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Periodontology

KEY WORDS: sinus lift, bonegraft, implant, synthetic Hydroxyapatite bonegraft

CLINICAL AND HISTOLOGICAL ANALYSIS OF SYNTHETIC HYDROXYAPATITE BONE GRAFT SUBSTITUTE IN SINUS AUGMENTATION

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ABSTRACT

Aim: To see the effect of synthetic Hydroxyapatite bone graft substitute in sinus augmentation. **Material and Method:** technique for direct sinus lift was followed wherein, a lateral window was cut on the buccal aspect of the maxilla on the posterior region in the area of molar I/II and after carefully lifting of the sinus membrane, bone graft was placed with a collagen membrane on top. After 8 months the site was re-entered using a trephine, simultaneously, implant (Bioner Top DM, 4/10) was placed at the surgical site. **Results:** The surgical site healed well. G-Bone has shown good bone growth histologically. **Conclusion:** The surgical site healed well. G-Bone has shown good bone growth histologically.

INTRODUCTION:

Placement of dental implants for replacement of missing teeth has become a very common procedure. And to increase the height in cases of pneumatization of the sinus, different bone grafts are used following the Tatum technique. In 1970s, Hilt Tatum used maxillary sinus cavity to increase available bone using graft material, which allowed greater implant to bone contact area once the bone graft matured[1]. With time there have been many modifications in the procedure which was originally described by Boyne and James[2].

Amongst all the techniques, direct sinus lift remains the most widely used procedure. as it gives direct view of the operating site. The procedure is simple, a bony window is cut on the buccal aspect of the maxilla in the region of maxillary I/II molar followed by careful lifting of the membrane and placement of bone graft. Sinus is then sutured back. Other technique is indirect sinus lift. When it comes to bone augmentation, bone graft materials are generally evaluated based on their osteogenic, osteoinductive or osteoconductive potential[3]. autogenous bone is the gold standard for grafting purposes. However, the autogenous bone resorbs very fast and has the tendency of excessive shrinkage. As a result, there are various commercially available bone grafts substitute with predictable results. The advantage of using a synthetic graft is its easy availability and the quantity. The advantage of using G-bone is that it is made of multiphasic calcium hydroxyapatite and is absorbed faster by the body as compared to a xenograft.

MATERIAL AND METHOD:

G-bone was grafted in a total of 20 patients requiring a sinus lateral wall augmentation based on the following inclusion

Inclusion Criteria:

1. Patients from the age of 18 years and above
2. Having deficient bone/intrabony defects with residual probing pocket depth of > 5 mm following phase I therapy in the affected sites/requiring sinus lift procedures
3. Compliant patients.
4. Who provided with written informed consents.

Exclusion Criteria:

1. Patients with systemic diseases and/or presence of infections contraindicating periodontal surgery.
2. Systemic antibiotic therapy in the preceding 3 months.
3. Patients on medication known to interfere with periodontal tissue health and healing.
4. Pregnant or lactating females.
5. Patients with known habit of smoking and tobacco chewing.
6. Patients allergic to silica products or to any of the medications used in the study.
7. Patients with parafunctional habits.
8. Teeth with hopeless prognosis.

All the patients were treated keeping Helsinki declaration (2019) into consideration[4]. Before participation patients signed a consent, form and only the ones without any systemic disease or controlled medical condition were selected for the study (figure 1). Surgically, technique for direct sinus lift was followed wherein, a lateral window was cut on the buccal aspect of the maxilla on the posterior region in the area of molar I/II and after carefully lifting the sinus membrane, bone graft was packed and a collagen membrane was placed on top of it. A bur was used to remove the sinus window, the piece of the bone was placed back on the buccal bone and soft tissue was sutured. After a period of 8 months the site was re-entered to take bone sample (figure 2) for histological analysis using a trephine, at the same time, implant (Bioner Top DM, 4/10) was placed at the surgical site.

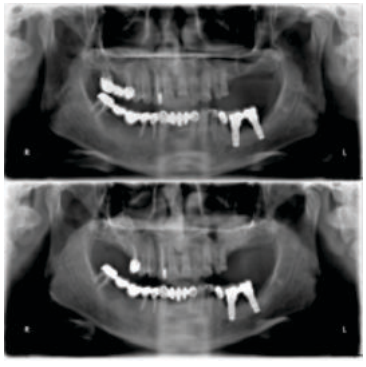

Figure 1: Pre-op OPG of the patient

Figure 2: Bone core for histological analysis

METHODOLOGY:

3.2 mm trephine core biopsies were obtained and fixed immediately in neutral buffered formalin solution for 24-48 hours. The specimens were processed after decalcifying in mild decalcifying agent (10% EDTA, pH 7.4). The tissues were processed using standard tissue processing laboratory protocol of dehydration, clearing and infiltration with paraffin wax. Embedding and tissue block preparation was done with paraffin wax. 4 micron thick sections were stained with Hematoxylin and Eosin stains. The slides thus obtained were viewed in research microscope (Olympus BX53) and digital images were captured in low and high magnification (Olympus EPL3).

RESULTS:

The Hematoxylin and Eosin stained section showed well-formed areas of mineralized bone with cellular components composed of osteoblasts, osteocytes, osteoid and vascular connective tissue. Abundant areas of mature bone formation with varying degrees of mineralization within a fibrocellular connective tissue stroma with minimal residues of remnant graft material were evident. The sections also showed focal areas showing residual graft particle at the graft- new bone interface. Areas showing new bone formation with entrapped osteocytes within the osteocytic lacunae at higher magnification were also seen (FIigure 3 and Figure 4 (a and b) H and E stain, 40x magnification).

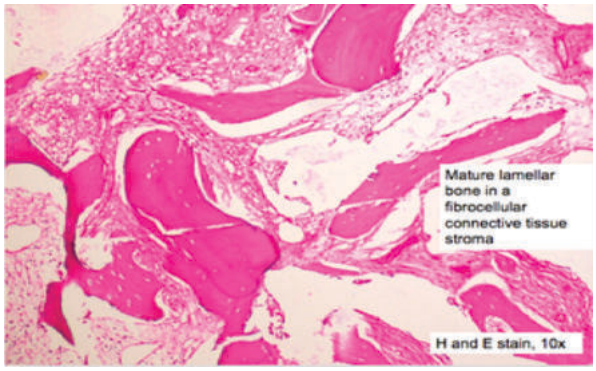

Figure 3: bone histology at lower magnification

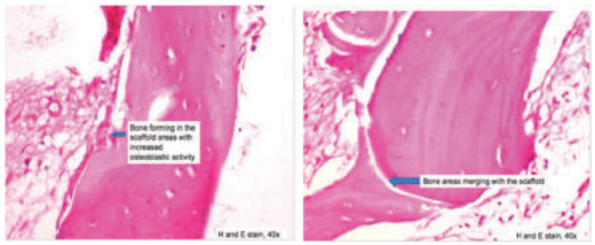

Figure 4: H and E stain, 40x magnification

DISCUSSION:

Bone has unique potential for regeneration however, in case of sinus defects, bone graft substitutes are needed to restore the required width and height of the resorbed bone. Loss of teeth in the upper posterior region makes bone to resorb faster. And sufficient amount of healthy bone is required for the normal functioning and long-term survival of implants. After teeth extraction the commonest way to increase posterior bone height is via direct or indirect sinus lift. Direct sinus lift is a more common procedure as compared to the latter, as good amount of bone height which can be achieved. A wide range of bone grafts are available for the same and can be classified into four categories: (1) autogenous bone or auto grafts; (2) allografts; (3) xenografts; (4) alloplastic bone grafts[5]. As aforementioned out of all the grafts available autogenous bone is the gold standard material to use. The main disadvantages are an additional surgical site, high resorption rate and limited availability. To overcome these clinical limitations, other types of bone grafts such as, xenografts and allografts became popular. However, due to controversies regarding osteoinductive

G-bone, is a synthetic bone graft and contains natural low crystalline hydroxyapatite with collagen[6]. From granules form to dowels and blocks, it is available in all types. It has been stated that when collagen when used in conjugation with other osteoconductive carriers like hydroxyapatite or tricalcium phosphate and further when these composites are combined with autologous bone marrow, it acts as an osteoinductive material[8]. Hydroxyapatite is a highly crystalline form of calcium phosphate procured through a high-temperature reaction. Its chemical composition is similar to the mineralized phase of bone elucidating excellent biocompatibility and osteoconductive capacity of this ceramic[7]. Wahl DA et al[8], proposed that, the composite of Hydroxyapatite & Collagen (G-Graft) may lead to earlier bone regeneration & greater density of the mature bone. Studies have shown that collagen type I and hydroxyapatite enhances osteoblast differentiation, but in combination, they accelerates osteogenesis[9]. Studies have stated that G-Graft has a definite regenerative potential and can be used in bony defects, also, the defects treated with G-Graft attain more density initially and enhances bone healing in early stage. Johnson KD et al[10], in their study, reported better results with Collagen-hydroxyapatite composite in comparison to tricalcium phosphate, and hydroxyapatite used alone, in healing 2.5 cm bony defect created surgically in a canine radius model. In the current study, the graft take-up was good, there was absence of remarkable host inflammatory reaction. Also, there were areas showing new bone formation with entrapped osteocytes within the osteocytic lacunae.

CONCLUSION:

The graft take-up was good, there was absence of remarkable host inflammatory reaction. Also, there were areas showing new bone formation with entrapped osteocytes within the osteocytic lacunae. Hence, it is a good material to be used for sinus augmentation.

Conflict of interest: None

Acknowledgement: None

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