"Build It Up Strong" – Ridge Augmentation With Titanium Mesh

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Abstract

As the formulation and the conservation of a space for collapse of the biomaterial can be averted by conserving and formulating space due to stiffness of the membrane and its easy customization. Hence, the objective of this case was to manifest that the use of rigid titanium occlusive barrier is a predictable alternative to perform a lateral alveolar bone augmentation and manage localized ridge deformities before reaching an ideal implant placement. The present case concluded that the use of rigid titanium occlusive screwed barrier with autogenous and bovine bone graft might be a predictable technique for alveolar ridge reconstruction.

Keywords: Implant, Repositioning, Reconstruction

INTRODUCTION

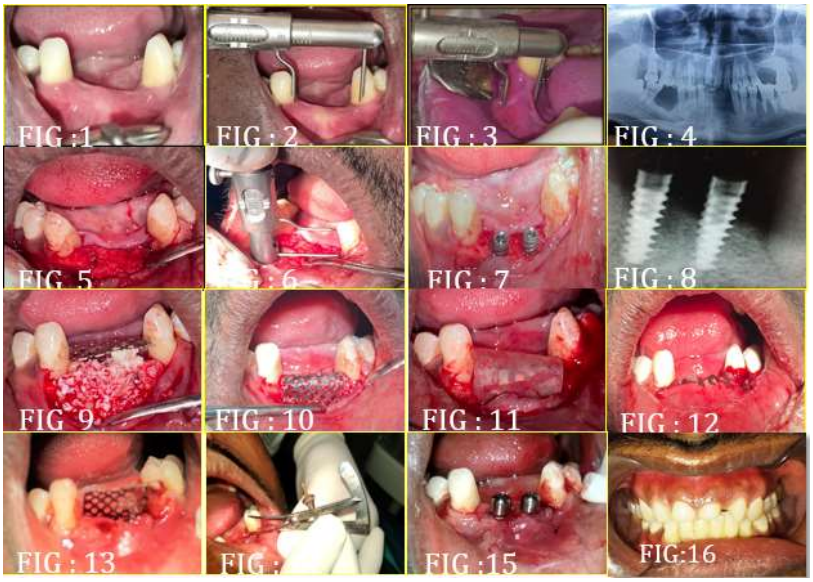
In dental implantology, factors like primary stability, implant positioning and recovery of the soft tissue shape, and other captious factors affiliated to adequate implantation restoration are altered by the volume and quality of bone at the implant site.[1] Broadly, atrophy of the alveolar bone occurs as a sequel to tooth loss and secondary absorption which manifest as decreased ridge dimensions thereby being insufficient for implantation over time.[2] Therefore, restoration of alveolar bone in the implant area is a significant point in oral implantology. There are many clinical approaches for alveolar bone defect reconstruction which include extrusion of bone, guided bone regeneration technique (GBR), onlay bone grafting, distraction osteogenesis and bone splitting technique. Its simplicity, low technical sensitivity, osteogenic stability and multidirectional osteogenesis ability make GBR one of the preferred techniques to refurbish the alveolar bone defects.[3] The mechanism of GBR technique is to judiciously prevent migration of epithelial and connective tissue cells from bone defect area through barrier membrane based on different migratory rates of various cells, indulging osteoblasts conversely enter the bone defect area to complete bone induction and regeneration. Synchronously, bone graft materials act as scaffolds thereby guiding osteocyte and osteoblasts to form new bone.[4] Expanded polytetrafluoroethylene (ePTFE) was the first non-resorbable membrane proposed to allow innate bone growth after the formation of a coagulum below the barrier after which guided bone regeneration comes into action.[5] Besides PTFE membrane, titanium mesh is one such material used in numerous medical applications and more of late for dental bone repair. Initially large osseous defects were restored by Titanium mesh after being introduced by Boyne in 1969.[6]

Hence, the formulation and the conservation of a space for collapse of the biomaterial can be averted by conserving and formulating space due to stiffness of the membrane and its easy customization. The Objective of this case was to manifest that the use of rigid titanium occlusive barrier is a predictable alternative to perform a lateral alveolar bone augmentation and manage localized ridge deformities before reaching an ideal implant placement.

CASE REPORT:

A 35-year-old healthy man was referred for replacement of missing teeth in the mandibular lower anterior tooth region. A history of trauma was reported preeminent to the loss of teeth 31, 32, 41,42 (Fig 1). The OPG and also measuring along with Vernier Calipers reveals horizontal bone resorption at the implant site and width of the alveolar ridge was < 5 mm (class H-m according to Wang HVC classification [2002]) [5] (Figs 2,3 and 4). Therefore, we determined to perform lateral bone augmentation prior to implant placement by using titanium mesh for GBR. After reflection of a full

thickness flap (Fig 5) remaining height was measured using Vernier Calipers (Fig 6) and fixture was placed immediately and simultaneously (Fig7,8). a rigid titanium occlusive barrier (CTi-mem Type B, Neobiotech, Seoul, Korea) was secured with tent screws after being trimmed and contoured to predicted shape of future alveolar ridge. Platelet Rich Fibrin was used which is harvested from a simple blood sample drawn from the patient at the time of surgical procedure, it is then treated with a single centrifugation. At the end of the centrifugation procedure 3 distinct layers are formed of which the intermediate layer is that of dense platelet rich fibrin clot . A mixture of platelet rich fibrin clot and xenograft were placed underneath the barrier(fig 9, 10) . Next, fixing screw was used to secure the mesh and bone graft followed by placement of GTR (fig 11). The wound closure was achieved using a buccal mucoperiosteal flap by coronally repositioning it . RVG reveals placement of fixing screw to secure the mesh and bone graft material. The postoperative antibiotic (amoxicillin 500 mg orally 3 times daily for 7 days) and analgesic coverage was taken care of. Patient was advised chlorhexidine 0.12% mouth rinse twice daily for 15 days. Sutures were removed 10 days after surgery. 5 months following healing; a crestal incision was given to expose the augmented site. Upon complete exposure and removal of the rigid barrier transverse bone of 6 mm width was observed when measured using Vernier calipers (Fig **14**). Adequate healing abutment was screwed simultaneously (Fig 15). Then, a metal-ceramic crown was fabricated(fig 16) with timely clinical maintenance and recall. Minor flap dehiscence and mesh exposure occurred at one month follow-up visit during healing phase. Clinically no signs of infection or inflammation were observed. Mesh exposure did not have any significant outcome on regeneration. Patient was advised on chlorhexidine gel until the time of mesh removal. He came in for weekly appointments for bacterial plaque control and to substantiate the status of the clinical healing. The regenerated hard tissue and alveolar bone were clinically consistent upon implant site entry. During implant osteotomy preparation, compelling resistance was noted, the implant was then inserted with a primary stability of 40 N/cm. Implant stability with excellent osseo-integration was observed during post-operative follow-up and the surgical area reconstruction was done to augment the depression.



DISCUSSION:

Having an adequate bone volume is certainly an assuredly prerequisite for a long-term implant success. Among the numerous techniques developed to increase bone volume, the use of bone grafting materials and GBR or combination of these two methods are reported as providing the best and the most predictable results.[7] Abounding factors contribute to successful GBR outcomes. Barriers membranes must fulfill a certain design criteria as supposed by Scantlebury such as space making, biocompatibility, space making, tissue integration, cell occlusiveness and clinical manageability. Barriers membranes are concerted as resorbable and non-resorbable membranes [5]. Titanium mesh is non-resorbable membrane that has been broadly used in surgical dental application because of its excellent mechanical properties for the stabilization of bone grafts beneath the membranes. It is rigid enough to favor space maintenance, to forbid contour collapse and to conserve the blood clot from the overlying tissue and acquiesce only bone promoting cells to repopulate the bone defects, its plasticity permits contouring, bending and adaptation to define space below the mesh that resemble the shape of the desired alveolar ridge.[8]

Louis et.al., have demonstrated that Ti-mesh maintains space with a higher degree of predictably, even in cases with a large bony cavity. [9,10] Nonetheless, titanium mesh is not malleable as other membranes and this leads to an increased number of exposures[11]. Another factor that could contribute to the exposure is the trimming and the cutting of titanium mesh. The sharp edges and corners could cause the irritability of the mucosal flaps[12]. Despite the high risk of exposure, Von Arx et.al., noticed no infection although exposure in any of his patients[13]. The smooth surface of this barrier makes it less vulnerable to bacterial contamination and this may not require immediate removal[14]. Maiorana et.al., showed that mesh exposure directed to early graft resorption in the exposed area of around 15% to 25%, but did not enable any significant complications or impede with implant placement[15]. Her et.al., suggested a modification of the exposed

titanium mesh to relieve all sharp angles and inconsistencies in order to reduce the trauma and discomfort resulting from contact of the mesh with the cheek, tongue and gingival[8]. Torres et.al., have recommended that covering the titanium mesh with platelet-rich plasma was a determining factor in avoiding graft failure and mesh exposure[16].

Bone graft used was Xenograft {TIO-OSS} which is a Bovine Porous Bone Mineral (BPBM) formed by removal of organic compounds from bovine bone, that results in a trabecular structure corresponding to human cancellous bone and can enhance bone formation. The graft material is anorganic derived osteoconductive hydroxyapatite bone mineral[17]. In the present study along with xenograft , Platelet Rich Fibrin was used. Platelet-rich fibrin is a fraction of plasma that furnishes a rich source of growth factors and may enhance the revascularization and stabilization of the flaps and grafts [18].In the present technique, Rigid titanium mesh membrane and solid fixation were the two important keys for the new bone formation. The firm structure of titanium-mesh as the scaffold and barrier membrane were well definitive in the literature and screw fixation was imperative to gain stability of the structure [19]. Degidi et.al. Suggested that, titanium mesh is imperative in maintaining space with a large defect[20] and the titanium mesh has generally been marked to be highly biocompatible. The holes on titanium mesh allowed for vascularization from flaps to the surgical site, in discordance to other types of membrane that may block the blood circulation to the surgical site.

CONCLUSION:

The use of rigid titanium occlusive screwed barrier with autogenous and bovine bone graft might be a predictable technique for alveolar ridge reconstruction. Excellent esthetic outcomes of the implant-supported restoration are accomplished with this procedure. Exposure of the titanium mesh did not alter the outcomes of successful regeneration. Further studies are necessary to analyze the pore size and frequency of titanium mesh biomaterial to improvise effectiveness in dental applications.

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