CLINICAL PERSPECTIVES

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Clinical case presentations featuring 3i T3® Tapered Implants
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Introduction

In the more than 30 years since Per-Ingvar Brånemark introduced North American dental researchers to his work with endosseous dental implants, surgical and prosthetic components and implant-treatment protocols have evolved dramatically. Most recently, the realization has been growing that complex biological processes can sabotage even the most beautiful results over time.

There is a growing appreciation of the importance of establishing and sustaining the aesthetics of implant restorations. Four important factors for achieving this goal are implant primary stability, the implant surface, the implant-abutment junction geometry, and the implant-abutment connection. Each of these factors has played a role in the design of the 3i T3® Tapered Implant System (Fig. 1).

Implant Primary Stability

Excessive micromotion during the early implant-healing process has been well documented to impede or prevent osseointegration; it may be the most common cause of implant failure.1 A number of design elements can enhance the likelihood of achieving primary stability with a given implant system.

For example, the 3i T3 Tapered Implant System utilizes depth- and diameter-specific drills to create osteotomies that fit the shape (i.e. minor diameter) of the implants being placed. Implants placed so that their entire surface intimately contacts the full length of the osteotomy have been described as having high Initial Bone-To-Implant Contact (IBIC),2 which enhances primary stability. Furthermore, the 3i T3 Tapered Implant design incorporates additional macrogeometric elements to enhance primary stability,3 including tall, thin threads that penetrate laterally into the bone for secure long-term engagement.

In a prospective immediate loading study by Östman et al, the investigators placed 139 BIOMET 3i NanoTite™ Tapered Implants in mostly healed sites and reported a mean insertion torque of 53.1Ncm, a mean ISQ of 73.3, and a survival rate of 99.2%.4 Placing the tapered implants into fresh molar extraction sockets, Block reported mean ISQ values of 77 in the mandible, 73 in the maxilla, and a survival rate of 97.2%.5

Even when accelerated treatment is not applicable, (e.g. when bone quality is poor), good primary stability minimizes micromotion and reduces the risk of non-integration.1 When clinical conditions are good, primary stability can provide additional benefits, permitting early or immediate provisionalization and/or tissue sculpting to better meet aesthetic demands.
Implant Surface

The surface of dental implants is critical to establishing and sustaining aesthetic outcomes.

BIOMET 3i first refined the implant-roughening process with the introduction of the dual acid-etched (DAE) OSSEOTITE® Surface. Its topography includes 1-3 micron pitting superimposed on a minimally rough surface (Sa, Absolute Mean Roughness <1.0 μm). To reduce the risk of mucosal complications, the OSSEOTITE Implant initially was made available in a hybrid configuration that included the historically-proven turned surface on the first 2-3.0mm of the coronal aspect and the dual acid-etched surface on the remainder of the implant body. However, a prospective five-year multicenter, randomized-controlled study that compared OSSEOTITE hybrid and fully etched implant configurations in 2010 demonstrated that the fully etched surface did not increase the incidence of peri-implantitis as compared to the hybrid design. It also provided additional evidence that the fully etched surface reduced crestal bone loss (0.6mm versus 1.0mm, p<.0001). Continued research into the OSSEOTITE Surface culminated in a new surface enhancement – the 3i T3 Implant. More than just another roughened surface, the 3i T3 Implant surface targets different needs in two distinct regions of the implant (Fig. 2).

- The coronal aspect of the implant has a microtopography similar to the fully etched OSSEOTITE Implant.
- From the base of the collar to the apical tip, the 3i T3 Implant has an increased coarse roughness, resulting in a tri-level surface. The tri-level surface consists of submicron features superimposed on 1-3 micron pitting, overlaid on a moderately rough surface topography (Sa = 1.0 - 2.0 μm).

The 3i T3 Implant Surface represents a significant step forward, with multiple topography levels and features along the implant body designed to influence osseointegration and crestal bone levels, and lower the risk of peri-implantitis.

Implant-Abutment Junction Geometry

A third crucial factor for long-term maintenance of aesthetic restorations is the influence of the implant-abutment junction (IAJ) geometry on the biologic width. The biologic width is the natural seal that develops around any object protruding from the bone and through the soft tissue into the oral environment.

The discovery that implant design could impact biologic width occurred when standard 4.0mm diameter abutments were routinely used in the early 1990s to restore 5.0mm and 6.0mm diameter implant designs. Radiographic follow-up of these “platform-switched” implants yielded the surprising finding of greater preservation of the crestal bone. This led to the development of an implant system that incorporated platform switching into its design (PREVAIL® Implant).

Extensive study of the mechanisms at work ensued, and a recent systematic review and meta-analysis of ten clinical studies including 1,238 implants found significantly less marginal bone loss around platform-switched implants, as compared to platform-matched ones.

Fig. 2. Schematic of the contemporary hybrid design of the 3i T3® Tapered Implant.
• The primary stability necessary for early aesthetic provisional restoration and/or tissue sculpting.
• A refined surface design to assist osseointegration, with no increased risk of peri-implantitis as compared to hybrid implants.

The Certain System has been designed with exacting interface tolerances for precise abutment mating and Gold-Tite Abutment Screw (Fig. 3) technology to maximize clamping forces while reducing the potential for micromotion. Improved performance in these areas has been theorized to reduce the inflammatory processes associated with bone or tissue loss. The Certain System has been designed with exacting interface tolerances for precise abutment mating and Gold-Tite Abutment Screw (Fig. 3) technology to maximize clamping forces while reducing the potential for micromotion. Improved performance in these areas has been theorized to reduce the inflammatory processes associated with bone or tissue loss.

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In summary, the 3i T3® Tapered Implant System has been engineered to provide:

• The system strength for long-term aesthetic function.
• An implant/abutment geometry and related connection features designed to preserve bone at and around the implant to provide support for the development and maintenance of soft tissue.
• An accurate connection well positioned to meet current and future digital restorative needs.

References


In support of their research or for preparation of their work, one or more of the authors of the publications cited in the references may have received financial remuneration from BIOMET 3i LLC.

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Replacement of hopeless maxillary central incisors with immediate implant placement, grafting, and provisional restoration

Ronnie J. Goené, DMD† and Alwin C.L. van Daelen, DMD

A 30-year-old male patient presented with hopeless maxillary central incisors, which had been traumatized when he was a professional basketball player. A treatment plan was developed that called for extraction of the hopeless teeth, followed by immediate implant placement, grafting, and immediate provisional restoration. After the patient provided informed consent, treatment proceeded as follows:

Fig. 1
Clinical and radiographic views of the two central incisors, which were failing secondary to root fractures. Both teeth were mobile, and apical granulomas were present.

Fig. 2
The two hopeless teeth were carefully extracted to minimize trauma and preserve the buccal bone plate. The intact status of the buccal plate was verified.

Fig. 3
After osteotomy creation, Depth and Direction Indicators were placed, preventing the apical area from being obscured when the sockets were filled with Endobon® Xenograft Granules.

Fig. 4
Each Depth and Direction Indicator was carefully removed, creating two compact channels. A 3i T3 Tapered Implant 5mm(D) x 4.1mm(P) x 13mm long was placed into the channel in the maxillary right central incisor.

Fig. 5
The second 3i T3 Tapered Implant, also 5mm(D) was placed into the osteotomy in the left maxillary central incisor site. Compacted graft material now surrounds both implants.

Fig. 6
Excellent primary stability was obtained for both implants, which were positioned slightly toward the palatal. The graft material helps retain bone volume during healing.
Six months later, the patient returned for impressions to fabricate the definitive restorations. Note how well the papillae and facial tissue contours have been preserved.

Two zirconia abutments were placed into the implants, and complete seating was confirmed radiographically.

IPS e.max® crowns fabricated for the zirconia abutments were placed.

Although the patient had a high smile line, he was delighted with the aesthetic result.
Immediate loading of post-extraction implants in the aesthetic zone

Tiziano Testori, MD, DDS† and Fabio Scutellà, DDS, MSD

The 47-year-old female patient presented complaining about dull pain when occluding on her maxillary central incisors. The teeth had been endodontically treated following trauma from a car accident that had occurred when she was 32. The following case presents the clinical, radiographic, and aesthetic outcomes achieved when implants were placed and immediately restored in these infected sites in the aesthetic region.

Fig. 1
Initial examination found a coronal fracture of the left central incisor root and severe external root resorption of the coronal third of the right central incisor.

Fig. 2
The teeth were atraumatically extracted using small periotomes. A bone dehiscence was detected at the level of the fistulous tract on the left central incisor site.

Fig. 3
Two 3i T3™ Tapered Implants 5mm diameter x 4.1mm platform x 13mm long were placed into the osteotomies created by positioning the bur against the palatal wall, in alignment with the future restorative incisal edge.

Fig. 4
The implants were torqued to 90Ncm, and a 2mm gap remained on the buccal side of each. This space was created intentionally for the regenerative material.

Fig. 5
Healing abutments were placed into the implants. Using a periodontal probe, the buccal gaps were filled with Endobon® Xenograft Granules and collagen.

Fig. 6
Two PreFormance® Posts were screwed into the implants. Using a surgical scalpel to minimize any contamination of surgical site, the PreFormance Posts were reshaped.
During the implant healing phase, the coronal tissue around both central incisors grew notably. The emergence profile of the provisional crowns was deliberately kept flat.

This occlusal view of the definitive restorations shows the excellent buccal bone contours achieved by ridge augmentation.

CBCT scan taken six months after delivery of the definitive zirconia abutments and crowns shows excellent preservation of the buccal ridge thickness.

Final results with definitive prosthesis six months after the extractions and immediate implant placement.
The 29-year-old female patient presented with pain in her maxillary central incisors. Periapical lesions were noted radiographically. A treatment plan was developed, that included extraction of the teeth, followed by five weeks of soft-tissue healing, early implant placement in conjunction with hard- and soft-tissue grafting, and further time allowed for gingival remodeling. The patient provided informed consent, and treatment was carried out as follows:

Replacement of hopeless maxillary central incisors using early implant placement and hard- and soft-tissue grafting

Xavier Vela Nebot, MD, DDS

Fig. 1
Clinical and radiographic examination of the maxillary central incisors revealed the presence of periapical lesions. The teeth were deemed to be non-restorable.

Fig. 2
The central incisors were atraumatically extracted, and the sockets were immediately filled with collagen sponges to aid with clot stabilization.

Fig. 3
The patient returned five weeks after the extractions for the implant placement surgery. A flap was reflected, and the absence of the labial bony plate was noted.

Fig. 4
Osteotomies were created, and two 3i T3® Tapered Implants (both 4mm diameter x 3.4mm platform x 13mm long) were placed.

Fig. 5
Good stabilization was obtained for both implants. But large labial defects were present, as demonstrated by this occlusal view taken immediately after implant placement.

Fig. 6
Along with the implants, Endobon® Xenograft Granules, an OsseoGuard® Collagen Membrane and a connective tissue graft, were placed.
The definitive abutment screws were tightened to 20Ncm and the screw-access openings were filled with composite in preparation for placing the cement-retained provisional bridge.

The patient wore the implant-supported fixed resin bridge for three months, enabling further maturation of the soft tissues.

Three months later, after the soft tissues had further matured and stabilized, the definitive two-unit full-ceramic bridge was fabricated.

Six and a half months after placement of the implants, the definitive PFM bridge was cemented in place. Note obtained thickness of the facial soft and hard tissues.

Facial view of the definitive two-unit ceramic bridge cemented to two modified GingiHue Abutments six and a half months after implant placement.

Occlusal view after implant placement and grafting. The provisional prosthesis was a removable bridge that was progressively modified to shape the soft tissue and expose the cover screws.

Three months after placement, the implants were uncovered. GingiHue® Abutments, modified in the laboratory to achieve a six-degree taper and margin-free restoration, were placed.

The patient wore the implant-supported fixed resin bridge for three months, enabling further maturation of the soft tissues.

Six and a half months after placement of the implants, the definitive PFM bridge was cemented in place. Note obtained thickness of the facial soft and hard tissues.
The 39-year-old female patient presented seeking to replace her previously extracted central incisor. Although the healed bone was adequate for implant placement, the horizontal soft tissue was deficient. The treatment plan called for placing a 3i T3® Tapered Implant and a simultaneous connective tissue graft. The patient provided informed consent and was treated as follows:

Implant placement and simultaneous soft-tissue grafting of a maxillary central incisor

Tommie Van de Velde, DDS, MSc, PhD

Fig. 1
Ten years after extraction of her right maxillary central incisor, the patient presented seeking an implant-supported restoration.

Fig. 2
A cone-beam CT scan of the maxillary central incisor revealed adequate bone volume to enable placement of an implant.

Fig. 3
In this preoperative image of the missing central incisor, a facial concavity due to a lack of soft-tissue thickness was evident.

Fig. 4
Into the healed extraction site, a 4mm diameter x 3.4mm platform x 13mm long 3i T3 Tapered Implant was placed.

Fig. 5
As seen in the occlusal view, only a minimal flap was reflected to place the 3i T3 Tapered Implant.

Fig. 6
A connective tissue graft was harvested from the palate and placed on the facial aspect of the edentulous site.

Clinical treatment in collaboration with Drs. Babs Hiel, An Van kerkhoven and Carl De Boeck.
A healing abutment was connected to the implant, and the soft tissues were secured with sutures.

Two weeks later, the Maryland bridge was removed in preparation for delivery of a CAD/CAM zirconia abutment.

A provisional crown was cemented to further guide soft-tissue maturation before delivery of a definitive crown. Additional soft-tissue corrections were performed with a micro-surgical approach.

Facial view of the definitive restoration six months after implant placement. Note the excellent bone level around the implant.

† The contributing clinician has a financial relationship with BIOMET 3i LLC, resulting from speaking engagements, consulting engagements, and other retained services.
The 82-year-old female patient presented to the clinic with a maxillary right central incisor that was failing due to fracture of the tooth root. Clinical and radiographic examination revealed adequate bone volume to accommodate an implant. The treatment plan included immediate provisional restoration of the implant if adequate primary stability could be obtained. This was accepted by the patient, and the treatment was performed as follows:

Replacement of a hopeless maxillary central incisor with immediate implant placement and provisional restoration

Pär-Olov Östman, DDS, PhD

Using a periotome and without raising a soft-tissue flap, the hopeless tooth was carefully extracted.

A 4.1mm platform PreFormance® Post was placed into the implant and modified intraorally for fabrication of an immediate cement provisional restoration.

The gap between the implant and the facial bone plate was grafted with Endobon® Xenograft Granules, and the original crown was fitted to the modified PreFormance Post.

Three months later, excellent soft-tissue healing was evident, and fabrication of the definitive restoration began.

A BellaTek® Encode® Healing Abutment was placed into the implant to be scanned for fabrication of a BellaTek Definitive Abutment.
A 3M Lava™ C.O.S. Digital Impression System was used to capture the codes on the BellaTek® Encode® Healing Abutment, the adjacent teeth, the opposing arch, and the occlusion.

The scan data was sent to the BellaTek Production Center for design of the definitive abutment. The virtual abutment design file was sent to 3M Lava for fabrication of a digitally printed SLA model.

The definitive BellaTek Abutment was milled in titanium and nitride-coated at the BellaTek Production Center.

The patient received the definitive abutment and crown. A periapical radiograph taken at the one-year follow-up appointment is shown (inset).
The 25-year-old female patient presented after recent extraction of the mandibular first molar. The second bicuspid was congenitally missing. Sufficient bone was present to enable placement of a 5mm diameter 3i T3® Tapered Implant in the molar site and a 4mm diameter implant in the bicuspid site. The patient consented to the implant placement with simultaneous bone grafting, followed by an extended healing period. Treatment was delivered as follows:

Fig. 1
Clinical view of the sites where the mandibular left second bicuspid was congenitally missing and the first molar was extracted four weeks earlier. The osseous bone was immature.

Fig. 2
Periapical radiograph of the sites at four weeks post-extraction of the molar.

Fig. 3
An incision was made in the soft tissue and a full-thickness mucoperiosteal flap was reflected.

Fig. 4
3i T3 Tapered Implants were placed (5mm diameter x 4.1mm platform x 10mm long in the molar site and 4mm x 3.4mm x 11.5mm in the second bicuspid site).

Fig. 5
A mixture of autogenous bone and Endobon® Xenograft Granules was prepared. The graft material was packed around the implants and the surrounding osseous defects.

Fig. 6
To protect against soft-tissue infiltration, a 20mm x 30mm piece of OsseoGuard® Resorbable Collagen Membrane was trimmed and placed over the implants and the xenograft.
Three months after placement of the implants and graft material, healing of the soft tissue was complete. The patient returned for second-stage surgery. The implants were uncovered and temporary healing abutments were placed. The soft-tissue flaps were secured with intermittent sutures. The sutures were removed after two weeks.

The soft-tissue flaps were closed and secured with sutures. The patient was discharged to heal for three months. No provisional prosthesis was placed.

One month after implant placement and grafting, healing was progressing as planned.

The implants were uncovered and temporary healing abutments were placed. The soft-tissue flaps were secured with intermittent sutures. The sutures were removed after two weeks.

Penapical radiograph of the healing abutments in place taken at the time of second-stage surgery. Note the height of the crestal bone level.

Penapical radiograph of the definitive two-unit bridge, at nine months after implant placement and grafting.

Francisco J. Enrile de Rojas, MD, DDS

Dr. Enrile received his medical degree from the University of Seville, Spain in 1989 and his dental degree from the University of Oviedo (Spain) in 1995. He completed his masters degree in Periodontology and Osseointegration at the same university in 1997. He is member of the Spanish Society of Periodontology (SEPA) and has a private clinic in Huelva (Spain) dedicated exclusively to Periodontology and Implants with a training center. His website is www.clinicaenrile.es.

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The patient was a healthy 73-year-old man who presented with a right mandibular first molar that was unrestorable due to interradicular caries. The treatment plan called for extraction of the tooth followed by placement of an implant and a BellaTek® Encode® Healing Abutment two months later. The definitive prosthesis was a BellaTek Titanium Abutment with a cemented crown. The patient provided informed consent, and treatment unfolded as follows:

Fig. 1
Eight weeks after extraction of the molar, the bone was immature, but the height and width were adequate to accommodate a wide-diameter implant.

Fig. 2
A flap was reflected, revealing the immature state of the newly created bone in the extraction site.

Fig. 3
After osteotomy creation, a 5mm diameter x 10mm long 3i T3® Tapered Implant was placed. The restorative platform of this implant was 4.1mm wide.

Fig. 4
The primary stability was good with >50Ncm starting torque, and the condition of the soft tissues was good, enabling immediate placement of a BellaTek Encode Healing Abutment.

Fig. 5
The soft tissues were secured with intermittent sutures. Healing was uneventful, and when the patient returned 10 days later for suture removal, the soft tissue looked healthy.

Fig. 6
Six weeks after implant placement, the width of the attached mucosa was stable. The appearance of the soft tissue was also excellent.
The definitive abutment and the master cast were sent to the ceramist, who fabricated a porcelain-fused-to-metal crown. The definitive patient-specific BellaTek Titanium Abutment was placed in the implant; the margin was only slightly subgingival. The Gold-Tite® Screw was torqued to 20Ncm.

At the six-week postoperative appointment, a conventional elastomeric impression was made of the BellaTek® Encode® Healing Abutment. A BellaTek Titanium Abutment was milled from a solid blank of titanium and placed in the master cast at the BIOMET 3i BellaTek Production Center.

Eight weeks after placement of the implant, the definitive crown was cemented to the BellaTek Abutment. The contributing clinician has a financial relationship with BIOMET 3i LLC resulting from speaking engagements, consulting engagements, and other retained services.

Dr. Fischer graduated in dentistry in 2009 and received his title “Dr.med. dent” in 2011. Between 2010-2012, he was working as a Clinical Assistant Professor at the Department of Periodontology, University of Wuerzburg, Germany where he obtained further training in periodontology and implant dentistry. In 2013, he became a Specialist in Periodontics. Currently he is a Clinical and Research Associate at the Department of Periodontology, UCL Eastman Dental Institute, London, UK.
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