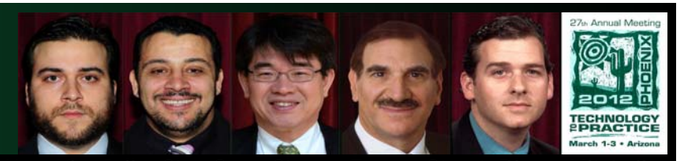
Utilizing Anew® Narrow Diameter Implants as a Tent Pole for Vertical Ridge Augmentation - Case Series



Oleaga, Mikel; Elzer, Ashraf; Yu, Chia-Hua; Yip, Julie; Cho, Sang-Choon; Froum, Stuart; Bloom Mitchell

Ashman Department of Periodontology and Implant Dentistry
New York University College of Dentistry

INTRODUCTION

High degrees of success have been documented for dental implant restorations in fully and partially edentulous patients. In addition, ridge augmentation procedures have clearly widened the scope of implant therapy. Pre-surgical site development is often necessary to allow implant placement in ideal position for prosthetic restoration, however, 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 alveolar defects (1-15). Among these, guided bone regeneration (GBR) has become a predictable and well documented surgical approach. However, this procedure has shown to be more successful for horizontal compared to vertical augmentation. Autogenous onlay block grafts, guided bone regeneration with reinforced membranes or titanium mesh and distraction osteogenesis are alternative procedures capable of generating and maintaining vertical height. On the other hand, these techniques have disadvantages that include requiring a secondary surgical procedure, exposure of the membrane or the mesh and limited access respectively (10-12).

Marx et al, described another technique that is a viable option to restore the severely resorbed mandible through the simultaneous placement of endosseous dental implants to serve as a tent pole with a corticocancellous bone graft (16). Bach et al, successfully gained vertical height by using titanium screws in combination with particulate human mineralized allografts in a "tenting" fashion, to augment alveolar ridges (17). They were able to maintain space and minimize the resorption of the allograft. However, these techniques have the risk of improper placement and angulation of dental implants, as well as a higher risk of dehiscence that may cause total failure of the implants and the graft. The same concepts can be applied using Anew narrow diameter implants (NDI, Dentatus USA Ltd., New York, NY, USA). The narrow diameter implants were originally introduced as temporal implants to support immediately loaded provisional restorations in a single stage surgery (18-22). Achieving high levels of stability with sufficient length when anchored into natural bone, these implants were designed to be removed at the end of the provisionalization period and replaced with definitive implants (23, 24). Thus, NDIs can be used clinically not only for fixed provisionalization and space maintenance, but also as a guide for proper position and angulation of the final implants.

The purpose of this case series was to present and to describe the step by step technique for the use of an Anew implant as a tent pole in a guided bone regeneration procedure and their use as a guide for proper position and angulation of the final implant. Three case reports will be presented to demonstrate the technique used to regenerate vertical bone defects.

MATERIALS & METHODS

Clinical data in this study was obtained from the Implant Database (ID). This data set was extracted as deidentified information from the routine treatment of patients at the Ashman Department of Periodontology and Implant Dentistry at New York University College of Dentistry (NYUCD). The ID was certified by the Office of Quality Assurance at NYUCD. This study is in compliance with the Health Insurance Portability and Accountability Act (HIPAA) requirements.

Study Subjects

Three partially edentulous subjects with anterior maxillary atrophy, and requiring vertical ridge augmentation, were chosen from the anonymous database and were included in this study. The subjects consisted of two males and one female with a mean age of 54.5 years (range: 47 to 61years).

Inclusion Criteria

Each subject selected from the database for the study had undergone the new tent-pole technique procedure and met the following inclusion criteria:

- Each subject was required to have an anterior maxillary partially edentulous maxillary anterior area with insufficient vertical bone height (Fig 1, 2).
- A healed ridge at least two months following tooth extraction (Fig 3).

Exclusion Criteria

- Presence of uncontrolled diabetes, immunological diseases, or other systemic conditions that contraindicated surgery.
- Radiation and chemotherapy to the head and neck region in the 12 months prior to proposed therapy.
- Periodontal disease, or unwillingness to undergo needed periodontal therapy, around remaining teeth.
- Smoking habit of one pack or more per day and unwillingness to enter a smoking cessation protocol.
- Psychological problems which, in the opinion of the surgeons, would have rendered the delivery of comprehensive therapy untenable. Such concerns ranged from severe manic depression for which patient was under professional care, to extreme nervousness or agitation, which precluded the patient from undergoing numerous, lengthy treatment visits.
- Unwillingness to commit to a long-term, post-therapy maintenance program.

A complete examination of oral hard and soft tissues was conducted for each patient, and a dental treatment plan was formulated in conjunction with the treating restorative dentist. Computer tomography (CT) scans as well as diagnostic casts, wax-ups, and surgical templates were prepared for each patient.

The clinical protocol was standardized and followed the tent-pole technique for all three cases as described below:

1. Patients were prescribed 2 grams of amoxicillin (TEVA, North Wales, PA, USA) one hour prior to surgery.
2. Local infiltration anesthesia using 2% lidocaine with 1:100,000 epinephrine (Henry Schein, Melville, NY, USA), or where a vasoconstrictor was contraindicated 3% Carbocaine (Henry Schein, Melville, NY, USA) was administered.
3. A crestal incision was performed, followed by two vertical releasing incisions on the distal aspects of the area. These incisions extended apical to the muco-gingival junction.
4. A full thickness muco-periosteal flap was raised and a Class III ridge defect was found that extended horizontally and vertically (Fig 4).
5. The initial osteotomy was made with an optimal angulation and position for the planned final implant, using a surgical stent made from an ideal wax-up. A CePo needle drill (Dentatus USA Ltd., NY, NY, USA) was used to a minimum depth of 4 mm in the existing natural bone.
6. Decortication was performed on the buccal plate using a small round diamond bur with high speed and copious irrigation.

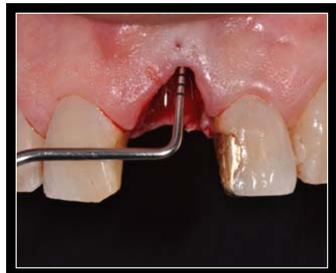


Fig 1. Extraction of tooth #9

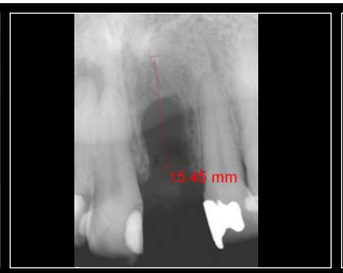


Fig 2. Radiograph shows severe vertical bone loss

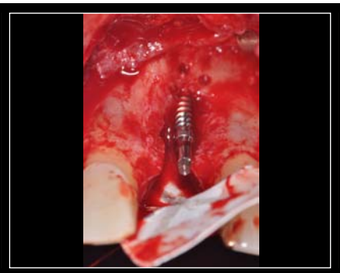


Fig 5. Anew NDI in place

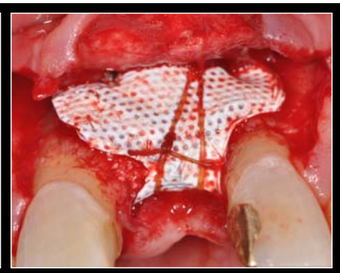


Fig 6. Non-resorbable membrane in place

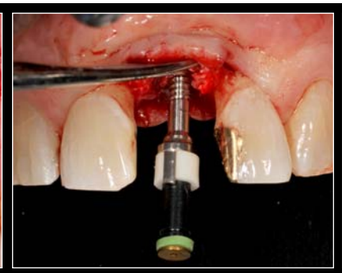


Fig 9. Retrieval of Anew NDI

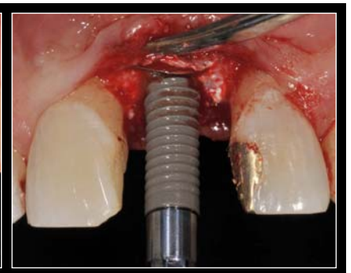


Fig 10. Placement of definitive implant (4.1x14)

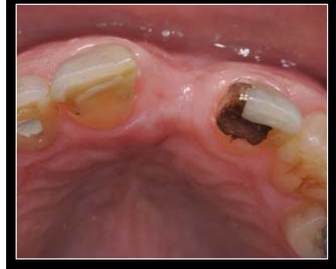


Fig 3. Ridge after extraction

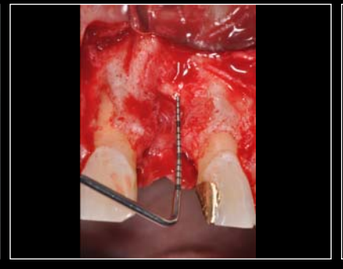


Fig 4. Vertical defect after flap elevation

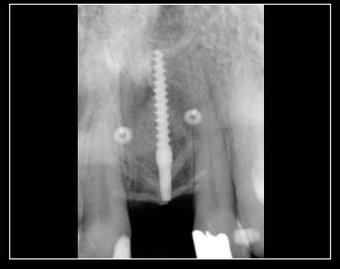


Fig 7. Radiograph after Anew NDI and GBR

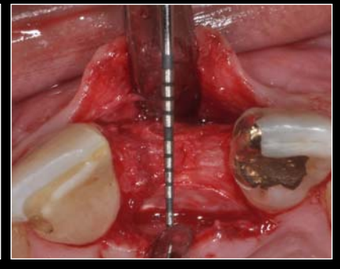


Fig 8. Re-entry

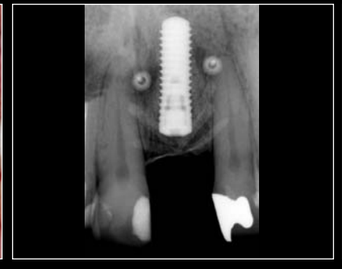


Fig 11. Radiograph after final implant placement

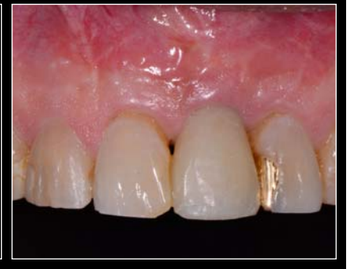


Fig 12. Provisional crown in place

Sites	Position in the arch	Defect type	NDI	Vertical augmentation achieved
1	# 8	V, H	2 x 14 mm	10.06 mm
2	# 10	V, H	2 x 14 mm	2.10 mm
3	# 8	V, H	2 x 14 mm	1.51 mm
4	# 9	V, H	2 x 14 mm	8.81 mm

Table 1. Results

RESULTS

Three (two males and one female) patients with severe localized vertical ridge defects, underwent surgery. The mean patient age was 54.5 years (range 47 to 61yrs) and the mean vertical augmentation was 5.61mm. All four NDIs were placed in the anterior maxilla. Adequate tension free closure over the grafted area was achieved in all patients, and there were no post operative wound infections. Healing of the sites proceeded uneventfully, except for one patient who had partial wound dehiscence three months after final implant placement, this was treated with topical application of 0.12% chlorhexidinegluconate until the removal of the membrane. Additional secondary grafting surgery was needed before implant loading.

DISCUSSION

Bone remodeling after tooth extraction results in horizontal and vertical bone loss (25, 26). Depending on the anatomical position and size of the defect, 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 to allow for the correct positioning of implants (1, 2, 5-8, 13, 14, 16, 28, 29). However, when treating a severely atrophic alveolar ridge, it is common to encounter large volume 3-dimensional defects that must be fully reconstructed to create an esthetic and functional result. To build these large volume defects, it has often been necessary to obtain bone from extraoral sources. On the other hand, with the technique reported by Marx et al, by appropriately placing titanium screws interposed by particulate graft, it was possible to augment large vertical ridge defects with no need for autogenous bone. This technique involved expanding the soft tissue volume and using fixtures as "screw tent poles" for the surrounding particulate graft. This helped to prevent the soft tissues from collapsing over the particulate graft and subsequently displacing it, thus causing a compromised outcome (16). In this case series, 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 (30). They reported that following three to seven 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 a composite graft consisting of 1:1 ratio of ABBM and autogenous bone for the vertical ridge augmentation procedure. They observed the composite bone graft underwent slower resorption and substitution by new bone (31). 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 six month period was 15% and 40% for ABBM and autogenous bone respectively. Therefore, bone substitutes with less postoperative resorption than autogenous bone, have become the preferential material for the grafting procedure (32). Furthermore, in addition to restoring the hard tissue defect, the particulate bone preserves and augments the soft tissue architecture. This allows for proper implant placement and creates a better esthetic result.

The primary advantages of using the procedure described in this current case reports are the diminished treatment time, correct position and angulation of the final implant and pre-existing natural bone anchorage. Buser et al reported bone formation using a non-resorbable membrane after a period of healing of seven to thirteen months, prior to implant placement (6). Implants placed into a grafted area have been shown to require a healing period of eight and a half months when placed simultaneously with GBR and a non-resorbable membrane. In the current series the Anew NDI was used as a tent pole, the membrane was kept in place at the time of implant placement in order to maintain its biological function. The non-resorbable titanium reinforced membrane used in this procedure also prevented the Anew NDI from perforating through. In these case reports, the conventional implant was placed while the bone material was still maturing, this allowed the clinician to place the final implant not only in optimal position and angulation but also in the patient's pre-existing natural bone. All of these advantages are achieved by placing the final implant following the same 3-dimensional path that the Anew NDI had before it was removed. Stage II surgery four months post implant insertion revealed successful osseointegration of the definitive implant that allowed the removal of the non-resorbable membrane (33).

Non-resorbable membranes have reported high degrees of success in guided bone regeneration procedures. However, a statistically significant number of cases have shown soft tissue dehiscences (34). These dehiscences can occur at two different stages of the healing process. During the early stages, due to a lack of tension free primary closure, the entire graft could be highly compromise. Conservative treatment is appropriate, including oral hygiene maintenance and oral rinse for the remaining of the healing period. Proper fixation of the membrane and tension-free primary closure play key roles in avoiding these types of soft tissue complications. Another major complication that could affect the success rate of the tent-pole technique is infection of the surgical site. Although the risk of developing an infection of the grafted area is low, the potentially devastating complications still require caution. Depending on what stage infection occurs in, it may compromise the final outcome of the surgical procedure. Wound dehiscence and infection of the site are two highly related complications in augmentation procedures.

Looking forward to the future, there are new techniques that could be combined with the one described in this case series. Products like bone morphogenetic proteins (BMPs) can be very helpful in minimizing the risks and complications of the augmented sites by improving the healing of the hard and soft tissues (35). As this "new science" within the areas of cell/molecular biology, genetics, tissue engineering, nanotechnology, and informatics develops, more advanced products and materials are going to play a helpful role in the success rates of GBR procedures and will diminish the possible complications.

"...this technique allowed a successful reconstruction of large volume defects, permanent implant placement in the proper position and angulation and anchorage of the implant in the patient's own natural bone..."

CONCLUSION

The three case reports in the present study demonstrated the use of an Anew NDI as a tent pole for ridge augmentation. This technique allowed a successful reconstruction of large volume defects, permanent implant placement in the proper position and angulation and anchorage of the implant in the patient's own natural bone. However long-term follow- up is needed to evaluate the stability of the graft after implant loading. In addition, more cases using the present protocol with NDIs as tent poles in GBR augmentation procedures are necessary to determine the predictability of this new procedure.

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