

**Maxillary sinus floor Elevation by lateral approach and augmentation with autogenous cortical bone graft plus Platelet rich fibrin followed by delayed implant installation: A Case report**

<sup>1</sup>Jenifer Cynthia, Senior Lecturer, Department of Periodontics, Sri Venkateswara Dental College and hospital, Chennai, India

<sup>2</sup>Arumugam Mariappan, Senior Lecturer, Department of Periodontics, CSI dental college, Madurai, India

<sup>3</sup>Srinivasan Sivaprakasam, Professor, Department of Periodontics, Rajah Muthiah Dental College and Hospital, Chidambaram, India.

**Corresponding Author:** Jenifer Cynthia, Senior Lecturer, Department of Periodontics, Sri Venkateswara Dental College and hospital, Chennai, India

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**Abstract**

Dental implants which are the most sought alternatives for natural tooth not only because they merely supplants the missing teeth but also aids in maintaining and strengthening the remaining bone structure, averting further bone resorption especially in maxillary distal extension situation with sinus pneumatization. The dearth in the height and width of the alveolar bone can be emended by using Autogenous cortical bone grafts in conjunction with the elevation of inferiorly expanded maxillary sinus. Also along with the incorporation of Platelet rich fibrin, a second generation platelet concentrate, encompassing multifarious growth factors and cytokines entangled in a tri-dimensional fibrin network, it has been believed to restore the defective site, fostering soft and hard tissue regeneration and ensuring

finest possible outcome along with long term success of the treatment.

**Keywords:** Implant, Sinus elevation, Autograft

**Introduction**

Dental implant installation in maxillary distal extension case is the preferred choice of treatment following tooth extraction. It is quite challenging especially when there is unpredicted inferior expansion of the maxillary sinus (pneumatization) and reduction in alveolar bone height over time<sup>1</sup>. Though in most cases, the extraction socket heals uneventfully, there is always an expected rapid loss of bone both in the bucco-lingual and apico-coronal direction during the first 6 months<sup>2</sup>. Thus to achieve primary stability of Implant, sufficient alveolar bone volume and favourable architecture of bone is the mandatory<sup>1</sup>.

Elevation of pneumatized sinus along with increasing the height and width of residual alveolar bone can be accomplished by adhering to the classification and treatment protocol given by **Misch in 1987**. The treatment categories for sub-antral augmentation ranges from SA1-SA4 (based on remaining bone height below the sinus); SA1: It has an adequate vertical bone for implants, that is (12 mm) No manipulation of sinus is required; SA2: It has 0-2 mm less than the ideal height of bone and may require surgical correction; SA3: It has just 5-10 mm of bone below sinus; SA4: It has less than 5 mm of bone below sinus. Based on ridge width it is classified as A>5mm and B<5mm<sup>3</sup>. In a worst case scenario of SA4-B, Elevation of maxillary sinus floor using lateral approach along with autogenous bone graft and delayed implant placement yields the best possible outcome and paves way for the long term success of the treatment.

#### Case Description

A 44 years male, came to the department of periodontology, with a chief complaint of bleeding gums for the past 1 year and missing teeth in the left upper back jaw region for the past 3 years. On taking a detailed case history, patient revealed that the teeth were extracted in a private dental clinic due to loosening. Intra-oral clinical examination showed missing 16, 26, 27 along with generalized gingival inflammation and moderate periodontal pockets of 5-7mm, spacing in upper anteriors and eccentric wear facets in lower anteriors and he was provisionally diagnosed with generalized chronic periodontitis. Patient was systemically healthy, non-smoker, non-alcoholic and his routine blood investigations were found to be normal. The pre-operative OPG and CT showed a severe reduction in bone height & width in both 26 region (3mm & 3.6mm respectively) and 27 region (3.5mm & 4.6mm) along with pneumatization of left maxillary sinus (**Fig 1**).



Fig. 1: Pre-operative OPG showing severe reduction in bone height & width in both 26 and 27 region along with pneumatization of left maxillary sinus

Since the defect falls under SA4-B category, Elevation of maxillary sinus floor using lateral approach along with autogenous bone graft plus PRF membrane and delayed implant placement was planned. Treatment protocol, probable outcome and procedures were explained in patient's own residential language and informed consent for treatment and using his personal details and images were obtained.

Initial non-surgical therapy including scaling and root planning were done followed by sequential flap surgery in areas necessitating elimination of pockets. All the treatment were done under aseptic conditions following infection control protocol and sterilization.

#### Donor site preparation and procurement of autogenous graft

Under Local Anesthesia, using no.15 size Bp blade, Horizontal incision was made at the level of Muco-gingival Junction in relation to 34-44 (**Fig 2**) to elevate muco-periosteal flap by blunt dissection using periosteal elevator to expose the symphysis region from 34-44 region. Template was prepared using lead foil and using rotary instruments, two horizontal (parallel) osteotomy cuts were given at a distance of 10mm between each

other. Upper horizontal osteotomy cut given 2mm beneath the apex of mandibular anteriors & lower cut given sufficiently above the base of mandible (Fig 3). The horizontal cuts were joined by two vertical limiting cuts mesial to the premolars. Cortical block graft were split into two pieces at the midline and block grafts were removed from the right and left side by gently tapping the block graft using osteotome, sparing a smaller portion in the midline to avoid any iatrogenic fracture induced by complete removal of bone from the donor site (Fig 4). The procured grafts (size approximately 15mm X 10mm) were stored in normal saline (Fig 5). Bone wax was used to cover the donor site to aid in bony healing and to help in preventing depression in the esthetic zone. Flaps were approximated and simple interrupted sutures were placed using 3-0 vicryl suture (Fig 6).

#### PRF preparation

20 ml of venous blood (2x20 ml syringes) was drawn from the patient by venipuncture of the ante-cubital fossa for the preparation of Platelet rich fibrin (Fig 7). The blood was collected in sterile tube without anti-coagulant and it was immediately centrifuged at 3000 rpm for 10 minutes. After centrifugation, the lower fraction of the tube contains red blood cells, middle fraction containing fibrin clot and upper acellular plasma fraction (Fig 8). PRF was then separated from the RBC layer using sterile tweezers and scissors. A smaller amount PRF was then transferred to PRF box and compressed to make it into a membrane.

#### Maxillary sinus elevation and augmentation

Under LA, an initial mid-crestal incision was placed using no. 15 bp blade from edentulous region of 28 to distal surface of 25, extending as sulcular incision involving 25, followed by vertical releasing incision, distal to 25 extending upto the muco- gingival junction. A full thickness (Mucoperiosteal) flap was reflected to expose the buccal cortical plate in the left posterior maxilla

exposing the site required for the preparation of lateral Window in the maxillary sinus region. Osteotomy cut for lateral window prepared by using piezotome using sinus elevation kit under copious amount of saline irrigation. Horizontal cuts were joined by two vertical limiting cuts at a distance of 15mm (Fig 9). The buccal cortical plate was gently fractured using osteotome and the Schneiderian membrane gently elevated by gentle tapping of the lateral window into the roof of the sinus (Fig 10).

Autogenous block graft along with prepared PRF was packed in the elevated sinus space. Condensed and compressed PRF membrane was placed to close the window created (Fig 11). Since the procured cortical graft was adequate to increase the desired height and width of the residual bone, additional use of particulate graft was not necessitated. Later the surgical area closed by interrupted sutures using 3-0 vicryl suture (Fig 12). Antibiotics and anti-inflammatory drugs were prescribed and post-operative instructions were given. One week follow up of the patient was done.



Fig.2: Horizontal incision was made at the level of Mucogingival Junction in relation to 34-44



Fig.3: Upper horizontal osteotomy cut given 2mm beneath the apex of mandibular anteriors & lower cut given sufficiently above the base of mandible



Fig.4: Cortical block bone grafts (15mmX10mm) was obtained from parasymphysis region



Fig.5: Procured grafts stored in saline



Fig.6: Flaps were approximated and simple interrupted sutures were placed using 3-0 vicryl suture



Fig.7: Blood collected from ante-cubital Fossa for PRF preparation

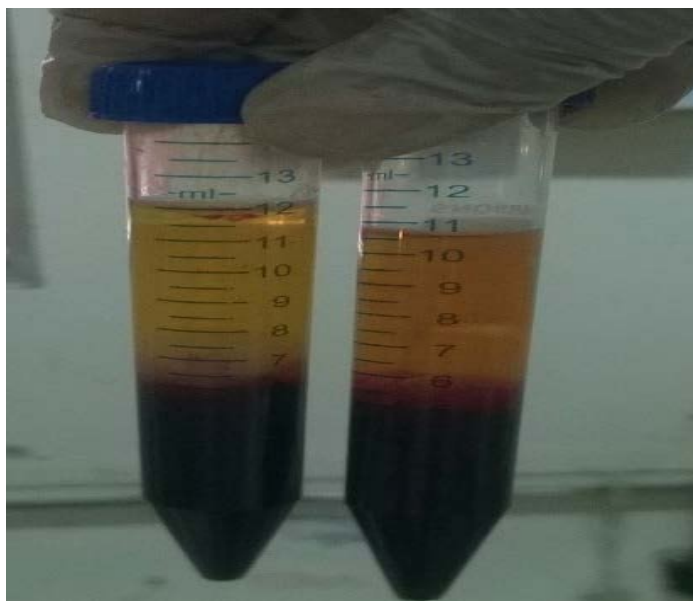


Fig.8: PRF Prepared after centrifugation



Fig.9: Horizontal and vertical cuts given using Piezotome



Fig.10: Schneiderian membrane elevated by gentle tapping of the lateral window into the roof of the sinus



Fig.11: Autogenous bone graft and PRF was placed beneath the elevated sinus



Fig.12: Surgical area closed by interrupted sutures using 3-0 vicryl suture

### Results

Post-operative OPG after 6 months showed, a gain in the residual bone height and width (26-11.8mm & 5.8 mm; 27- 13.1mm & 6.7 mm respectively). Delayed implant placement was planned and osteotomy site was prepared according to the standard implant placement protocol in relation to 26 and 27. Two implants (Mydriad) of size 4.5mm x11mm were installed and the area was sutured (Fig 13).



Fig.13: After 6 months, two implants (Mydriad) of size 4.5mm x11mm were placed in relation to 26, 27

After 3 months, OPG was taken, and it revealed well Osseo-integrated implants in relation to 26,27. Abutments were placed and cement retained crowns were delivered in relation to 26,27 along with bridge fabrication in relation to 15,16,17 region for ensuring balanced occlusion (**Fig 14**). OPG taken after two years showed, stable results with no loss of bone around the installed implants (**Fig 15**).



Fig.14 Cement retained crowns delivered in relation to 26,27 and bridge placed in 15,16,17 region



Fig.15 Post-operative OPG taken after two years of Implant loading

### Discussion

The formation, shape and preservation of the alveolar bone relies on the development and eruption of teeth and its undeniable that resorption of the bone becomes an inevitable sequel subsequent to tooth extraction<sup>4</sup>. Though the accurate ground for bone loss is unspecified, it is widely accepted that bone remodeling along with tissue modeling may occur following loss of tooth<sup>5</sup>. The defects formed in the remaining alveolar bone maybe complicated by previous bone loss due to periodontal disease, periapical pathology or following a traumatic injury to tooth/ bone<sup>4</sup>.

Dental implants are the eminent solution for replicating natural teeth lost, especially in the maxillary posterior region. Implants not only duplicates the missing tooth providing proper mastication but also aid in maintaining and strengthening the remaining bone structure, averting further bone resorption<sup>6</sup>.

In Maxillary distal extension areas with reduced bone under a pneumatized sinus, restoration of lost tooth can carried on by diverse replacement therapies like removable partial denture, cantilevered fixed partial denture, using short implants(atleast 6mm of residual bone height required) or having a shortened dental arch (premolar occlusion without replacement of molars)<sup>7</sup>

**Summer in 1994** suggested that, in patients with appropriate residual bone height, sinus floor elevation with crestal approach (osteotome technique) may be beneficial<sup>8</sup>. **Tatum**<sup>9</sup> and **Boyne and James**<sup>10</sup> stated that if the remaining bone is less than 5mm, elevation of the sinus floor using lateral approach along with grafting and delayed implant placement can provide successful outcome.

Autogenous cortical grafts have been considered “GOLD STANDARD” supplying growth factors, cells and mechanical support by providing its osteoconductive, osteoinductive and osteogenic characteristics compared with other bone substitutes and composite materials<sup>11</sup>. They retain the cell viability and promote bone healing and gradually be resorbed and replaced by new viable bone. Autografts for sinus augmentation procedures are most commonly harvested from intra-oral sites like mandibular ramus, symphysis, edentulous sites, exostosis etc. The quantity and the quality of bone required is determined and the ideal site is chosen and success rates exceeding 95% have been achieved in severely resorbed ridges<sup>12,13</sup>.

Platelet rich fibrin (PRF) as described by **Choukran et al.**<sup>14</sup>, this second generation platelet concentrate, has exclusive properties and when used in conjunction with bone grafts, it offers several advantages including promoting wound healing, bone growth and maturation, graft stabilization, wound sealing and haemostasis, and improving the handling properties of graft materials. PRF acts a scaffold encompassing of three dimensional fibrin supporting matrix with leukocytes, cytokines, structural glycoproteins<sup>15</sup>, stem cells and growth factors such as platelet derived growth factor, vascular endothelial growth factor, transforming growth factor, fibroblast growth factor etc. these brings about anti-bacterial, neo-vascularization and regenerative properties. The use of

PRF as a filling material during sinus lift and implant placement, as observed from the radiologic and histologic point of view after 6 months post-surgery has revealed high volume of natural bone in the sub sinus cavity upto the tip of the implants<sup>16</sup>.

### Conclusion

Dental implant placement in maxillary posterior region with severely resorbed ridge both in horizontal and vertical dimension is strenuous especially when the inferior border of the sinus cavity has been enlarged due to pneumatization. But with proper and detailed knowledge of the sinus cavity by radiographic and clinical assessment, adhering with selection of implant modalities combined with the clinician's skill, complications like sinus floor perforations can be avoided and the survival rate of implants can be considerably be increased.

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