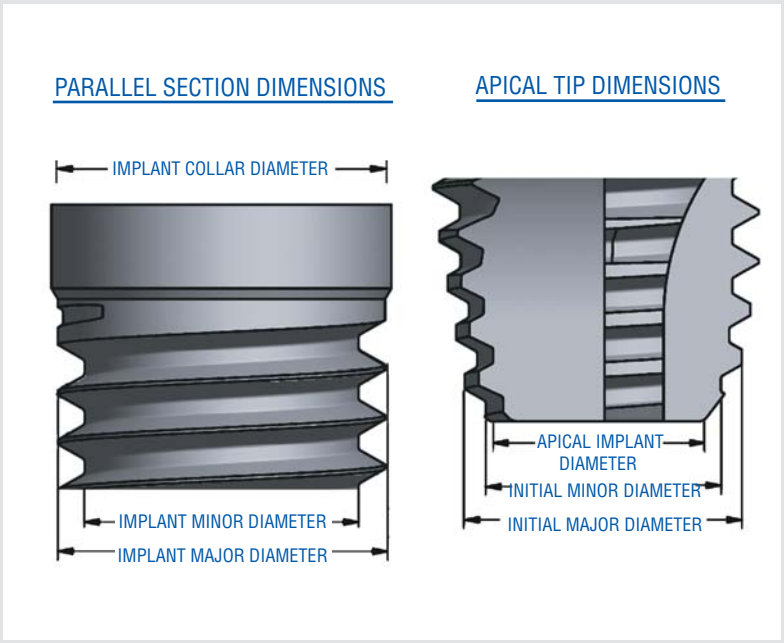


Fig. 2

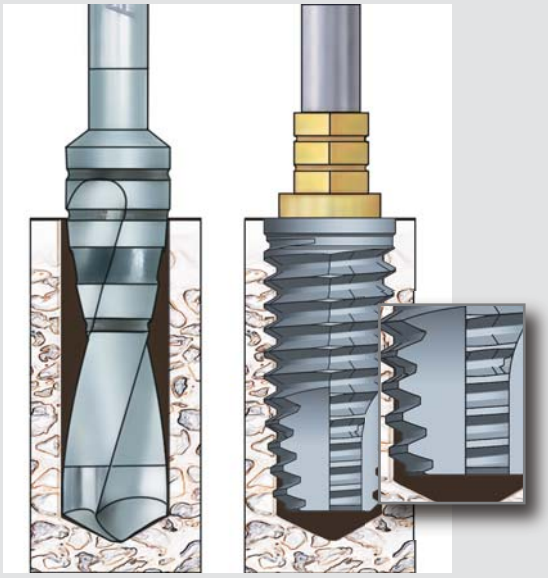


Fig. 3

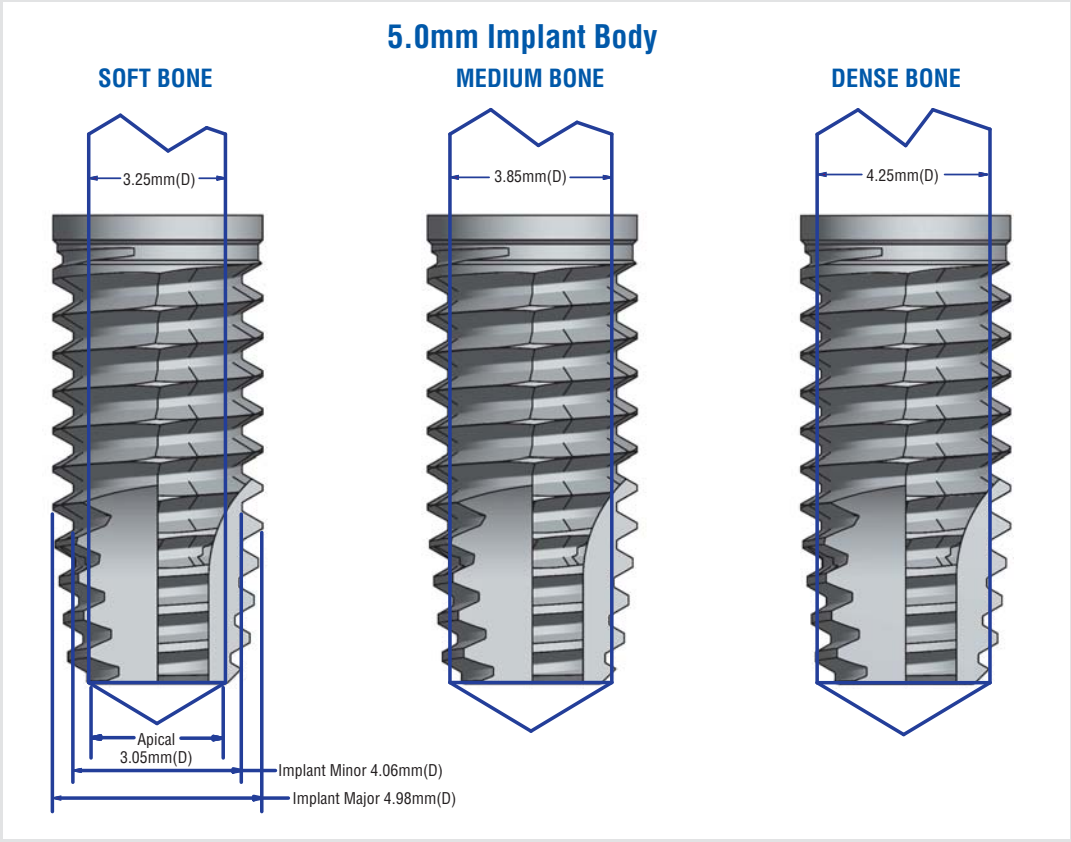


Fig. 4

Fig. 1 Back-scattered electron image of one plane of a t-shaped implant chamber. Such studies have shown that the closer the bone is to the surface of the implant, the faster BIC is established.[11]

Fig. 2 Parallel-walled implants are not truly parallel, as these have various diameters throughout the length of the implant including: the implant collar, from thread base to thread base (minor diameter), from thread tip to thread tip (major diameter), and at the apical self-tapping region.

Fig. 3 Use of a straight drill may reduce IBIC in the apical third of the implant because of the narrower diameter and self-tapping incremental cutting edge of the implant.

Fig. 4 Revised drilling guidelines may improve IBIC. The blue overlays suggest guidelines based on soft, medium, and dense bone scenarios. For example, when placing a 5mm implant in soft bone, creation of a 3.25mm osteotomy may compensate for the implant's tapered apex. In denser bone, less undersizing of the osteotomy may be necessary.

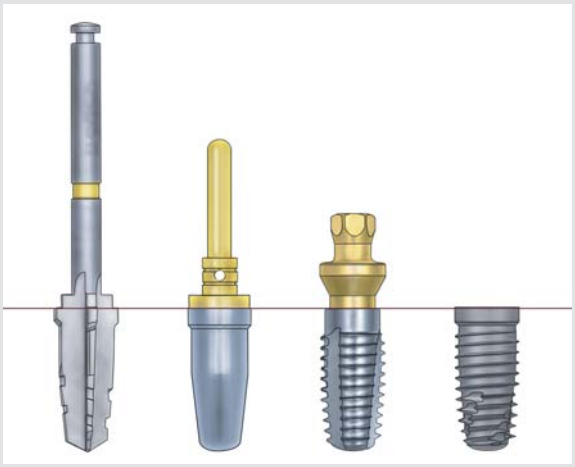


Fig. 5

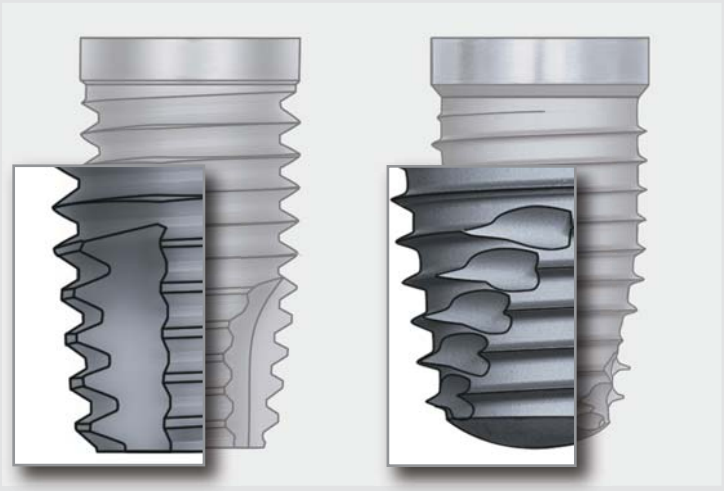


Fig. 6

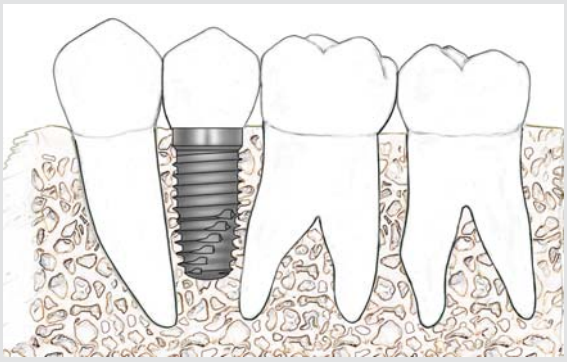


Fig. 7

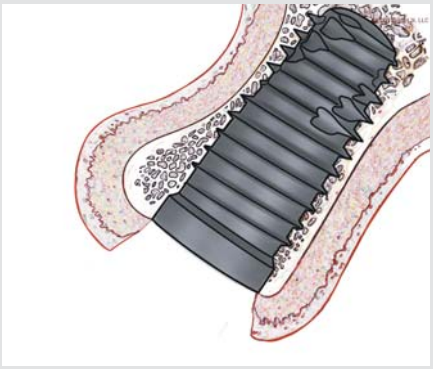


Fig. 8

A variety of measures can increase IBIC. These include:

Altering Drilling Guidelines

The drilling protocol determines the fit of the implant within the osteotomy and the extent of IBIC. Although osteotomies for parallel-walled implants traditionally have utilized a final drill that is smaller than the diameter of the implant, closer consideration of the complex geometry of parallel-walled implants reveals that they typically have many diameters: one at the prosthetic platform, another at the collar, still more when measuring along the major and apical portions of the implant body. As Fig. 2 illustrates, a typical so-called 4mm diameter implant only truly measures 4mm from thread tip to thread tip along the major parallel portion of the implant body. Self-tapping features at the apex of parallel-walled implants introduce another dimension for consideration in bone-to-implant contact.

When classic drilling protocols are utilized for such implants, the result may be overpreparation of the osteotomy, particularly in the apical third (Fig. 3). To improve IBIC, some modification of the classic protocols is justified (Fig. 4). Revised Drilling Guidelines from BIOMET ***3i*** for the parallel-walled implants call for creation of a slightly undersized osteotomy, resulting in greater IBIC. In areas of softer bone quality, the osteotomy site may also be stepped, in order to further improve IBIC.

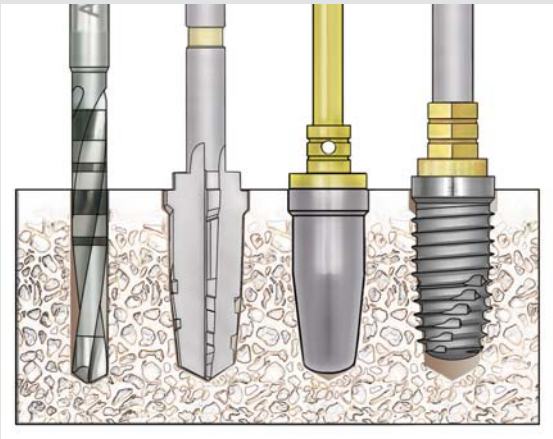


Fig. 9

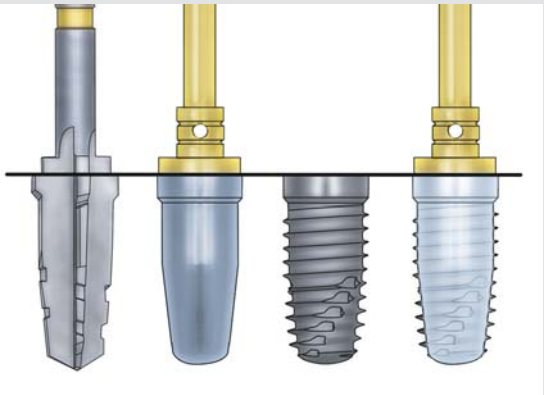


Fig. 10

Fig. 5 Osteotomies that intimately conform to the depth and diameter of specific-sized tapered implants can be created by using depth- and diameter-specific drills.

Fig. 6 The Spiral ICE™ (Incremental Cutting Edge) design of the BIOMET ***3i*** Tapered Implant may allow more IBIC than the self-tapping features of traditional parallel-walled implants.

Fig. 7 A tapered implant may better accommodate the surgical space when converging roots are present.

Fig. 8 Tapered implants may be ideally suited in those clinical situations where facial concavities are present.

Fig. 9 Illustration depicts a tapered implant (far right) that is incompletely seated within the prepared osteotomy. When this occurs, the result may be reduced IBIC and initial primary stability.

Fig. 10 In order to maximize IBIC, tapered implants should be completely seated within the prepared osteotomy. Use of the corresponding Depth/Direction Indicator (NTDI) (second from the left) prior to implant placement may confirm the proper apical-occlusal positioning of the implant. The corresponding NTDI is equal to the minor diameter of the specific implant, as depicted on the far right.

Using Tapered Implants

IBIC can also be improved by altering the implant macrogeometry. When tapered implants are placed using depth and diameter specific drills, the osteotomy can be more precisely matched to the depth and diameter of the implant (Fig. 5). The BIOMET ***3i*** Tapered Implant also incorporates taller and thinner threads that penetrate laterally into the bone, further increasing mechanical stability. The self-tapping feature of the tapered implant has been modified into a spiral incremental cutting edge design (Fig. 6). While this new self-tapping modification provides ease of insertional torque, this cutting edge has been shortened to further improve IBIC at the implant apex. Revised drilling guidelines for BIOMET ***3i*** Tapered Implants may improve the IBIC still further. For example, in cases presenting with soft bone, undersizing the osteotomy by one drill diameter is recommended.

Tapered implants may offer additional benefits when used in the presence of converging roots or large facial concavities (Figs. 7 and 8). However, the tapered design also imposes greater demands upon the clinician for precision in terms of vertical positioning. Failure to seat a tapered implant completely within a tapered osteotomy may result in less IBIC and hence reduced primary stability (Fig. 9). To avoid such underseating, BIOMET ***3i*** Tapered Implants come with Depth/Direction Indicators (NTDIs) (Fig. 10). Once the osteotomy has been prepared with the Shaping Drill, a NTDI makes it clear where the implant-abutment junction should be positioned. The implant itself must then be driven to the vertical position that was visualized with the directional indicator. The step-by-step protocol for placement of tapered implants in dense bone is demonstrated in (Figs. 11.1-11.12).

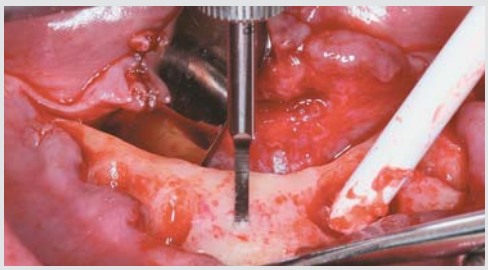


Fig. 11.1

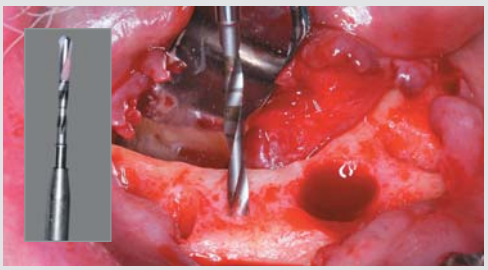


Fig. 11.2

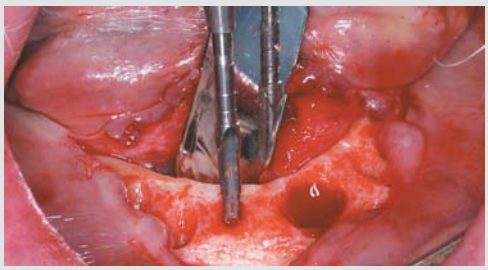


Fig. 11.3

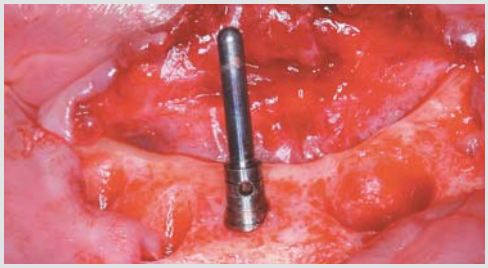


Fig. 11.4

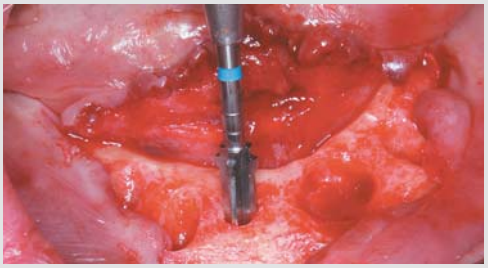


Fig. 11.5

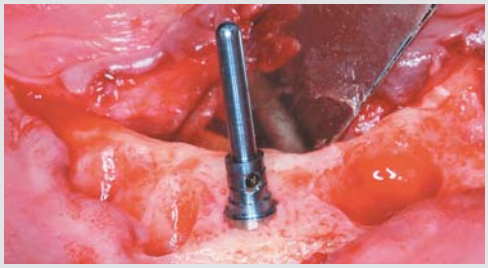


Fig. 11.6

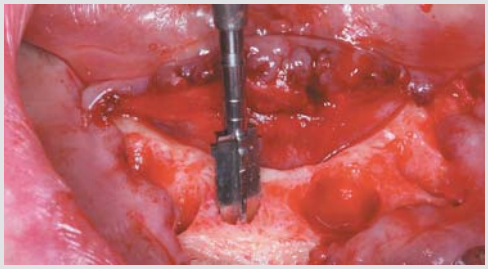


Fig. 11.7

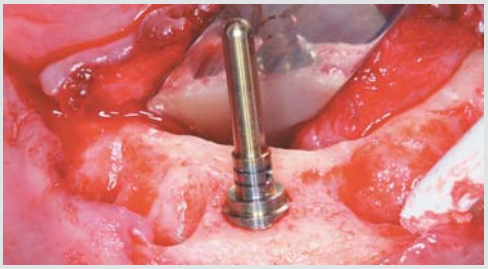


Fig. 11.8

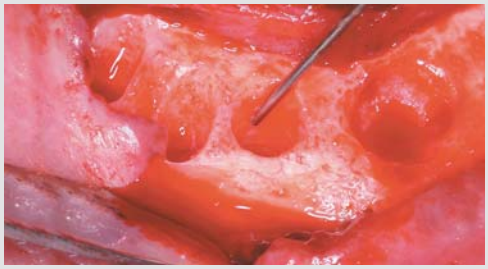


Fig. 11.9

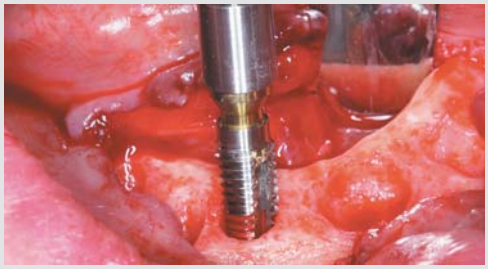


Fig. 11.10

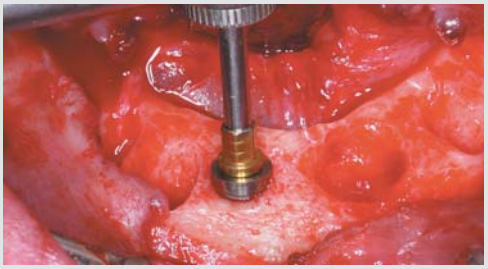


Fig. 11.11

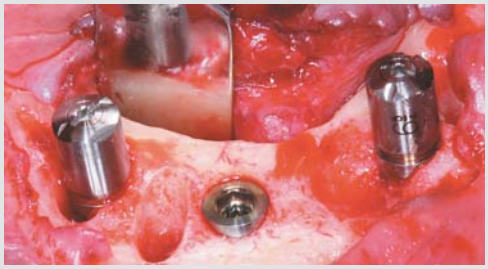


Fig. 11.12

Fig. 11.1 An ACT® Pointed Starter Drill was used to pierce the cortical plate and initiate the drilling sequence.

Fig. 11.2 Osteotomy creation continued with a 2mm diameter Twist Drill.

Fig. 11.3 A 3.25mm (D) x 13mm (L) Quad Shaping Drill (QSD) was advanced into the osteotomy.

Fig. 11.4 A 3.25mm (D) x 13mm (L) Natural Tapered Depth and Direction Indicator (NTDI) was placed to verify the osteotomy positioning and orientation.

Fig. 11.5 A 4mm (D) x 13mm (L) QSD was then advanced into the osteotomy.

Fig. 11.6 A 4mm (D) x 13mm (L) NTDI was placed for verification.

Fig. 11.7 A 5mm (D) x 13mm (L) QSD was advanced into the osteotomy.

Fig. 11.8 A 5mm (D) x 13mm (L) NTDI was placed for verification.

Fig. 11.9 The osteotomy was irrigated with saline and suctioned to remove any debris.

Fig. 11.10 Because of the dense nature of the bone at this site, a 5mm (D) x 13mm (L) Tapered Implant Bone Tap was used to full depth.

Fig. 11.11 A 5mm (D) x 13mm (L) NanoTite™ Tapered Implant was seated into the prepared osteotomy with the drilling unit set on 40rpm.

Fig. 11.12 Final seating of the implant was accomplished with a hand ratchet to approximately 80Ncm.

After insertion of the implant using a handpiece, a hand ratchet must also be employed to apply a sufficient torque (up to 100Ncm) to achieve the final apico-occlusal positioning. Higher insertion torque values have been found to correlate with high resonance frequency analysis (RFA) values,[13] and low RFA values have been associated with increased risk for implant failure after immediate loading.[14] In the author's opinion, the tapered implant body design is associated with higher insertion torque values and high implant stability quotients, therefore creating a synergy which may promote osseointegration.

Clinical Relevance

Patients increasingly are demanding implant-placement protocols that deliver functional and aesthetic implant-supported restorations quickly and economically, without requiring use of a removable prosthesis. In order to meet these expectations, clinicians must find ways to place implants that have a high level of primary stability as well as rapid osseointegration. Achieving a high degree of IBIC by means of optimized implant macrogeometries and drilling protocols can help to achieve both of these requirements.

More information including an interview entitled "Why Tapered Implants?" will be coming soon to www.JIRD-online.com.

Alan M. Meltzer, DMD, MScD

Dr. Meltzer received his dental degree from the University of Pennsylvania and his Masters in Periodontics and Oral Medicine from Boston University, School of Graduate Dentistry. He is a Diplomate of the American Board of Periodontology and a Fellow of the Academy of Osseointegration, where he serves on its Research and Education Committees. He is a featured speaker for the New Jersey Society of Periodontists, The University of Milan, Milan, Italy and is Former Director of Graduate Periodontology at Temple University. Dr. Meltzer maintains a private practice in Voorhees, New Jersey.

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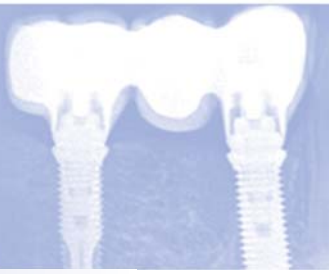
For more information, refer to the BIOMET 3i Surgical Manual.

Literature Review

Immediate occlusal loading of NanoTite™ PREVAIL® Implants: A prospective 1-year clinical and radiographic study



Pär-Olov Östman, DDS, PhD, MD,* Ann Wennerberg, DDS, PhD,** Tomas Albrektsson, MD, PhD, ODHc†
Clin Implant Dent Relat Res [Internet]. 2008:[9 p.]. Available from: http://www3.interscience.wiley.com/journal/121459870/abstract

What Was Done?

Primary implant stability, commonly accepted as a prerequisite for implant success, is particularly important when an immediate loading protocol is planned. Initial stability is often indicated by torque resistance and can also be influenced by bone quality, the osteotomy preparation, and the design of the implant. The macrostructure (e.g. the threads and tapered/straight design) of the implant may influence the ability to gain primary implant stability, while the microstructure (i.e. the surface texture) may play a role in obtaining high secondary stability. Pre-clinical studies have shown that the NanoTite Surface Treatment results in statistically significantly enhanced integration compared to OSSEOTITE® Control Implants. In the present single-center study, the authors evaluated the outcome of NanoTite Implants used for immediate loading of fixed prostheses and single-unit restorations.

How Was It Done?

NanoTite Certain® PREVAIL Implants (4/5/4mm diameter x 8.5-15mm) were placed into undersized osteotomies. The final drill was chosen according to the predominant local bone quality (Lekholm and Zarb scale). In Type I bone, the final drill used was 3.25mm diameter; in Type II bone-3.0mm diameter, and for Type III and IV bone-2.75mm diameter. A countersink drill was then used to enable ideal crestal seating of the PREVAIL (expanded collar) Implant.

Torque values achieved during final implant positioning were measured using a drill unit, and RFA values were evaluated with an Osstell Mentor Device. The implants were immediately loaded only if the ISQ values met or exceeded 55, and a minimum of 25Ncm of torque was achieved. Thirty-five out of 38 patients met these criteria and received immediate restoration. QuickBridge® Provisional Components were used for multi-unit restorations, and PreFormance® Posts were used for single-unit restorations. All single-unit crowns were left out of occlusion and free from interproximal contacts. In total, 102 implants were restored.

All patients returned to the clinic for follow-up after three, six, and twelve months. To evaluate the marginal bone loss, digital periapical radiographs were taken using a custom holder to ensure identical positioning of the radiographic film. Implant success was evaluated according to the guidelines of Albrektsson and Zarb (Int J Prosthodont 1993).

What Were the Results?

The mean ISQ value at implant placement was 73.4 ± 8. One provisional fixed-partial denture showed mobility due to screw loosening. One implant failed in the anterior maxilla (Type IV bone), while the two adjacent implants integrated successfully. The cumulative survival rate after one year was 99.2%. The average bone loss for the 102 implants was 0.37mm for the same timeframe. For 93% of the implants studied, the success was judged to be grade 1, according to the guidelines by Albrektsson and Zarb.

Clinical Relevance

The authors attributed the excellent results found in this study in part to the modified drilling protocol. Adaptation of the final drill to the local bone quality appears to be particularly important in immediate load cases. Primary stability of the implant can be considered adequate if the insertion torque values are at least 25Ncm and the ISQ values are at least 55. To reduce the risk of macro-movement at the implant interface during the healing period, it is of utmost importance to splint multi-units and place single-unit restorations with a non-occlusal load protocol, taking care to avoid any lateral contacts.

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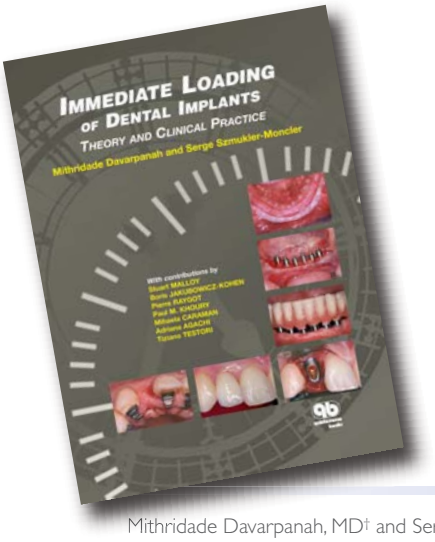

Book Review

review

Immediate Loading of Dental Implants: Theory and Clinical Practice

-Reviewed by David A. Garber, DMD

Mithridade Davarpanah, MD† and Serge Szmukler-Moncler, DDS, IEP, PhD‡
With contributions by: Stuart Molloy, Boris Jakubowicz-Kohen, Pierre Raygot, Paul M. Khoury, Mihaela Caraman, Adriana Agachi, and Tiziano Testori.

What Is It About?

Immediate loading has become one of the hottest arenas in implant dentistry. Hundreds of papers have appeared in the dental literature, and now an authoritative and comprehensive book *Immediate Loading of Dental Implants: Theory and Clinical Practice,* has been published. In a comprehensive manner, it deals with the benefits and the concepts of immediate loading, various treatment strategies, and the reasons for choosing one prosthetic alternative rather than another.

What Does It Cover?

Specific topics addressed include: preparation required for a successful immediate loading experience, patient gains and treatment-team benefits achievable with immediate loading, and financial impacts on the clinical practice. Methods of increasing implant primary stability and decreasing the stresses imposed on the immediately loaded implants are explored. Aesthetic requirements when treating fresh extraction sockets, and pros and cons of screw-retaining versus cementing provisional restorations are enumerated. Failures also receive attention, and the reader may be surprised to learn that a mobile implant may still be salvageable under certain circumstances.

Clinical protocols of treating the edentulous mandible, the edentulous maxilla, the anterior maxilla, the anterior mandible, the posterior mandible, and the posterior maxilla are each addressed in separate chapters. Potential surgical and prosthetic complications are enumerated, along with any possible immediate and late failures, with a well developed list of solutions. The book's final chapter focuses on the NanoTite™ Implant, explaining why the surface topography is different from bioactive coatings that have been used in the past and its potential relevance to immediate loading.

What Stands Out?

In addition to being highly readable, what distinguishes *Immediate Loading of Dental Implants* is its systematic use of charts, flow charts, and a materials check-list for each treatment option. For each indication, a chart shows several possible approaches, with the pros and cons for each. Readers will also appreciate the chart with eight features, similar to a cooking recipe with specific icons. For each treatment option, the degree of technical difficulty is presented, along with the comprehensive interaction required among the members of the implant team (surgeon, restorative dentist, and laboratory), the treatment time necessary, clinical financial factors, risks involved, aesthetic concerns, and the literature substantiating the technique. Another diagram shows the individual responsibilities of each treatment team member.

Clinical Relevance

As the authors point out, when immediately loading dental implants, the treatment team must plan all the clinical protocols and timing, as well as be prepared for all relevant potential risks. This book addresses the planning protocols and communication process for even the experienced clinician.

David A. Garber, DMD

Dr. Garber completed his post-doctoral training in Periodontics and fixed Prosthodontics (periodontal prosthetics) from the University of Pennsylvania, School of Dental Medicine in Philadelphia, Pennsylvania. He is an active member of numerous dental societies and a board member of the American Academy of Esthetic Dentistry. He has a dual appointment at the Medical College of Georgia School of Dentistry and Louisiana State University. Dr. Garber lectures extensively worldwide and maintains a private practice, limited to advanced restorative and implant therapy, in Atlanta, Georgia.

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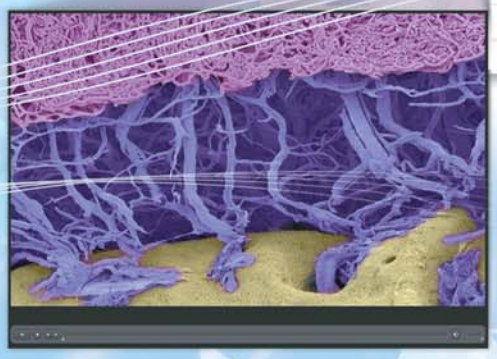

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