

Case Report

Osseodensification of a piezosurgically harvested and augmented premaxillary alveolar segment - A clinical case report with a year follow up

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ABSTRACT:

This clinical case report describes horizontal augmentation of a premaxillary alveolar segment with a piezosurgically retrieved symphyseal block graft followed by osseodensification-driven dental implant placement. The use of osseodensification facilitated plastic deformation of the low density grafted bone, thereby preserving the thickness of the augmented bone and increased primary stability of the implants. A yearlong follow up, using sequential radiographic (CBCT) and clinical evaluation, highlighted the satisfactory performance of the implant supported prosthesis in the augmented site.

Key words: Atrophic premaxilla, CBCT, Osseodensification, Piezosurgery, Symphyseal block graft.

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INTRODUCTION

The rehabilitation of extensive premaxillary alveolar defects has been challenging, owing to its proximity with the vital structures and being in an esthetic zone.¹ Bone augmentation procedures using different graft materials have been in the clinical practice, however autogenous variant of corticocancellous graft remain as the gold standard due to its exemplary potential to stimulate new bone formation.²⁻³ However, the

suboptimal density of the grafted bone (Misch type IV or V bone) poses a challenge to the clinician to gain adequate primary stability for the dental implant.⁴ This clinical report presents the management and prosthetic rehabilitation of an alveolar defect classified as Type 1 defect: deep vestibular defect with native periosteum.⁵ It involved harvesting a symphyseal block graft using piezosurgery followed by osseodensification (OD) of the grafted bone prior to implant placement.

Controlled retrieval of the corticocancellous bone segments with piezosurgery (adopting the PASS principle⁶- primary wound closure, angiogenesis, space creation, stability of wound) ensured a clean wound with minimal mechanical and thermal damage to the adjoining vital structures.⁷

The technique of OD has been documented to provide increased primary and secondary stability, especially in less dense bone.⁸ OD is primarily a burnishing process that redistributes bone material on the bony surface through plastic deformation.⁹ Placement of dental implants in grafted bone using OD helped preserve the optimum labial cortical bone thickness serving as a prerequisite for an esthetic restoration.

The introduction of cone-beam based CT (CBCT) scan has enabled a three dimensional evaluation of the anatomic structures keeping radiation dose within the permissible limits.¹⁰ Successive CBCT scans- preoperative scan , 7 months after graft placement , 3 months after implant placement ,and 6 months after prosthetic rehabilitation were done to carefully monitor the dimensional changes.

This report highlights prosthetic rehabilitation of a trauma inflicted premaxillary alveolar defect, with a yearlong follow up based on radiographic and clinical parameters. The use of piezosurgery and OD ensured predictable results with respect to labial bone thickness and graft resorption rate.

CLINICAL REPORT

A 21-year old male patient reported to the dental clinic with a chief complaint of excessive mobility of a 6-unit fixed dental prosthesis extending from right to the left maxillary canine. On radiographic evaluation, coronal fracture of both the canines was observed. The mobile prosthesis was removed. Post removal, a vertical and horizontal alveolar defect was noted with respect to the edentulous span of four maxillary incisors. (Fig. 1)



Figure 1: Pre-operative image of defect

Considering the present scenario, the Patient was suggested two treatment alternatives. First alternative

was fabrication of a Kennedy Class IV cast partial denture (CPD). Owing to the removable nature of CPD, the patient opted for block grafting of the defect area followed by an implant- retained prosthesis.

The symphyseal block graft harvesting involved preparation of both the donor and recipient site. The recipient defect site was anaesthetized bilaterally with infraorbital nerve block and nasopalatine nerve block using 2% lignocaine with adrenaline (Lignospan, Septodont). A full thickness mucoperiosteal flap was elevated and released extending between maxillary second premolars. This was followed by creating bleeding points at the recipient site using 1mm round bur with copious amount of irrigation.

Donor site was prepared using a modified incision preserving the gingival margin of mandibular anterior teeth. The resultant trap door incision extended between the mandibular first premolars. Once exposed, the Piezo surgical tool (Ultrasurgery, Woodpecker) with a vibration speed of 25 to 30 Hz at the tip, was used to score the bone following the path drawn by the indelible pencil .This was followed by creating successive puncture points at the required depth.

Depth gauge with markings of 6, 8 and 10 mm (US1, Wood Pecker) was used to retrieve the required thickness of symphyseal graft, preserving the symphyseal ridge for esthetics. Two segments of corticocancellous bone graft (1.5 X 0.6 cm) were obtained. The block graft was fixed at the recipient site using titanium fixation screws (1.2 mm X 8 mm) (Cross Drive, Ortho Max company)



Figure 2: Fixed symphyseal Block graft

Xenograft (Bio-Oss, Geistlich) was placed in and around the graft to level out the irregularities created between graft segments. A Resorbable collagen membrane (Bio-Gide Perio, Geistlich) was stabilized using tack screws (Bone screw BSSET, Osung) . Platelet-rich Growth factor placed over the membrane ensured faster healing of the tissues. Tension free suturing was done with 4-0 Vicryl suture (Ethicon, Johnson & Johnson). Simultaneously, the donor site

was packed with particulate xenograft and covered with a long resorbing collagen membrane (Bio-Gide Perio, Geistlich). The use of resorbable membrane prevented in-growth of the soft tissue in the grafted site.¹¹

A post-operative check-up was done at 24 hours and 7 days. Patient was instructed to maintain adequate oral hygiene. A carefully designed Essix appliance was delivered after 7 days as shown in Figure 3.



Figure 3: The ESSIX appliance given as a temporary prosthesis

Radiological evaluation was done using Orthopantomogram and successive Cone-beam CT scan. A second CBCT after 6 months revealed a satisfactory uptake of the graft (Fig. 4).

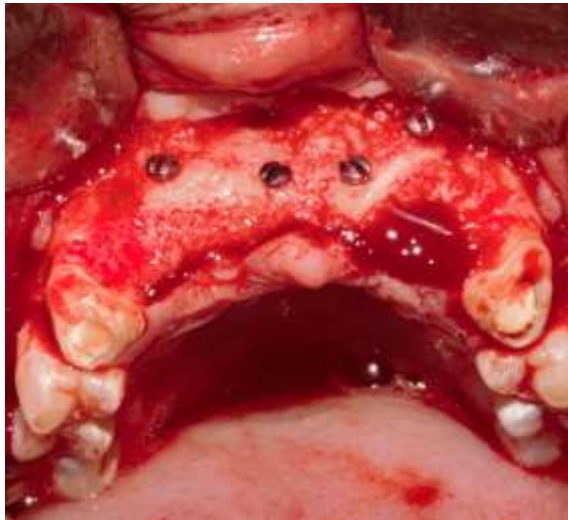


Figure 4: 6 months post-augmentation of the alveolar defect

The site was re-opened for osseodensification and implant placement. Following the removal of the fixation screws, osteotomy sites were prepared using OD burs (Densah, Versah) burs (Fig. 5).



Figure 5: The burs used for osseodensification

The increased bone plasticity and density was achieved using the burs in reverse, non-cutting mode. Three dental implants (Nobel Replace Conical connection, Nobel Biocare) (3.5 by 13 mm in #7, #10 region, 3.5 by 11.5 mm in #8 region) were placed with an optimal insertion torque. Second stage surgery was performed after 4 months wherein 4 by 5mm diameter gingival formers were placed. After 1 month of the second stage surgery implant level impression was made. Final four-unit screw retained prosthesis was delivered (Fig. 6).



Figure 6: Four unit Screw retained Prosthesis

DISCUSSION

Restoring the ideal bone contour requires skill and adherence to absolute surgical protocols, especially for augmentation of ridge defects. An important aspect is the nature and amount of graft being used to prepare the site for future implant placement. Due to its proximity to the recipient site and easy maneuverability, mandibular symphysis is a preferred donor site. However atraumatic harvesting of the symphyseal graft is of prime importance. In the present case, piezosurgery ensured reduced morbidity and decreased graft necrosis. A horizontal augmentation of 4-5mm was achieved as shown in Figure 7A, Figure 7B, and Figure 7C for region of right maxillary lateral incisor and Figure 8A, Figure 8B, and Figure 8C for region of left maxillary lateral incisor.

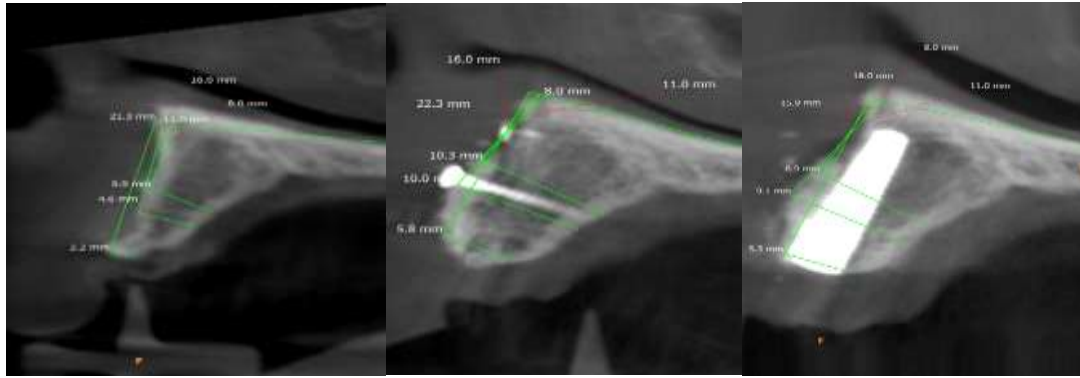


Figure 7A

Figure 7B

Figure 7C

Figure 7 (A): Pre-operative CBCT section of the right maxillary lateral incisor. The measurements are taken from a stable landmark - Nasal floor: top of the crest (16mm-19mm), mid buccal (11 mm) and 8mm from nasal . **7(B):** 6 months post augmentation CBCT section of the right maxillary lateral incisor. The measurements are taken from a stable landmark - Nasal floor: top of the crest (16mm-19mm), mid buccal (11 mm) and 8mm from nasal **7(C):** Post-implant placement CBCT section of the right maxillary lateral incisor. The measurements are taken from a stable landmark - Nasal floor: top of the crest (16mm-19mm), mid buccal (11 mm) and 8mm from nasal (All the measurements are in mm)



Figure 8 (A): Pre-operative CBCT section of the left maxillary lateral incisor. The measurements are taken from a stable landmark - Nasal floor: top of the crest (16mm-19mm), mid buccal (11 mm) and 8mm from nasal **8 (B):** 6 months post augmentation CBCT section of the left maxillary lateral incisor. The measurements are taken from a stable landmark - Nasal floor: top of the crest (16mm-19mm), mid buccal (11 mm) and 8mm from nasal **8(C):** Post-implant placement CBCT section of the left maxillary lateral incisor. The measurements are taken from a stable landmark - Nasal floor: top of the crest (16mm-19mm), mid buccal (11 mm) and 8mm from nasal (All the measurements are in mm) .

Table 1 and Table 2 denote the different measurements of horizontal bone augmentation from a fixed landmark (nasal floor) to crestal bone at a distance of 16 mm, 11 mm and 8 mm.

TABLE 1 :

| | Preoperative | 6 months after augmentation | Post- implant placement | 6 months after loading |
|-----------------------|--------------|-----------------------------|-------------------------|------------------------|
| At crest | 2.7mm | 5.8mm | 5.3mm | 5.1mm |
| 11mm from nasal floor | 4.2mm | 10 mm | 9.1 mm | 8.5 mm |
| 8 mm from nasal floor | 6.8 mm | 10.1 mm | 9.8 mm | 10.0 mm |

The Table 1 denotes the dimensions of horizontal augmentation achieved during the entire process of grafting,osseodensification and implant placement. The measurements are taken from a stable landmark - Nasal floor: top of the crest (16mm-19mm), mid buccal (11 mm) and 8mm from nasal (All the measurements are in mm) . The sequential Cone –beam CT scans were taken pre-operatively, 6 months after augmentation , post-implant placement and 6 months after loading.

TABLE 2 : Table 2 denotes the dimensions of horizontal augmentation achieved at the left maxillary lateral incisor region during the entire process of grafting, osseodensification and implant placement. The measurements are taken from a stable landmark - Nasal floor: top of the crest (16mm-19mm), mid buccal (11 mm) and 8mm from nasal (All the measurements are in mm) . The sequential Cone –beam CT scans were taken pre-operatively, 6 months after augmentation , post-implant placement and 6 months after loading.

| | Preoperative | 6 months after augmentation | Post- implant placement | 6 months after loading |
|-----------------------|--------------|-----------------------------|-------------------------|------------------------|
| At crest | 2.7mm | 5.2mm | 6.1mm | 5.1mm |
| 11mm from nasal floor | 4.2mm | 8.6 mm | 8.4 mm | 8.3 mm |
| 8 mm from nasal floor | 6.8 mm | 9.4 mm | 10.4 mm | 11.2 mm |

However the quality and density of the augmented bone is sub-optimal (TYPE IV or V) in its nature. Osseodensification provided the necessary stability to the implants by preserving the bone rather than sacrificing it, which is an inevitable consequence of conventional drilling. A 2mm thick cortical thickness of the graft ensured adequate labial bone thickness for the future implant retained prosthesis. This labial bone was of utmost significance. It ensured a highly satisfactory esthetics without the additional need of connective tissue grafting.¹²

The PASS protocol for predictable regeneration was strictly adhered to in the present case. Rigid fixation of the graft with titanium screws ensured minimum micromotion thereby enhancing the improved survival of the grafted bone.

SUMMARY

The use of osseodensification in a Piezosurgically harvested bone along with careful monitoring using sequential CBCT scans ensured minimal graft resorption at the defect site. This enabled the clinician to obtain the desired implant stability and labial bone thickness, thereby ensuring a functionally and esthetically satisfactory prosthetic rehabilitation.

ABBREVIATIONS: CBCT- Cone-Beam Computed Tomography, OD- Osseodensification, CPD- Cast-Partial Denture

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