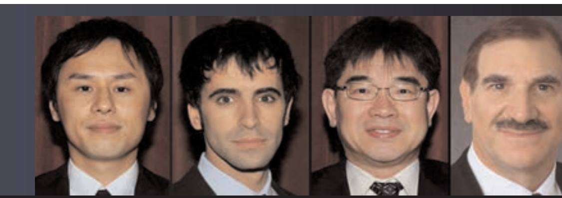
The Use of a Thin Bodied Diameter Implant as a Tent Pole for Vertical Ridge Augmentation: A Case Report



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INTRODUCTION

Treatment of vertical bone defects is often necessary to allow implant placement in ideal position for prosthetic restoration. Successful bone augmentation of large vertical maxillary and mandibular alveolar ridge defects is difficult to achieve. Various techniques have been described for the reconstruction of these large vertical defects prior to implant placement. These techniques have included autogenous onlay block grafts (1-4), autogenous particulate grafts (5-8), guided bone regeneration with membranes or titanium mesh (10, 11), distraction osteogenesis (12) and a combination of these (13-15). However, these techniques have disadvantages which include: requirement of secondary surgical procedure, limited access and exposure of the titanium mesh (1-15).

Marx et al reported on a novel surgical approach using dental implants as "tent poles" in combination with iliac crest bone grafting. A successful treatment of 64 severely atrophic mandibles, resulted in a mean gain in bone height of 10.2 mm (16). The novel strategy of this surgery was to allow iliac bone grafts to consolidate and maintain their volume around dental implants that provided a tenting effect. This concept can be performed using thin-bodied diameter implants (TBI). The latter were originally introduced as transitional implants (TIs) to support immediately loaded provisional restorations in a single-stage surgery (17-21). These TIs were designed to be removed at the end of the provisionalization period and replaced with definitive implants (22, 23). Oftentimes, TIs were used clinically, not only for fixed provisionalization, but also as a guide for proper angulation and position of final implants.

The purpose of this case report was to present and to describe the step by step technique for the use of a TBI as a tent-pole in a guided bone regeneration procedure.

MATERIALS & METHODS

Clinical data in this study was obtained from Implant Database (ID). This data set was extracted as de-identified information from the routine treatment of patients at the Ashman Department of Periodontology and Implant Dentistry at New York University College of Dentistry (NYUCD) Kriser Dental Center. ID was certified by the Office of Quality Assurance at NYUCD. This study is in compliance of the Health Insurance Portability and Accountability Act (HIPAA) requirements and approved by the University Committee on Activities involving Human Subjects.

Clinical Case

A 57-year-old male presented to Ashman Department of Periodontology and Implant Dentistry New York University (NYUCD). His chief request was to have an implant placed in the maxillary central left incisor area (#9) (Fig 1). His dental history revealed that root canal treatment had been performed on tooth #9. After radiographic evaluation, vertical bone loss was discovered on tooth #9 (Fig 2). A guided bone regeneration (GBR) procedure was performed under local anesthesia using 2% lidocaine with 1:100,000 epinephrine (Henry Schein, USA). A midcrestal incision between teeth #s 8 and 10 was performed followed by two vertical releasing incisions on the distal aspects of these teeth. These incisions extended apical to muco-gingival junction (Fig 4). A full thickness muco-periosteal flap was raised. A Class III ridge defect (24), found that extended 3 mm horizontally and 10mm vertically (Fig 5). The initial osteotomy was made in an ideal position for the planned final implant, using a needle drill (Dentatus, New York, NY), to a 4 mm depth in the existing bone. Decortication was performed on the buccal plate using a small diamond round bur with high-speed and copious irrigation. A TBI (Anew, Dentatus, New York, NY) with a 2.4 mm diameter and a 14mm length was placed 4 mm into the bone. A GBR procedure was performed simultaneously with implant placement. A non-absorbable titanium reinforced membrane (Cytoplast membrane TI 250, Sybron Dental Specialties, Orange, CA) in combination with an organic bovine bone mineral (ABBM) (Bio-Oss, Osteohealth, Shirley, NY) small particles were used in this procedure (Fig 6, 8). Tension-free primary wound closure was achieved. Resorbable suture material using (4.0 chromic gut, Henry Schein, USA) was used for the midcrestal closure. Simple interrupted sutures using 5.0 chromic gut were used to close the vertical incisions. The patient was monitored with a routine follow-up for 3 months. No complications were reported.

After a healing period of 3 months (Fig 9), the TBI was removed and a wider diameter implant was placed. This procedure was performed under local anesthesia using 2% lidocaine with 1:100,000 epinephrine (Henry Schein, USA). A midcrestal incision was made slightly palatal to the previous incision, followed by intrasulcular incision to the midbuccal of teeth #s 8 and 10. A full thickness muco-periosteal flap was reflected only in the crestal area, in order to avoid exposure of the buccal plate. The titanium reinforced membrane was cut with a 15-C blade and a surgical scissor, to create a round 4 mm diameter hole to accommodate the implant placement. Bone formation was observed just apical to the membrane. The TBI was removed using an implant adapter connected to a counter torque ratchet (Fig 7). The permanent implant, with a 4.1 mm platform diameter and 14 mm length, (SLActive, Straumann AG, Basel, Switzerland) was placed, following the manufacture's protocol in an ideal 3D position (Fig10, 11). Implant stability (>30 N/cm) was established with a torque wrench. Simple interrupted resorbable sutures were placed using 4.0 chromic gut to close the incisions (Fig 12). The patient was prescribed 0.2% chlorhexidine as an oral rinse, to be used twice a day for two weeks. The patient was monitored with routine surgical follow-up for two months after final implant placement. No post-operative complications were reported.

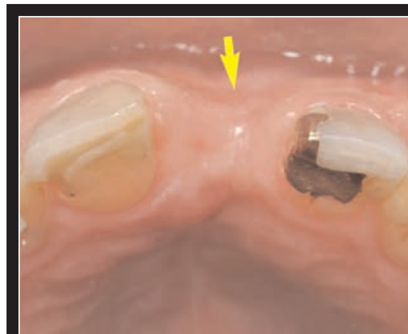
Fig 1. Pre-op occlusal view - labial defect

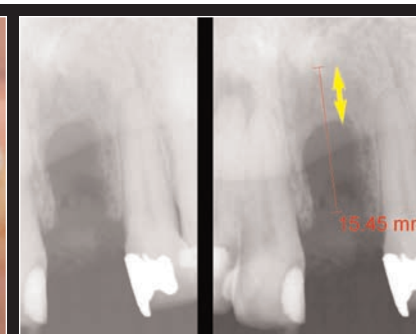
Fig 2. 4-6mm natural bone can be used for stability

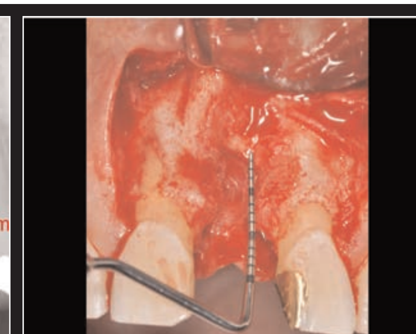
Fig 5. Through and through vertical defect 10mm

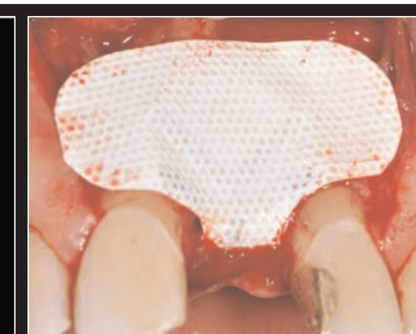
Fig 6. TR-PTFE membrane trial

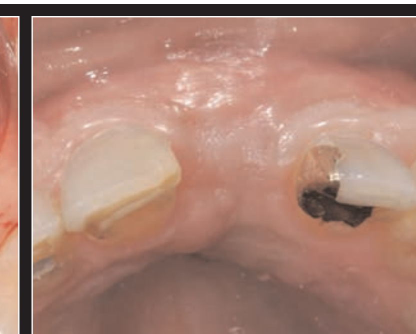
Fig 9. Three months post-op

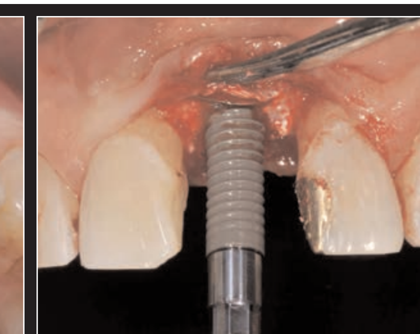
Fig 10. Occlusal opening of PTFE + 14mm BL implant

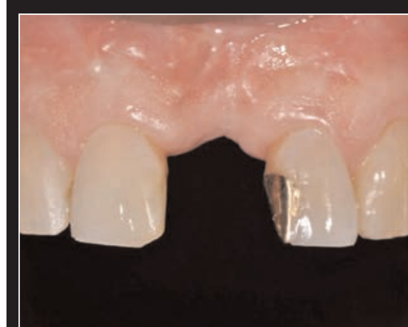
Fig 3. Frontal view - no vertical defect in soft tissue

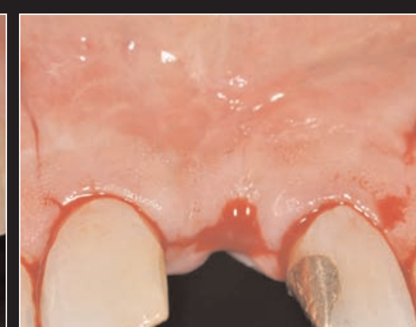
Fig 4. Incision design - conservative flap opening


Fig 7. TBI can be used for "tent-pole"

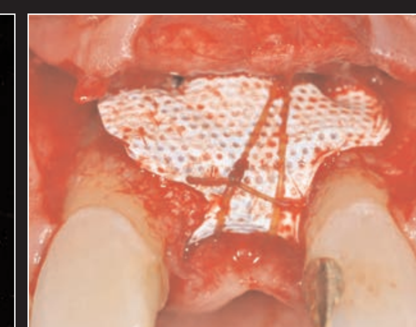
Fig 8. TBI + ABBM + TR-PTFE + Tacks + Suture

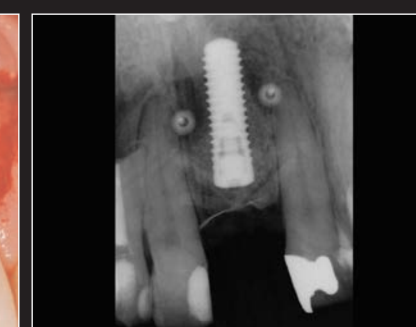
Fig 11. Implant with TR-PTFE

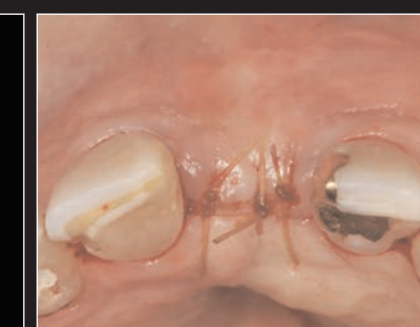
Fig 12. Tension-free primary closure

DISCUSSION

Bone remodeling after extraction results in vertical and horizontal bone loss (25, 26). Depending on the anatomic position, different surgical techniques can be performed to improve the bone dimensions of the implant site. Many authors have reported on the use of autogenous bone grafts to restore bony defects and allow for the correct positioning of implants (1, 2, 5-8, 13, 14,16, 27, 28). However, when treating a severely atrophic alveolar ridge, it is common to encounter large volume defects that must be fully reconstructed to create an esthetic and a functional result. With these large volume defects, it has often been necessary to obtain bone from extraoral sources. However, by appropriately placing titanium screws interposed by particulate graft, it is possible material to augment large vertical ridge defects with no need for autogenous bone. This technique involves expanding the soft tissue volume and using fixtures as "screw tent poles" for the surrounding particulate graft. This helps prevent the soft tissues from collapsing over the particulate graft and subsequently displacing causing a compromised outcome (16).

In this case report, ABBM particles were used. Berglundh & Lindhe studied the osteoconductive potential of ABBM when placed in a large self-contained defect in the mandible of beagle dogs (29). They reported that following 3 to 7 months of healing, the defect had been eliminated and the graft particles had become surrounded and in part substituted by parallel fibered bone and lamellar bone. In addition, Simion et al utilized the composite graft consisting of 1:1 ratio of ABBM and autogenous bone for the vertical ridge augmentation procedure. They observed that a composite bone graft undergoes slower resorption and substitution with new bone (30). Schlegel et al compared the resorption rate of autogenous bone and ABBM during sinus floor elevation procedure. The authors observed that the loss of bone volume after a three month period was 15% and 40% for ABBM and autogenous bone respectively. Therefore, bone substitutes with less post-operative resorption, such as ABBM has become a preferential material for the grafting procedure (31). Furthermore, in addition to restoring the hard tissue defect, the particulate bone preserves and augments the soft tissue architecture. This allows an option for implant placement and creates a better esthetic result.

The primary advantage of using the procedure described in this case report is the diminished treatment time. Buser et al reported bone formation using a nonresorbable membrane after a period of healing of 7 to 13 months, prior implant placement (32). Implants placed into a grafted area have been shown to require a healing period of 8.5 months with implant and GBR simultaneously using a non-resorbable membrane (33). In this case report using the TBI tent pole the membrane was kept in place at the time of implant placement in order to maintain its biological function. Also, the titanium reinforced membrane used in this procedure prevented the TBI from perforating through. In this case report, a con conventional implant was placed while the bone material was still maturing. Stage two surgery 3 months post implant insertion revealed a successful osseointegration, and allowed removal of the non-resorbable membrane.

> "…thin bodied implant can be used clinically not only for fixed provisionalization and also as a guide for proper angulation and position of final implants and allow to place more in patient's own pre-existing bone…"

CONCLUSION

This case report demonstrated the use of a TBI as a tent pole for ridge augmentation. This technique allowed a successful reconstruction of a large volume defect and permanent implant placement in the ideal position. Long-term follow- up is needed to evaluate the stability of the graft after implant loading. Moreover, more cases using the present protocol with TBIs as tent poles in GBR augmentation procedures are necessary to determine the predictability of this new procedure.

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