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Clinical guidelines for using T3® Short Implants

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Clinical case presentations featuring T3 Short Implants

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short

Clinical guidelines for using T3® Short Implants

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Although longer implants for many years were thought to be safest, with at least 10mm of implant length considered to be the standard, anatomical limitations often prohibit placement of such implants without undertaking invasive and potentially risky surgical interventions. More recently, good results have been found for the use of short implants to rehabilitate posterior partial edentulism in atrophic maxillary and mandibular bone. To increase the likelihood of long-term success for short implants, this article presents guidelines, including recommendations for platform-switching, treatment staging, splinting, osteotomy preparation, and more. Two maxillary cases illustrating the use of short implants are also presented.

Key words: implants, edentulous, resorption, guidelines, T3 Short Implants

Introduction

The crown-to-root ratio for natural teeth is often viewed as an indicator of tooth prognosis, with a minimum 1:1 ratio recommended and 1:2 seen as the ideal.[1] The increased functional lever arm of an unfavorable crown-to-root ratio is considered a non-axial loading force.[1] When dental implants were first introduced, similar guidelines were adapted. It was assumed that longer implants would prove more advantageous in clinical use than shorter ones, due both to the more favorable crown-to-implant ratio[2] and the greater implant surface area available for osseointegration. Implant dimensions of 4 mm in diameter and at least 10 mm in length became the standard and were considered to be safest,[3] with 10 to 12 mm of residual alveolar bone thought to be the minimum necessary to ensure predictable implant treatment.

In the posterior region, however, that amount of bone height is frequently unavailable,[4-6] and the bone quality may be compromised. The presence of the maxillary sinus or inferior alveolar nerve also may limit the availability of bone in posterior sites[7] (Figs. 1a-b, 2a-b). To overcome such limitations, surgical procedures such as sinus lifts, vertical bone augmentation, guided bone regeneration, alveolar nerve transposition, and placement of tilted implants were developed.[8-10] But these surgical procedures are substantially invasive and pose risks of intra- and post-operative complications, infection, or graft resorption.[11] Bone-augmentation surgeries also increase the length and cost of treatment.

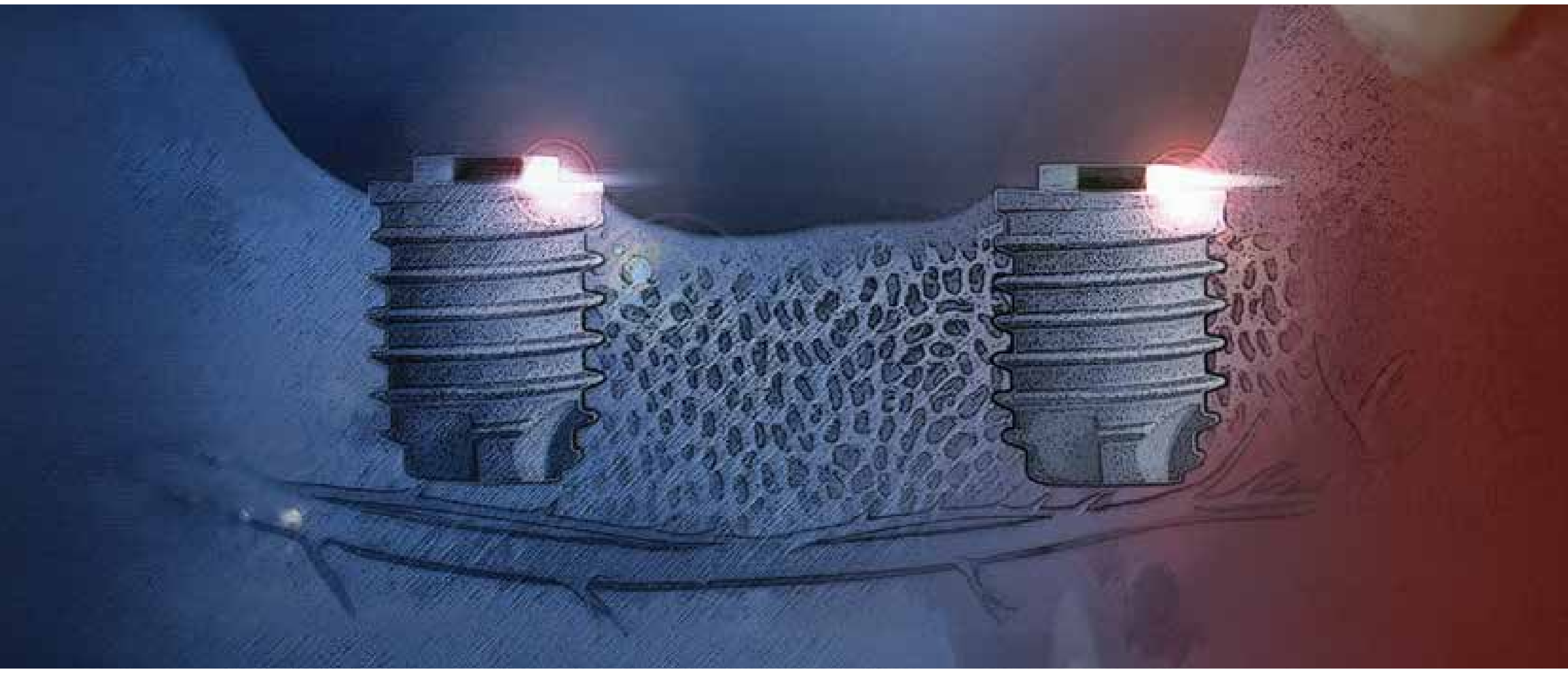

Fig. 1a

Fig. 1b

Figs. 1a, b. Radiograph and Cone Beam CT scan image showing minimal bone height under the maxillary sinus.

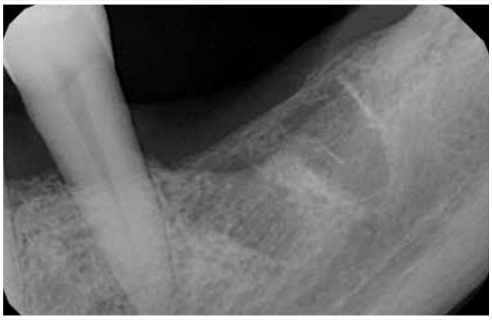

Fig. 2a

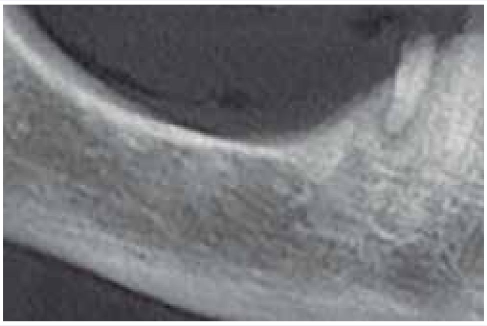

Fig. 2b

Figs. 2a, b. Radiograph and Cone Beam Scan image showing reduced bone height above the inferior alveolar nerve canal.

Fig. 3. T3® Short Implants
5 mmD x 5 mmL and 5 mmD x 6 mmL
6 mmD x 5 mmL and 6 mmD x 6 mmL

An alternative to these surgical procedures is to use short implants.[12,13] The term "short implants" has been controversial, with studies and reviews lacking consensus about its definition.[14] In 1991 8 and 9 mm length implants were introduced and defined as "short." Since then some authors have defined short implants as being less than 7 mm long, while others have extended the definition to include all implants with lengths of up to 10 mm[15] (Fig. 3).

Throughout the 1990s, higher failure rates for shorter implants were reported by a number of investigators.[16-23] However, more recent studies have found better results using short implants to rehabilitate posterior partial edentulism in very atrophic maxillary and mandibular bone. Renouard and Nisand in 2005 reported a 94.6% survival rate after 2 years of loading on short implants placed with high initial stability and good bone-to-implant contact.[24] In a six-year multicenter retrospective study, Misch et al in 2006 found a 98.9% survival rate for 745 7 mm and 9 mm long posterior implants.[25] A 2012 systematic review by Annibali et al that analyzed results of two randomized controlled trials and 14 observational studies and included a total of 6,193 short implants, found a cumulative survival rate of 99.1%, with a low incident of biological and biomechanical complications.[26] Another extensive review of 33 studies of short implants published between 1980 and 2004 found the overall success rate to be 95.2%.[27] While the authors found poor bone quality to be associated with short implant failures, they concluded that the use of implants 4 mm in diameter appeared to minimize failure in such situations.

Several explanations have been offered for the improvement in outcomes for short implants that has become apparent over time. Most importantly, newer surface treatments and wider diameters of short implants in use today increase the bone-to-implant contact exponentially. Whereas early implants had smooth (machined/turned) surfaces, various techniques have since been introduced to alter the implant surface topography, including acid-etching, grit blasting, titanium plasma-spraying, and nanoparticle deposition. These techniques both roughen and increase the implant surface area,[28] and they also have been found to accelerate osseointegration.[29] Evaluating the effect of titanium surface topography on bone integration, Wennerberg and Albrektsson concluded that surface roughness influences bone response at the micrometer level.[30] Many studies have concluded that the advances in surface topography and chemistry have made short implant survival rates comparable to those of standard length implants.[15,31-36]

While some studies have found that neither implant length nor width significantly affects short implant survival rates,[37,38] Anitua et al showed that crestal bone resorption around short implants decreased with increased implant diameter and that using wider implants can reduce the maximum von Mises stress in bone by 20 to 30%.[39]

Other reports of finite element analyses support the hypothesis that the use of shorter implants in appropriate clinical situations yields cumulative survival rates comparable to those reported for longer implants. Lum found that occlusal forces applied to implants were distributed primarily to the crestal bone, regardless of implant length.[40] Lum and Osier also reported that masticatory forces were well tolerated by the crestal bone, but parafunctional forces were not and should be attenuated.[41,42] Holmgren et al[43] and Himmlova et al[44] demonstrated that force application resulted in greatest force concentration at the bone crest. Himmlova et al stated that while implant length had no effect on either the magnitude of peak stress or stress distribution to the supporting bone, implant diameter was more important for improved stress distribution. When Anitua et al in 2010 conducted a finite element analysis of the influence of implant length, diameter, and geometry on implant surface stress distribution, they found stresses to be localized on the first six implant threads, independent of the implant length, diameter, or macrogeometry.[45] They also reported that at a constant diameter, the maximum stress value observed in the first six threads was equal or even lower in shorter implants (8.5 mm) than in longer ones.

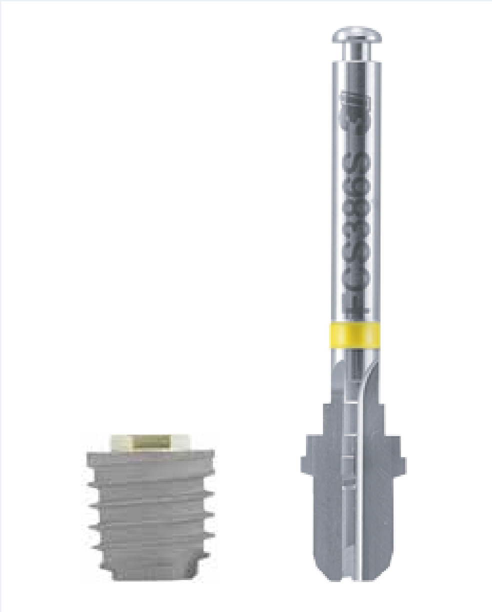

Fig. 4. T3® **Short Implant and Final Shaping Drill**
The last drill used before the insertion of a T3 Short Implant is a flat-bottom Shaping Drill, which is implant specific. It matches the exact shape of the implant without the threads to maximize the initial bone-to-implant contact and implant primary stability.

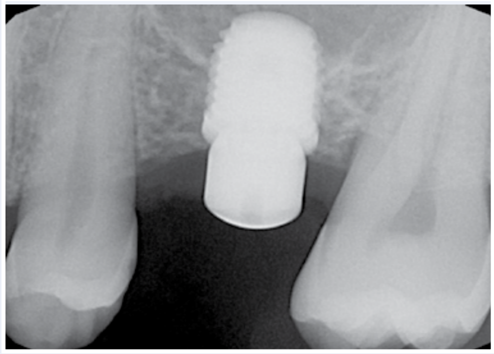

Fig. 5. A 5 mm diameter T3 Short Implant platform switched with a 4.1 mm diameter healing abutment.

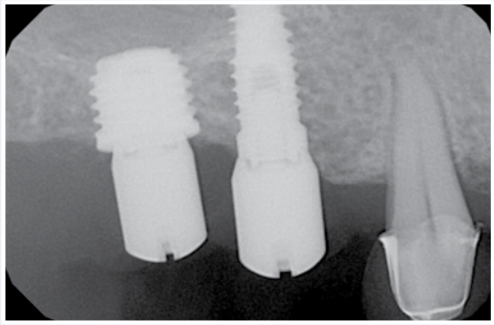

Fig. 6. A 6 mm diameter T3 Short Implant with a 4.1 mm diameter healing abutment (double platform switching).

Short implant placement guidelines

When placing short implants in areas of deficient bone height, following the recommended surgical protocols based on the bone type and using the original instruments and drills is critical to achieve good primary stability of the implants (Fig.4). Moreover, taking certain steps can increase the likelihood of long-term success. The author has developed the following guidelines:

Platform switching: After connection of implants to abutments and exposure to the oral environment, routine loss of approximately 1.5 to 2 mm of vertical bone has long been recognized to occur.[46] Such changes in the crestal bone can profoundly affect treatment outcomes; the discovery that significantly less peri-implant bone loss occurs when smaller diameter abutments are connected to larger diameter implants[47] was thus highly significant. Since then, platform switching has become widely accepted as an effective strategy for mitigating post-restorative peri-implant bone loss and increasing overall functional and aesthetic success. Given the fact that short implants are indicated for sites that are vertically deficient to begin with, preventing any additional bone loss is particularly important. When Telleman et al recently examined the impact of platform switching upon peri-implant bone remodeling around short posterior implants, they found it to be significantly effective.[48] In all cases, the author thus recommends connecting a smaller diameter abutment to short implants (Figs. 5-6).

Splinting: Splinting of short implant crowns is recommended in order to decrease lateral forces on the prosthesis and reduce stresses on the short implants.[49] This is true regardless of whether short implants exclusively have been placed or they are being used in combination with standard length implants. When Yilmaz et al compared the strain generated by splinted and non-splinted short implant crowns, they concluded that splinting may provide a more even strain distribution during functional loading.[50] While it is not possible to splint a single crown supported by a single short implant, an excellent 10-year cumulative survival rate (98.3%) recently was documented for short implants supporting single posterior crowns.[51] Lai et al concluded that a single crown supported by a short implant is a predictable treatment modality. However, as the survival rate for such implants placed in Type IV bone was lower (94%), they cautioned that short implants should be placed in Type IV bone with caution (Figs. 7-8).

Figs. 7, 8. Two T3® Short Implants splinted to a longer implant in a three unit bridge. Note the platform switching on the two T3 Short Implants and the crestal bone preservation one year after implant placement.

Fig. 9. Recommended surgical drilling protocol for crestal placement of 5 mmD x 5 mmL T3 Short Implants. See Surgical Manual ZBINSTMT3S for detailed instructions.

Underpreparation of the osteotomy: The closer contact between an implant and the surrounding bone that results from high insertion torque values (more than 50 Ncm) has been shown to result in more predictable results.[52] To achieve high insertion torques for short implants placed in Type III and Type IV bone sites, the author recommends underpreparation of the osteotomy following the recommended surgical drilling protocol (Fig. 9).

The crown/implant ratio: Placement of short implants in severely resorbed ridges often increases the crown/implant (C/I) ratio. Some studies have suggested this may lead to greater implant failure rates.[30] Some clinicians have considered the greater crown height to be a vertical cantilever that could increase the peri-implant bone stress[53] and eventually result in crestal bone loss, implant failures, or prosthetic complications.[54-56] However, recent studies have cast doubt upon these concerns. When Tawil et al followed 262 short, smooth-surfaced implants (for a mean of 53 months), they found no correlation between the C/I ratio or occlusal table and peri-implant bone loss. They concluded that even when the C/I ratio had increased by two to three times, it did not appear to be a biomechanical risk factor if the force orientation and load distribution were favorable. Others have also found that the C/I ratio does not appear to reliably predict implant survival.[57,58] Although the C/I ratio does not by itself represent a biomechanical risk factor, a very high ratio may lead to mechanical failures such as abutment screw loosening or fracture (Figs. 10-11).

Fig. 10. Two T3® Short Implants with a high crown/implant ratio are splinted in the same prosthesis to reduce biomechanical stress.

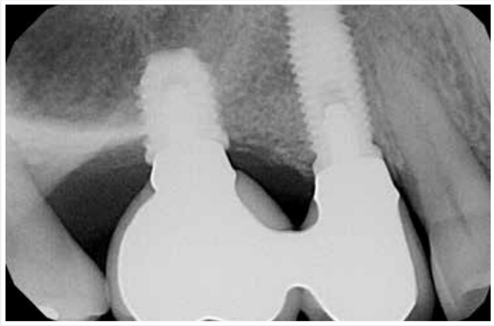

Fig. 11. A T3 Short Implant with an unfavorable crown/implant ratio splinted to a longer implant to distribute loading forces.

Staging of treatment: When short implants were first introduced, use of a staged approach was suggested, leaving the implants submerged to protect the initial phase of osseointegration and avoid the risk of implant failures due to micromovement or contamination.[59] However, patients often find it uncomfortable to wear removable provisional prostheses during the initial implant-integration phase. The ability to deliver a fixed prosthesis immediately after implant insertion is a major advantage.[60] Standard length implants placed in selected patients and immediately loaded have been shown to have survival rates comparable to those placed using standard staged procedures even in the presence of poor quality bone, if high insertion torque values (more than 40 Ncm) can be obtained during implant insertion.[52,61] The author believes the only indication for submerging short implants is an inability to achieve primary stability because of poor bone quality, for example, or inadequate osteotomy site preparation. In all other circumstances, a single-stage approach is preferable. If adequate insertion torque (>50 Ncm) can be achieved for each of the implants, immediate restoration with a healing abutment can be accomplished. When Cannizzaro et al in 2008 compared the outcomes of 7 mm-long implants that were immediately and early loaded, they found survival rates above 96% for both groups after nine months of loading, with no statistically significant differences between the two groups for implant losses, complications, mean marginal bone level changes, and patient preferences[62] (Figs 12-15).

Implant diameter selection: A minimum of 1 mm to 1.5 mm of bone should be maintained buccal to the implant to avoid buccal soft-tissue recession. Selection of the implant diameter should be based upon this criteria (Figs. 16-18).

Number of implants: In posterior partially edentulous cases, the rule of one implant per tooth should be applied for immediate loading cases. In full-arch cases, it is not necessary due to the cross-arch stabilization obtainable by splinting the provisional restoration (Figs. 19-21).

Connective tissue: An adequate band of keratinized tissue should be present around the implants. The significance of the presence of keratinized mucosa on long-term implant health has been well documented in the literature[63,64] (Fig. 22).

Figs. 12. Occlusal view of a case performed using flapless, single-stage approach with exposed healing abutments.

Figs. 13. Occlusal view after 4 months of healing.

Figs. 14. Clinical case including a standard length implant in the first premolar and two T3 Short Implants in the second premolar and first molar positions.

Figs. 15. The implants were placed in healed sites in a single stage procedure. A screw-retained bridge out of occlusion, was used as a provisional restoration.

Fig. 16. Occlusal view of the restorative platform of a 4.0 mm D x 11.5 mm L Ex Hex Implant, a 5.0 mm D and a 6.0 mm D T3 Short Implant. The hex size is the same for all three implant diameters.

Fig. 17. Clinical case with a 4.0 mm diameter implant in the premolar site and a 5.0 mm diameter T3 Short Implant in the molar site, allowing for a minimum of 1 mm of buccal bone around both sites.

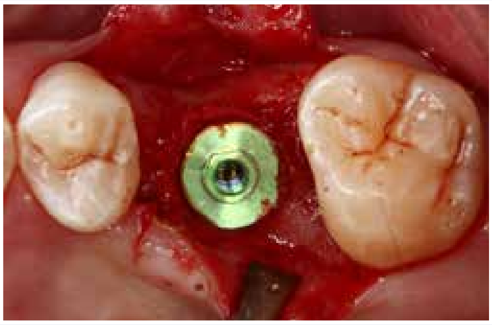

Fig. 18. Clinical case with a single 6 mm diameter T3® Short Implant with 1 mm to 2 mm of bone surrounding the implant.

Fig. 19. Posterior partially edentulous case with three T3 Short Implants in place. One implant per tooth was placed as immediate provisionalization was desired.

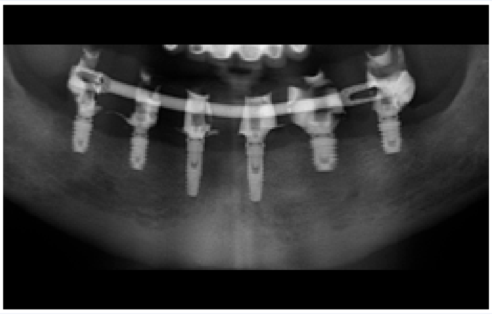

Fig. 20. Immediate loading of a full mandible with a fixed provisional prosthesis on six implants. The left quadrant posterior implants are two T3 Short Implants.

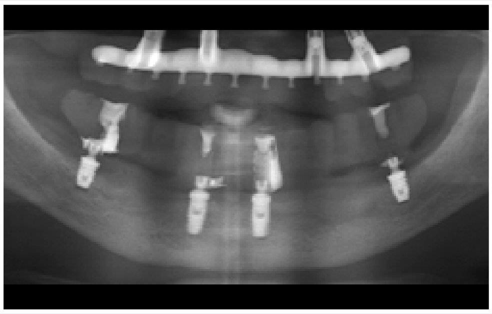

Fig. 21. Immediate loading of a full mandible with a fixed provisional prosthesis on four implants, with the two posterior implants being T3 Short Implants.

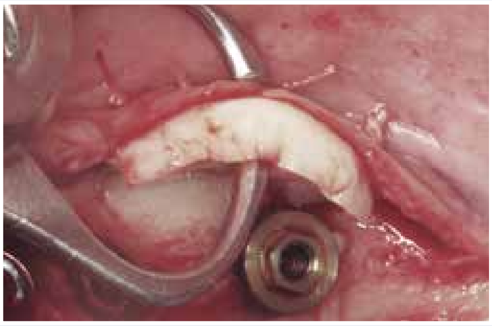

Fig. 22. Connective tissue graft in the buccal side around a T3 Short Implant to achieve an adequate thickness.

Conclusion

The use of short implants makes it possible to provide implant-supported restorations without the need to vertically augment atrophic ridges. The posterior zones can be restored in less time with less risk of complications normally associated with grafting procedures and with less treatment costs.

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Dr. Francesco Amato completed his MD degree at the University of Catania, Italy in 1991. In 1992–1993 he completed a one year full time Advanced Program for International Dentists in Periodontics at New York University College of Dentistry followed by two years full time Advanced Program for International Dentists in Implant Dentistry at New York University College of Dentistry, 1993–1995. He completed his continuing Education Program in Implant Dentistry at New York University College of Dentistry, 1994–1995. He received his Ph.D. Biopharmaceutical Microbiology at the University of Catania, Italy, 1994–1997. He has published numerous articles in international journals; is a lecturer in National and International Conferences and Courses. He is in private practice specializing in Periodontics and Implant Dentistry in Catania, Italy, and is a Clinical Professor in the Master of Periodontology at Universitat Internacional de Catalunya, Spain, a Visiting Professor in the Department of Periodontology at Columbia University, New York, and an International lecturer for the Continuing Dental Education at New York University, New York.

†The contributing clinician has a financial relationship with Zimmer Biomet Dental resulting from speaking engagements, consulting engagements, and other retained services.

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Short and long implants to restore an atrophic posterior maxilla

Francesco Amato, MD, DDS, PhD[†], Italy

The 62-year-old male patient presented with missing teeth in the left posterior maxilla. Clinical and radiographic examination revealed the presence of sufficient vertical and horizontal bone height to enable placement of a long implant in the first premolar region and adequate width, but insufficient height, in the first molar region. A treatment plan was developed that called for a standard length implant in the premolar region and a short implant in the molar site. The implants were submerged for 6 months of healing. A definitive three-unit bridge was then delivered.

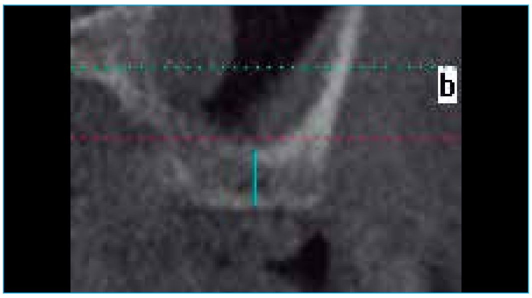
Fig. 1

Preoperative clinical photograph showing the missing premolars and first molar.

Fig. 2

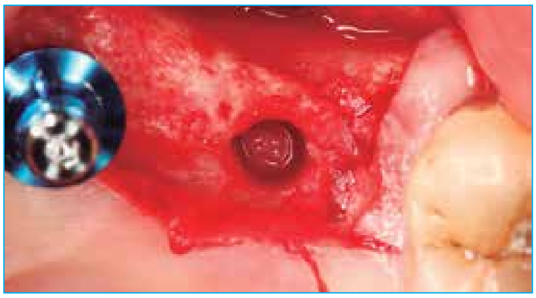
Occlusal view, note the buccal concavity in the edentulous area.

Fig. 3



TAC image of the remaining bone height in the molar region 3 mm.

Fig. 4

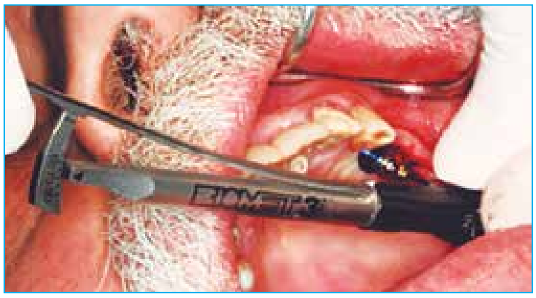


Insertion of a T3® Tapered Implant 4 mm D x 11.5 mm L in the first premolar region. Osteotomy preparation was performed with a small drill and a convex osteotome to push the cortical bone into the sinus cavity.

Fig. 5

Insertion of a T3 Short Implant 5 mm D x 6 mm L in the molar region.

Fig. 6



Hand ratcheting the implant to its final position. Final seating torque reading: 70 Ncm.

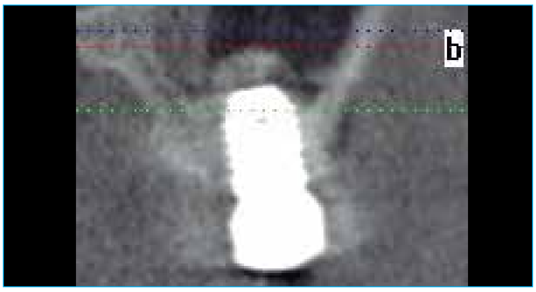
Fig. 7

Occlusal view of the two implants in place before healing abutment placement and proceeding to flap closure.

Fig. 8

Flap closure around the healing abutments following the Palacci technique to increase the thickness of the buccal gingiva.

Fig. 9

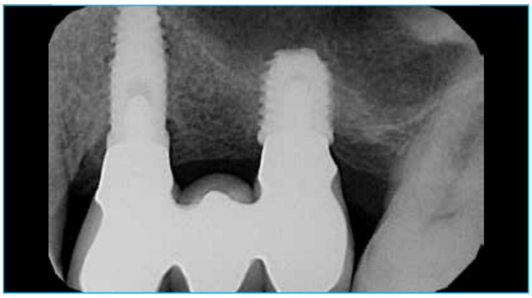


Radiograph of the T3 Short Implant just placed in the molar site with a manually platform switched healing abutment (4.1 mm diameter platform on the 5 mm diameter platform implant).

Fig. 10

A three-unit screw-retained porcelain-fused-to–metal bridge was placed 6 months post-implant placement.

Fig. 11



Control radiograph 6 months post-op. Note the consolidation of the bone around the apex of the T3 Short Implant.

Francesco Amato, MD, DDS, PhD†

Dr. Francesco Amato completed his MD degree at the University of Catania, Italy in 1991. In 1992–1993 he completed a one year full time Advanced Program for International Dentists in Periodontics at New York University College of Dentistry followed by two years full time Advanced Program for International Dentists in Implant Dentistry at New York University College of Dentistry, 1993–1995. He completed his continuing Education Program in Implant Dentistry at New York University College of Dentistry, 1994–1995. He received his Ph.D. Biopharmaceutical Microbiology at the University of Catania, Italy, 1994–1997. He has published numerous articles in international journals; is a lecturer in National and International Conferences and Courses. He is in private practice specializing in Periodontics and Implant Dentistry in Catania, Italy, and is a Clinical Professor in the Master of Periodontology at Universitat Internacional de Catalunya, Spain, a Visiting Professor in the Department of Periodontology at Columbia University, New York, and an International lecturer for the Continuing Dental Education at New York University, New York.

†The contributing clinician has a financial relationship with Zimmer Biomet Dental resulting from speaking engagements, consulting engagements, and other retained services.

Clinical Case

Short implant replacing the first molar in an extremely resorbed posterior maxilla

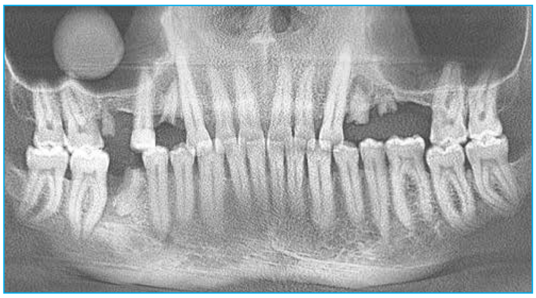
Francesco Amato, Italy, MD, DDS, PhD†, Italy

The 50-year-old male patient was missing the premolars and the first molar in the left maxilla. The clinical and radiographic findings were two hopeless premolar roots and a severely resorbed alveolar crest due to sinus pneumatization. The treatment plan included placement of a standard length immediate implant in the first premolar region and a short implant in the molar region splinted in a three-unit bridge.

Fig. 1

Preoperative clinical photograph showing the hopeless premolar roots.

Fig. 2



Preoperative radiograph. Note the severely resorbed alveolar crest and the sinus pneumatization.

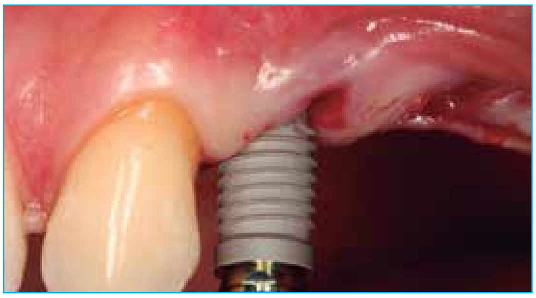
Fig. 3

Occlusal view after the roots were extracted.

Fig. 4

Osteotomy preparation. The molar site was prepared with a small 2 mm diameter drill followed by a convex osteotome to push the cortical bone and slightly elevate the sinus membrane.

Fig. 5



A standard size 11.5 mm L x 5 mm D T3® with DCD® Tapered Implant was inserted in the first premolar extraction site.

Fig. 6

A 5 mm D x 6 mm L T3 Short Implant with DCD was inserted in first molar site.

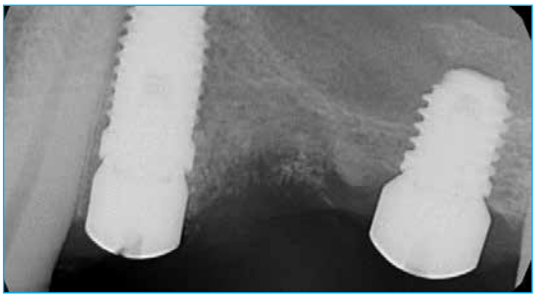
Fig. 7

Occlusal view of the two 5 mm diameter implants.

Fig. 8

Healing abutments in place for unsubmerged healing. The extraction sites are filled with Endobon® Xenograft Granules.

Fig. 9



Postoperative radiograph. Note the T3® Short Implant of 6 mm length partially invading the sinus.

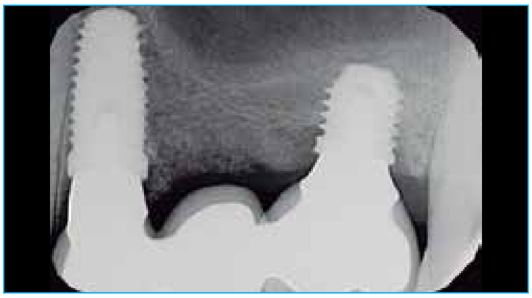
Fig. 10

Occlusal view of the definitive three-unit bridge 6 months post-op.

Fig. 11

Buccal view of the definitive prosthesis 6 months post-op.

Fig. 12



Final radiograph 6 months post-op. Note the bone growth inside the sinus around the apex of the T3 Short Implant.

Francesco Amato, MD, DDS, PhD†

Dr. Francesco Amato completed his MD degree at the University of Catania, Italy in 1991. In 1992–1993 he completed a one year full time Advanced Program for International Dentists in Periodontics at New York University College of Dentistry followed by two years full time Advanced Program for International Dentists in Implant Dentistry at New York University College of Dentistry, 1993–1995. He completed his continuing Education Program in Implant Dentistry at New York University College of Dentistry, 1994–1995. He received his Ph.D. Biopharmaceutical Microbiology at the University of Catania, Italy, 1994–1997. He has published numerous articles in international journals; is a lecturer in National and International Conferences and Courses. He is in his private practice specializing in Periodontics and Implant Dentistry in Catania, Italy, and is a Clinical Professor in the Master of Periodontology at Universitat Internacional de Catalunya, Spain, a Visiting Professor in the Department of Periodontology at Columbia University, New York, and an International lecturer for the Continuing Dental Education at New York University, New York.

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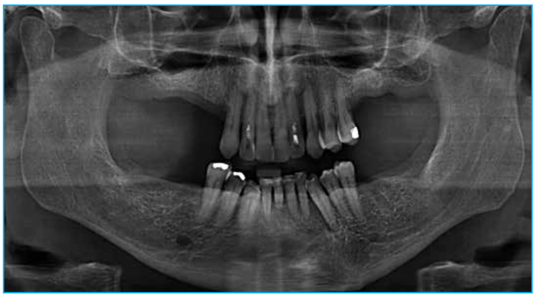
Restoration of a resorbed maxillary right posterior quadrant with short and long implants

Kai Fischer, DMD[†], Germany

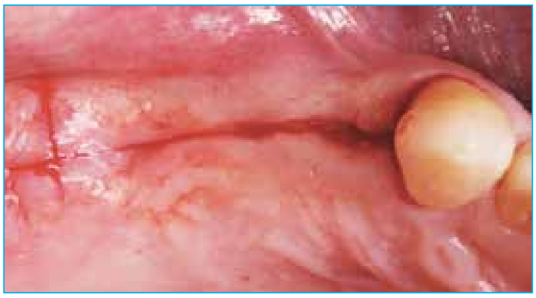
The 50-year-old male presented with moderate to severe periodontitis and multiple missing posterior teeth. The radiographic examination revealed reduced vertical bone height in the right maxilla but sufficient bone width. The treatment plan developed included periodontal treatment with some extractions, implant placement in all four quadrants, and supportive periodontal therapy. The right quadrant included placement of a short implant in the first molar region and a longer implant in the first premolar region.

Fig. 1



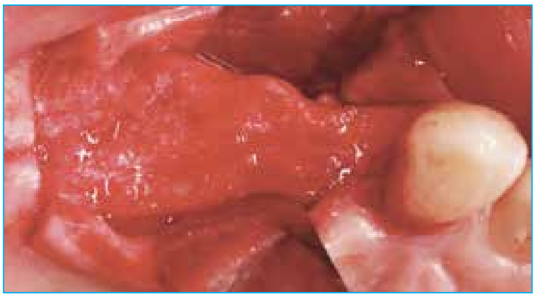
Preoperative radiograph, showing limited bone height in the maxillary posterior quadrants.

Fig. 2



Incision and flap design included a small t-shaped incision for better access without releasing into the vestibule.

Fig. 3



Clinical view after flap elevation revealing a wide ridge, especially in the posterior area.

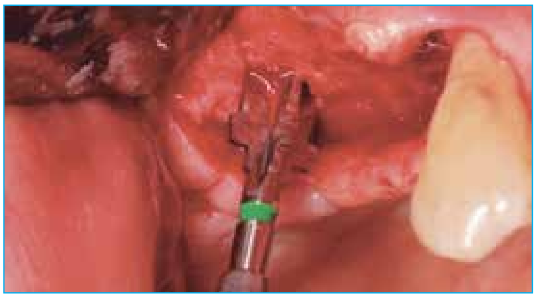
Fig. 4

Initial preparation osteotomy with the 2 mm diameter Twist Drill.

Fig. 5

Widening the osteotomy with the next drill in the recommended protocol (3.25 mm diameter Twist Drill).

Fig. 6



Finishing the site preperation with the final Flat Bottom Shaping Drill for a 6 mm D x 6 mm L implant.

Fig. 7

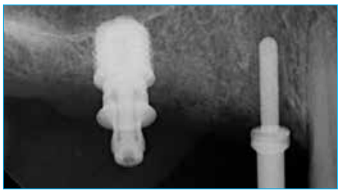


Fig. 8

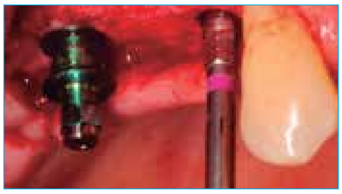


Fig. 9

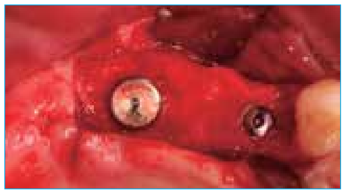


Fig. 10

Fig. 7. T3® Short Implant (6 mm D x 6 mm L) placement with the handpiece connector.
Fig. 8. Radiograph of the T3 Short Implant in place. Note the sinus cortical engagement.
Figs. 9, 10. T3 Tapered Implant (4 mm D x 11.5 mm L) placed in the maxillary right first premolar position.

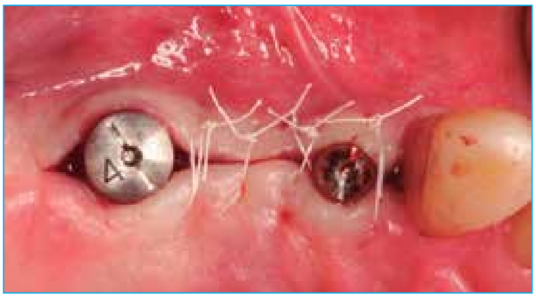
Fig. 11

Continuous interlocking sutures.

Fig. 12

Complete healing after 4 months.

Fig. 13



Sutures around the healing abutments after second-stage surgery. Note the adequate width of keratinized attached gingiva.

Fig. 14

Definitive restoration in place 6 months post-surgery.

Fig. 15

Final radiograph at the time of insertion of the definitive prosthesis.

Kai Fischer, DMD†

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. From 2013–2016 he was a Honorary Research Associate & Clinical Teaching lecturer at UCL Eastman Dental Institute, London, UK and at the University Witten/Herdecke. Currently he works at Drs. Schütz/Tawassoli, Würzburg - Private dental practice.

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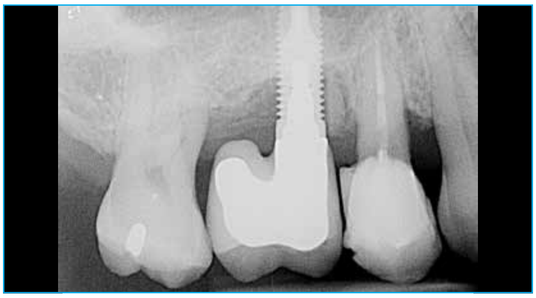
Clinical Case

Replacement of an implant due to peri-implantitis in the maxillary molar region with delayed placement of a short implant and simultaneous grafting

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

The patient presented with a failing implant due to peri-implantitis in the maxillary first molar position and a failing natural premolar tooth with periodontitis. Clinical and radiographic examination revealed the presence of very reduced bone height in the molar region, which would enable the placement of only a short implant. A treatment plan was developed where a short implant was placed in tooth position 3 [16] with simultaneous grafting in a two-stage approach. A longer implant was to be placed in the premolar site. After a 4-month healing period, two single definitive crowns were delivered to the patient.

Fig. 1



Radiograph showing the infected implant in the molar region and a failing premolar tooth.

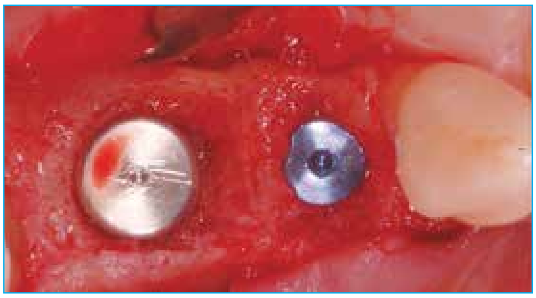
Fig. 2

Preoperative radiograph 4 months after explantation of the failed implant. Note the limited remaining bone height in the molar region.

Fig. 3

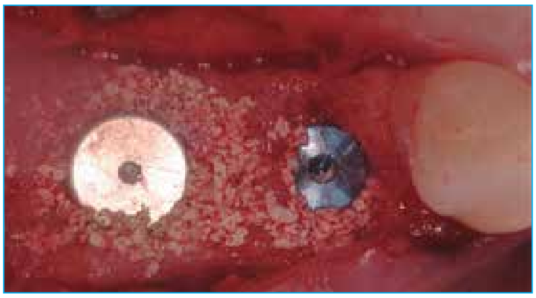
Placement of a T3® Short Implant (6 mm D x 5 mm L) in position 3 [16] and a longer T3 Parallel Walled Implant (4 mm D x 10 mm L) in tooth position 4 [15].

Fig. 4



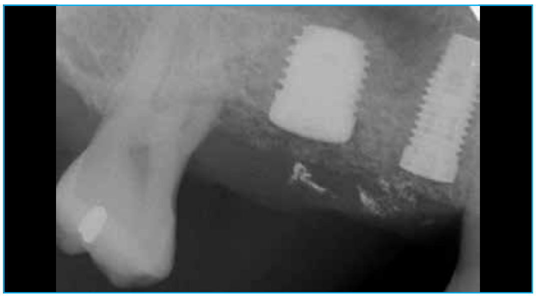
Occlusal view of the two implants in place with their corresponding cover screws for submerged healing.

Fig. 5



Grafting of the remaining bone defect around the T3 Short Implant with Endobon® Xenograft Granules.

Fig. 6

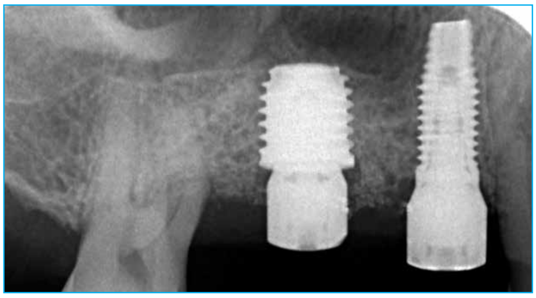


Radiograph after implant placement, grafting and sutures.

Fig. 7

Re-opening 4 months after surgery.

Fig. 8



Radiograph at second-stage surgery 4 months post-op. Manual platform switching was done on the T3® Short Implant by placing a 5 mm diameter healing abutment on the 6 mm diameter implant.

Fig. 9

Two definitive abutments in place 4.5 months after implant placement.

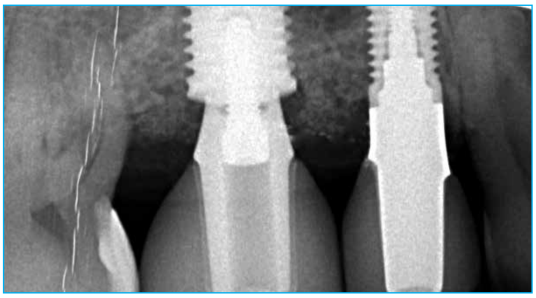
Fig. 10

Final cemented single-unit premolar and molar crowns.

Fig. 11

Occlusal view of the definitive crowns.

Fig. 12



Radiograph of the definitive restorations taken at 4.5 months post-implant placement.

Ronnie J. Goené, DMD†

Dr. Goené is an Associate Professor in the Department of Oral and Maxillofacial Surgery/Pathology of the Academic Center for Dentistry Amsterdam and VU University Medical Center. He lectures extensively on implant aesthetic dentistry. He maintains a private clinic limited to implantology in Amsterdam, the Netherlands.

Alwin C.L. van Daelen, DMD†

Dr. van Daelen is a Clinical Assistant Professor at the Department of Oral and Maxillofacial Surgery/Oral Pathology, Academic Center for Dentistry Amsterdam and VU University Medical Center. He maintains a renowned private and referral practice in Amsterdam, The Netherlands, treating restorative and aesthetic cases.

†The contributing clinicians have financial relationships with Zimmer Biomet Dental resulting from speaking engagements, consulting engagements, and other retained services.

Replacement of a single maxillary molar with a short implant to avoid sinus grafting

Stefano Sivolella, DMD, PhD†, Italy

The patient was a 65-year-old female missing two molars in the maxillary left quadrant. The radiographic findings were a sinus pneumatization and a moderate atrophy of the alveolar process. Clinical findings revealed a good preservation of the buccal-palatal dimension and an adequate amount of keratinized gingiva. The treatment consisted of the placement of a single short implant in site 14 [26] with single-stage, unsubmerged healing. The patient refused treatment consisting of placement of another implant in site 15 [27] and extraction of tooth 16 [28].

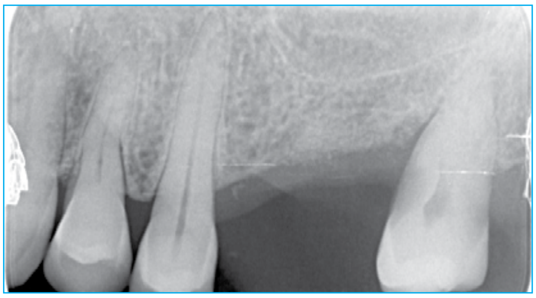
Fig. 1

Preoperative clinical photograph showing missing molars, tooth numbers 14 and 15 [26 and 27].

Fig. 2

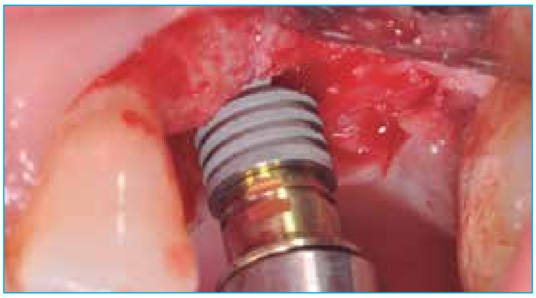
Preoperative clinical occlusal view. Observe the adequate ridge width.

Fig. 3



Preoperative periapical radiograph showing approximately 7 mm of bone height under the sinus.

Fig. 4

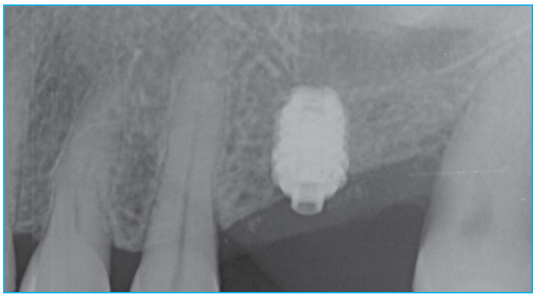


Insertion of a 5 mm diameter x 5 mm length T3® Short Implant in tooth position 14 [26].

Fig. 5

Final position of the implant, level with the bone crest in the buccal part and subcrestal in the mesial and distal parts.

Fig. 6



Immediate postoperative periapical radiograph. A platform-switched Low Profile Abutment with a healing cap was used for an unsubmerged healing period of 3 months.

Fig. 7

Clinical aspect after removal of the healing cap and the abutment, 3 months of healing. The mucosa looks healthy and not bleeding.

Fig.8

Definitive screw-retained metal ceramic crown prepared by the laboratory using a 4.1 mm diameter UCLA abutment on the 5 mm diameter implant.

Fig. 9

Insertion of the final crown: occlusal view.

Fig. 10

Lateral clinical view of the final crown.

Fig. 11

Periapical radiograph at the time of final prosthesis insertion. Note the platform switching (inserting a smaller diameter crown than the implant platform) to help crestal bone preservation.

Fig. 12

Lateral clinical view 6 months post-loading and 1 year after implant placement.

Fig. 13

Periapical radiograph 6 months post-loading and 1 year after implant placement. Note the maintenance of the crestal bone level.

Stefano Sivolella, DMD†

Dr. Stefano Sivolella graduated in Dentistry at the University of Padua, Italy. Then he specialized in Oral Surgery at the University of Florence, Italy. Since 1998 he is an Assistant Professor at the Department of Oral Surgery at the University of Padua, and since 2000 he is a Clinical Assistant Professor at the Dental Clinic of the University of Padua, Italy. He received his PhD degree in 2015 at the University of Ferrara (Italy). Since 2016 he is Adjunct Professor at the University of Padua, Department of Neurosciences, Section of Dentistry. He is a national and international speaker and author or co-author of more than 50 indexed scientific articles.

†The contributing clinician has a financial relationship with Zimmer Biomet Dental resulting from speaking engagements, consulting engagements, and other retained services.

Restoration of a resorbed mandibular left posterior quadrant with short and long implants

Francisco J. Enrile de Rojas, MD, DDS†, Spain

The 70-year-old female was missing the mandibular posterior teeth in both quadrants. The clinical and radiographic studies revealed very little bone height, only 6 mm in the molar region of the mandibular right posterior quadrant with sufficient ridge width for a short, wide implant. The bone appeared dense and the gingiva thin and non-keratinized, in some areas as thin as 1 mm. The mandibular left quadrant had sufficient bone height for standard length implants. The treatment for the mandibular right quadrant consisted of placement of two short implants in tooth positions 29 and 30 [45 and 46] and a longer implant in tooth position 28 [44] using a conservative two-stage approach. Due to the advanced age and medical conditions of the patient it was decided to not do a connective tissue graft.

Fig. 1

Preoperative radiograph: Observe the very little bone height above the mental nerve in the mandibular right posterior quadrant.

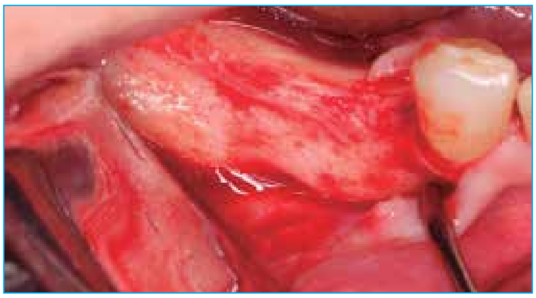
Fig. 2

Case planification with the Cone Bean CT scan. Only 6 mm bone height in the second premolar and first molar regions above the mental nerve.

Fig. 3

Preoperative view.

Fig. 4

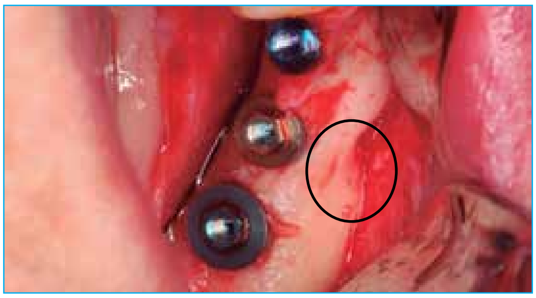


Sufficient bone width for 5 and 6 mm diameter implants in the second premolar and first molar regions.

Fig. 5

Implant placement in position 28 [44] a T3® Tapered 4 mm D x 13 mm L, in position 29 [45] a T3 Short Implant 5 mm D x 5 mm L, in position 30 [46] a T3 Short implant 6 mm D x 5 mm L. After using the dense bone tap, 50 Ncm of insertion torque was registered.

Fig. 6



Occlusal view of the implants, observe the vicinity of where the mental nerve exits.

Fig. 7

All three implants covered with their corresponding cover screws.

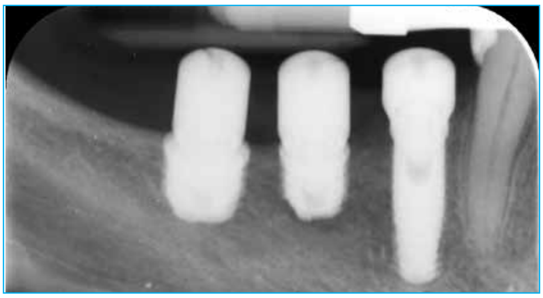
Fig. 8

Sutures for submerged healing.

Fig. 9

Second stage surgery after 3 months of healing. Connection of the healing abutments, with platform switching of the 5 and 6 mm diameter implants to aid in crestal bone preservation.

Fig. 10

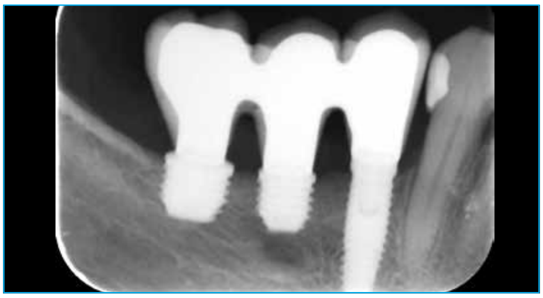


Radiographic control at 3 months.

Fig. 11

Delivery of the final screw-retained bridge 6 months after implant placement.

Fig. 12



Radiograph at final prosthesis placement.

Fig. 13

Occlusal view of the final metal-ceramic screw retained three-unit bridge after sealing the screw-access holes 6 months post-surgery.

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 clínic with a training center in Huelva (Spain) dedicated exclusively to Periodontology and Implants.

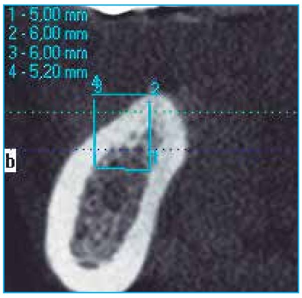
[†]The contributing clinician has a financial relationship with Zimmer Biomet Dental resulting from speaking engagements, consulting engagements, and other retained services.

Restoration of resorbed mandibular right posterior quadrant with short implants after horizontal bone augmentation

Piotr Majewski, Ph.D, DMD†, Poland

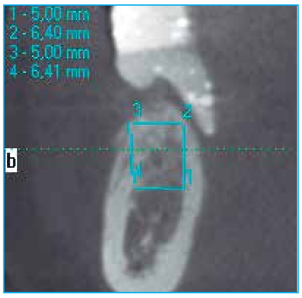
The 54-year-old female patient was missing teeth numbers 29, 30 and 31 [45, 46 and 47]. The clinical and radiographic studies revealed reduced bone height (less than 6 mm) in the molar region with insufficient ridge width for a wide implant. The treatment plan consisted of horizontal ridge augmentation with an autogenous bone block and xenograft to increase width to allow for the replacement of the three missing teeth with short implants.

Fig. 1



Cone Bean CT scan before the bone graft. A thin alveolar ridge is observed with insufficient width for placement of a 5 mm diameter implant.

Fig. 2



Cone Bean CT scan after the bone augmentation. The implant site width now allows for the placement of a 5 mm diameter implant.

Fig. 3

Exposition of the narrow crest in the posterior right mandible prior to the bone augmentation procedure.

Fig. 4

Autogenous bone block harvested from the retromolar area and fixed with two mini-screws in tooth positions 29 and 30 [45 and 46].

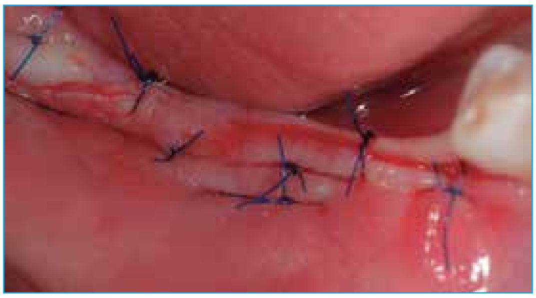
Fig. 5

The bone block and the distal zones are covered with particulated xenograft.

Fig. 6

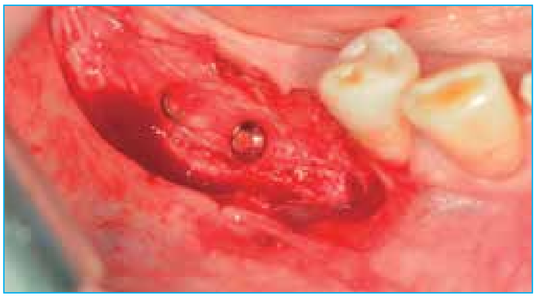
The bone grafts are covered by two resorbable collagen membranes.

Fig. 7



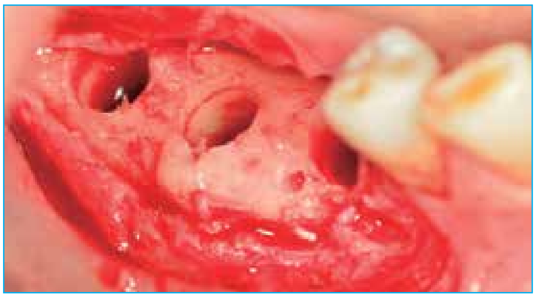
Suturing after horizontal augmentation procedure. Note the primary closure achieved.

Fig.8



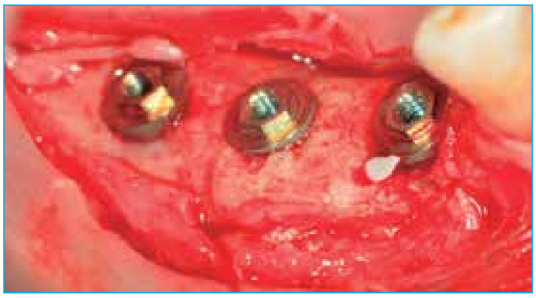
Reopening of the grafted sites after 4 months of healing. The bone block has been biologically incorporated. Optimal ridge thickness has been achieved for placement of 5 mm diameter implants.

Fig. 9



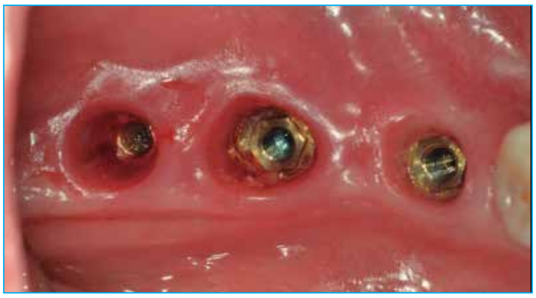
Osteotomies in the regenerated sites following the drilling protocol of the T3® Short Implant system.

Fig. 10



Three T3 Short Implants of 5 mm diameter x 5 mm length were placed.

Fig. 11



4 months after placement the implants are osseointegrated and ready for the prosthetic phase.

Fig. 12

Three GingiHue® Abutments adjusted by the laboratory technician are placed and screwed into the implants with Gold-Tite® Screws torqued at 35 Ncm.

Fig. 13

Final cement-retained bridge in place 9 months after the augmentation surgery and 5 months after implant placement.

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Dr. Majewski is a Graduate of the Faculty of Medicine/Department of Dentistry at the Jagiellonian University Medical College, Cracow, Poland. He completed his supplementary studies at the University of Melbourne, Australia and trainings at different implant centers in USA, Sweden, Italy, Switzerland and Germany. He received the Specialist degree in Dental Surgery. Since 2004, He is Head of Department of Implantology at the Institute of Dentistry at the Jagiellonian University Medical College in Cracow, Poland and Head of the CEIA (Central European Implant Academy). He is a lecturer at the Implant Continuum Education Program at New York University College of Dentistry and an international speaker and faculty member of the Zimmer Biomet Institute.

†The contributing clinician has a financial relationship with Zimmer Biomet Dental resulting from speaking engagements, consulting engagements, and other retained services.

NOTES

NOTES

T3® Short Implants

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Your progress. Our promise.®

5 mm and 6 mm Lengths

The T3 Short Implant's length and features provide an implant treatment option in those cases where vertical bone height is insufficient for a traditional length (>6 mm) implant.

- **T3 Surface**
  Blasted and acid-etched implant surface with an average roughness of 1.4µm along the full length of the implant.[1]
- **Implant/Abutment Clamping Force**
  Use of the Gold-Tite® Screw increases the implant/abutment clamping force by 83% vs. a non-coated screw.[2] * Manual platform switching is recommended.**
- **Initial Bone-to-Implant Contact (IBIC)**
  The dimensions of the surgical instrumentation and the T3 Short Implant provide a tight implant-to-osteotomy fit, which can assist with primary stability.[3]
- **New Compact Surgical Kit And Instrumentation**
  Designed to specifically support site preparation and placement of T3 Short Implants.

1 Gubbi P[†], Towse R[†]. Quantitative and Qualitative Characterization of Various Dental Implant Surfaces. Poster Presentation: European Association for Osseointegration, 21st Annual Meeting; October 2012; Copenhagen, Denmark.
2 Suttin Z[†], Towse R[†]. Effect of Abutment Screw Design on the Seal Performance of an External Hex Implant System. Presented at the European Association for Osseointegration, 22nd Annual Scientific Meeting; October 2013; Dublin, Ireland.
3 Meltzer AM[‡]. Primary stability and initial bone-to-implant contact: The effects on immediate placement and restoration of dental implants. J Implant Reconstr Dent. 2009;1(1):35-41.

† The authors conducted this research while employed at Biomet 3i.
‡ Dr. Meltzer had a financial relationship with Biomet 3i LLC resulting from speaking engagements, consulting engagements and other retained services at the time the study was conducted.
* Bench test results are not necessarily indicative of clinical performance.
** Placement of a smaller diameter restorative component than the diameter of the implant seating surface.

For more information regarding T3 Short Implants, please contact your local Zimmer Biomet Dental Sales Representative.
www.zimmerbiometdental.com