Predictability of Xenograft with Resorbable Barrier Membrane in the Management of Deficient Anterior Maxilla for Implant Placement

Jigna Shah*, Jaladhi Patel**

* Professor and Head, ** Assistant Professor, Department Of Dentistry, Govt. Medical College & Sir T Hospital, Bhavnagar, Gujarat

Abstract: This paper discusses the predictable use of xenograft with resorbable barrier membrane to widen the deficient anterior maxilla. The esthetic zone of premaxilla requires optimum volume of bone and soft tissue to achieve long term esthetic end result with special emphasis on the emergence profile. Compressing short or narrow implants into deficient ridges is a poor technique that often fails to correctly replace ridge anatomy or afford stable restorations. Patients with deficient anterior maxilla with missing maxillary anterior tooth were found suitable for this study. In the anterior maxilla the thin labial cortices were decorticated followed by tenting of resorbable barrier membrane for placement of Bio-Oss xenograft bone particles. Ten patients were included in this study out of which in some cases simultaneous implant placement was done and in rest of the cases implants were placed after a period of six months. In comparison to other bone graft materials xenograft has very good osteo conductivity and helps in regeneration of natural bone by maintaining its density for longer period of time.[Jigna S NJIRM 2017; 8(2):91-98]

Key Words: Xenograft, Bio-Oss resorbable barrier membrane, deficient anterior maxilla, augmentation, Implant placement

Author for correspondence: Jaladhi Patel, M.D.S. Assistant Professor, Department Of Dentistry, Govt. Medical College & Sir T Hospital, Bhavnagar, Gujarat. M: 9727406389 E-Mail: djaladhi2205@gmail.com

Introduction: Tooth loss in anterior maxilla represents a significant esthetic challenge for the restorative dentist, because of the regions' visibility and role in smile performance[1,2,4]. Conventional dentistry and implant prosthodontics offers a variety of strategies for replacing the missing anatomy and both require special pre-surgical case planning[1,2].

Successful esthetic results can only be achieved if the anatomy of the residual alveolus and bone volume permits optimal implant placement[2,3,5]. Many clinical studies have documented the highest success rate of maxi. Ant. Single tooth implant compared with other. Many prospective clinical studies have confirmed that maxillary anterior single tooth implant has highest success rate in comparison to any other treatment option. The biggest challenge in anterior maxillae is the quality and quantity of bone, as most of the conditions that leads to single tooth loss result in the loss of some or all the facial bone in the region of the missing tooth[5,10,13]. In addition 25% decrease in width occurs within the first year of tooth loss, subsequently leads to 30%-40% reduction over the next three years. Though an intact alveolous 6 to 8mm wide is inadequate in width after a year and almost inadequate bone for optimal implant positioning after a period of three years. The bone loss occurs primarily from the labial surface as it is very thin compared to the palatal wall. Minimum faciopalatal width required for implant placement must be 5-6mm[3,5]. A ridge augmentation is necessary to restore the proper anatomy of the ridge and avoid compromised implant position, more palatal and apical, which can jeopardize whole esthetic outcome[3]. There are variety of augmentation material and techniques are in use for improving ridge conditions that meet these requirements. The most ideal would be autogenous bone which is considered the "gold standard", harvested from the intra and extra oral sites[1,2,4,6]. Harvesting of autogenous bone requires surgery at donar site. This results in increased morbidity, operation time and cost. This has demanded the search for bone substitutes which can simulate the autogenous grafts and they are biocompatible, noninfectious, nonantigenic and resorbable [1,4,10,15].

Technique and graft material selection for ridge augmentation defect depends on patient consent, hypersensitivity, amount of bone volume defect, implant site and number of teeth to be replaced, bone quality and financial condition. Patients having localized deficient alveolus in anterior maxillae require one or two teeth replacement with only faciopalatal width loss were suitable for Bio Oss anorganic bovine bone mineral with slowly resorbable barrier membrane Bio Gide[3,14]. Implant placement can be done simultaneously or after six month of graft healing , for the purpose of more predictability, better positioning and loading of implant, and optimum results, as observed in our study.

This study was designed to evaluate use of Bio-oss with resorbable membrane as a better option or as an alternative to autograft at localized small defect. At

the same time to see osteointegration of the implant to the grafted bone, adequacy of the thickness of alveolous after grafting, long term stability of graft and most important of all, patients' satisfaction .

Osteem implants were placed in one patient and Endopore implants were placed in nine patients. Facio-palatal width of grafted implant site was measured and sufficient bone width of approximately of 5 to 7mm was achieved with good density of bone. Size and diameter of implant were selected in respect to the size of adjacent teeth. No compromised was done in selection size and angulation of implant

Method: 10 patients, out of which 5 were male and 5 were female, with the mean age of 32.9 years were included in the study. They received bone enhancement procedure for reconstruction of localized defect of anterior maxilla to achieve sufficient bone volume for optimum placement of endo-osseous dental implant[1,3] . All patients selected were non-smokers, non-alcoholic and with no significant medical contraindication. In few of the cases single tooth gap was present and in two cases gap of two teeth was found and four teeth were missing only in a single case. In all the cases implant site needed to be reconstructed on buccal site due to deficient facio palatal width.

The defects were located in the "esthetic zone" of the anterior maxillae [Fig. No. 1,2,3,13,19,20] and the pre surgical evaluation disclosed the anatomy of the local bone according to sibert's class 1. That did not allow placement of an endoosseous implant with sufficient initial stability, T o reconstruct these defects.Biooss spongiossa with resorbable Biogide membrane were used. OPG, CT scan, RVG were taken before surgery respectively.

Surgical procedure: All patients were done grafting under local anesthesia with 2% lignocaine hydrochloride along with 1:80000 adrenaline. Prophylactic antibiotic was given prior to surgical procedure. Amoxicillin 500mg and clavulanic acid 125mg 1 hour preoperative and every 8 hour post operatively. A crestal incision with vertical releasing incision 5mm on each side of the defects on buccal side was given and split thickness flap on the palatal side of the defect, mucoperiosteal flap was reflected from the top of the crest and the incisions diverged to the buccolabial fold and were placed in such a way that the mucoperiosteal flap is on each side 5mm wide than the area to be augmented[1,2][Fig. No. 3,14] .

Interdental papillae were included in the flap, in few papillae preservation flap was raised. The extension of the incision to palatal is +/- 7mm from the top of the crest. Debridement of the defect was done followed by mucopariosteal flap reflection and de-epithelization of the flap is also performed after the defect is completely debride of unhealthy granulation tissue [Fig. No.20]. Facio palatal width of the defect is measured with Caliper at the crest level clinically. Even height and length of the edentulous span were measured radio-graphically, quality and quantity of bone were evaluated at the recipients' site . The width measurement ranged from 1 to 3 mm preoperatively [Fig. No.2]. The cortical bone on the defect was decorticated using small round surgical bur in order to initiate bleeding and to open the cancelous bone [Fig. No.3,14], xenogenic Bio Oss spongiosa anorganic porous bone minerals mixed with patients' own blood or saline and placed over the decorticated buccal bone plate over the crest of the ridge which was covered with resorbable bio gide membrane [Fig. No. 4,5,15] and in few cases bio gide membrane tenting with resorbable screw was done prior to bone graft placement [Fig. 20,21] . Bio Oss bone mineral was placed under tanted membrane [Fig. 22,23]. Patients' were radiographycally evaluated by RVG/ OPG/ CT Scan to evaluate the width of bone [Fig. 6,7,9,16]. After radiographic evaluation, graft site were opened surgically for implant placement [Fig.6] and in 9 patients Implants of 4.1mm wide in diameter from Endopore were placed [Fig.8,9] and only in one patient Ossteem implants of 3.75mm diameter were placed. Facio palatal width of the implant site was measured and sufficient bone width was achieved with good density of bone of approximate 5 to 7 mm respectively.

Size and diameter of implants were selected in respect to the site of adjacent teeth. No compromise was done in selection of size and angulation of implants and all the implants were placed in optimum position [Fig. 8-11,14,15]. After six months of implant placement definitive prosthesis were given and successful esthetic end results were achieved [Fig.10, 11, 12, 17] [Fig.13-17]. Minimum observation period kept for evaluation was one year as per study protocols but few cases were followed for a period of ten years.

Fig. 1Case-1preoperative picture for implant restoration

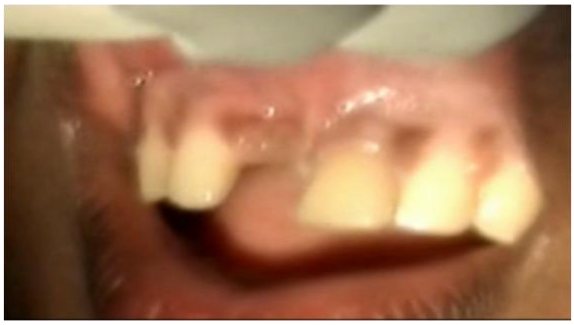


Fig. 2 paraaxial section of CT scan shows thin labial plate

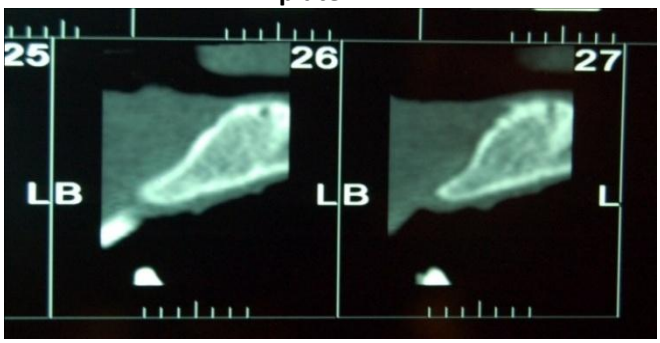


Fig. 3 reflaction of mucoperioseal flap with split thickness on palatal site

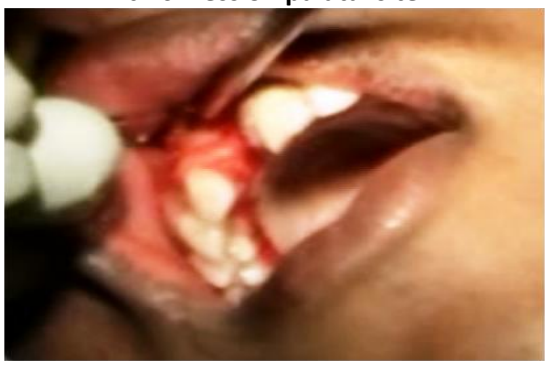


Fig. 4 Bio-oss spongiosa granules augmanted after decortication on labial surface

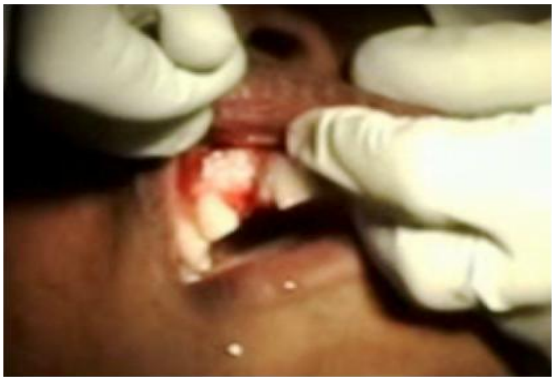


Fig. 5 Bio gideresorbable membrane tenting is done on labial and palatal surface

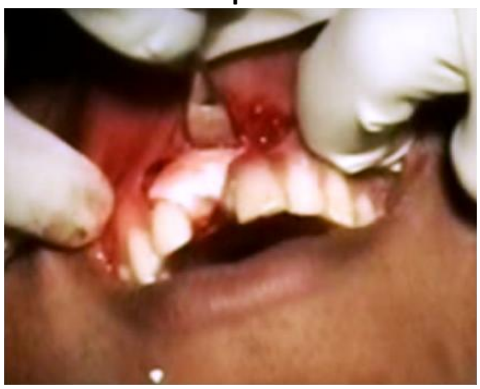


Fig. 6 post grafting RVG

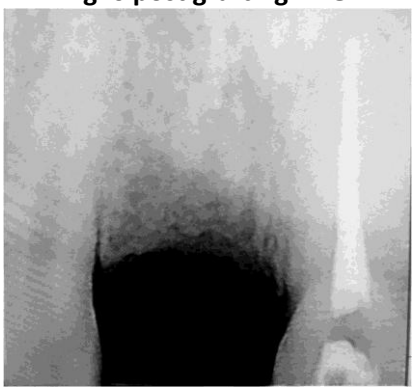


Fig. 7 CT Scan 6 months after Bone grafting

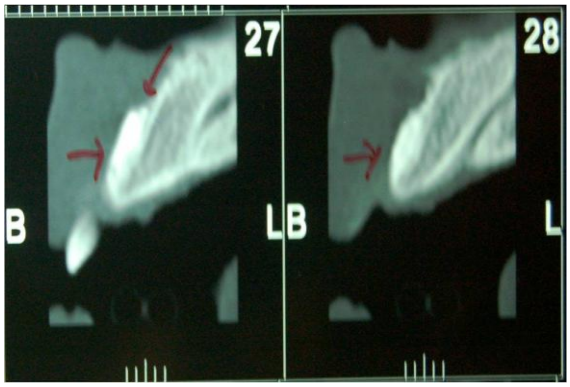


Fig. 8 Soft tissue healing after six months of implant placement

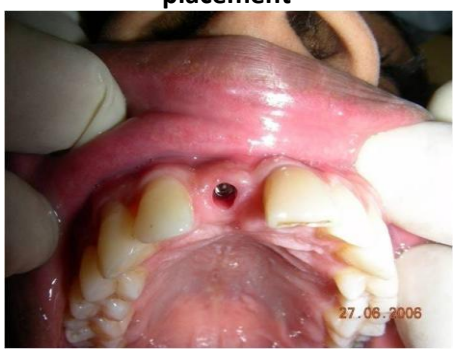


Fig. 9 RVG six months after implant placement

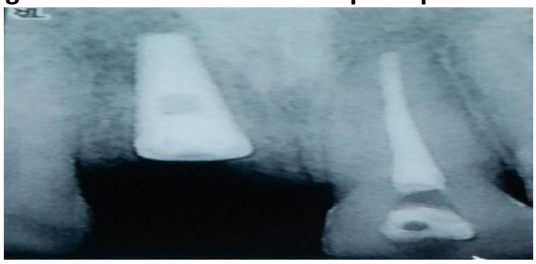


Fig. 10 soft tissue healing after second stage surgery

Fig. 11 straight abutment in position with ideal implant angulation

Fig. 12 final restoration in ceramic fused to metal crown

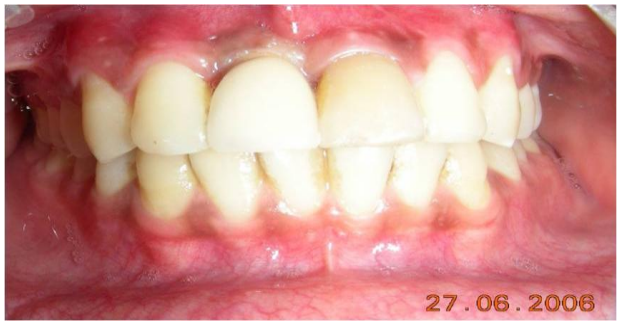


Fig. 13, Case-2 Labial bone defect

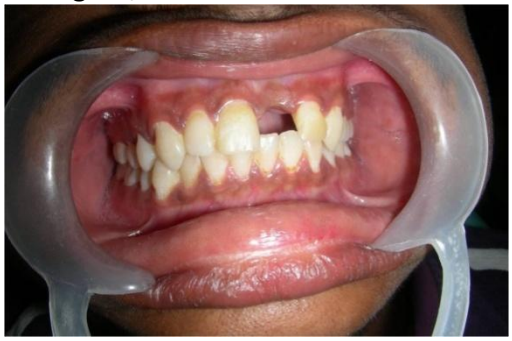


Fig. 14 Case-2 implant placed after buccal bone expansion thin buccal plate needs bone grafting , decortication done to receive bone graft.

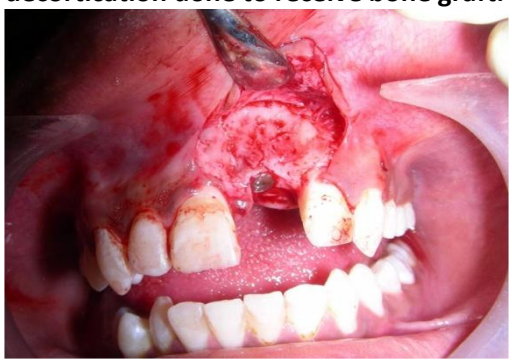


Fig. 15 simultaneous implant placement and bone grafting-Case-2

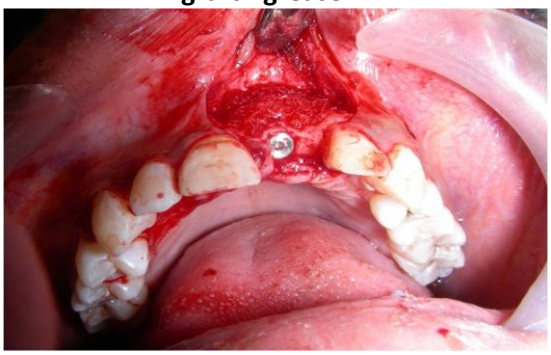


Fig. 16 Bio gide membrane covering Graft and implant both

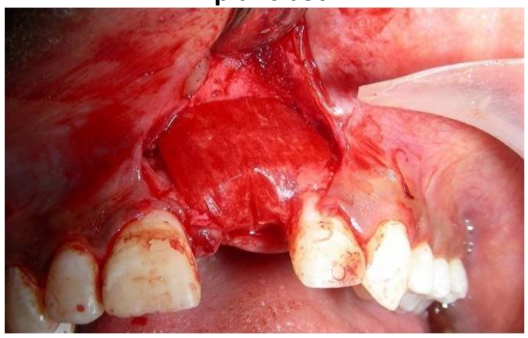


Fig. 17 RVG six month after implant placement

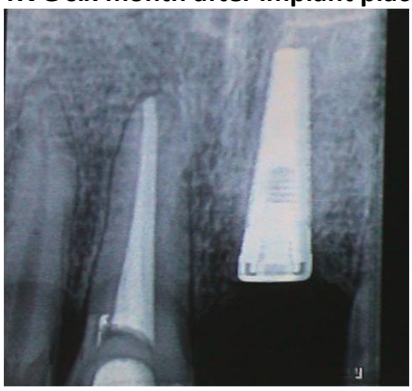


Fig. 18 permanent restoration in metal fused to ceramic crowns

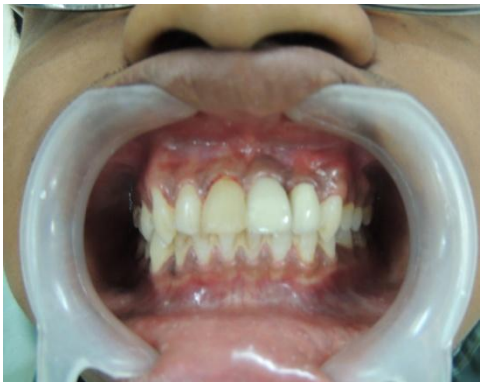


Fig. 19 Bio oss bone graft, Bio gide membrane, resorbable screw

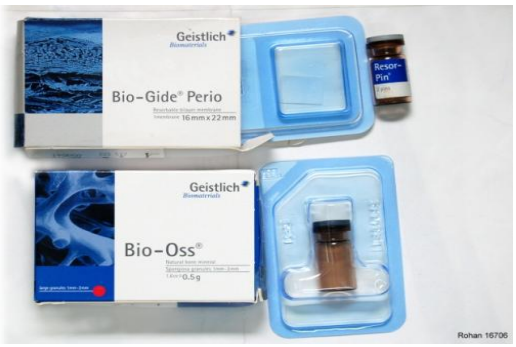


Fig. 20 Case-3 Labial bone defect

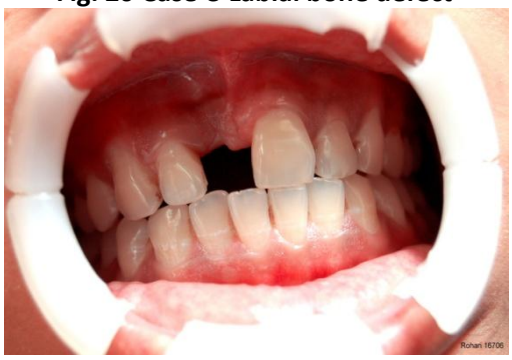


Fig. 21 Labial bone defect with unhealthy granulation currattage in the socket after surgical exposure

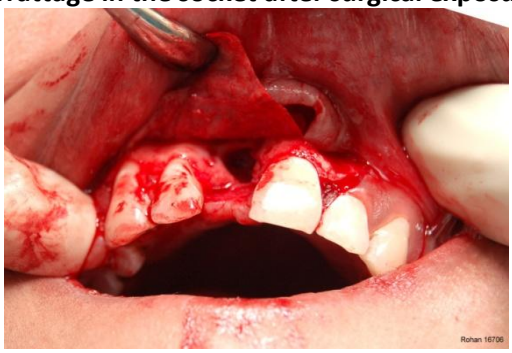


Fig. 22 Bio Gide Membrane tenting with resorbable pins, prior to bone graft placement

Fig. 23 Bone graft placed under tented membrane

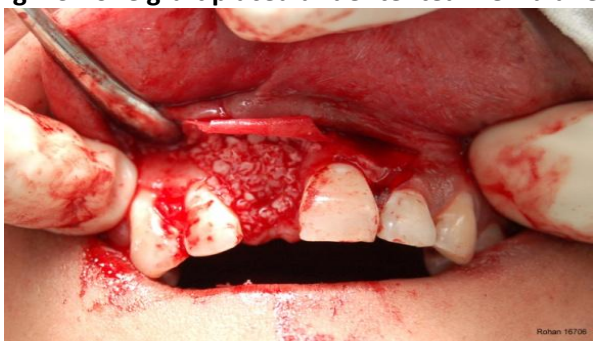
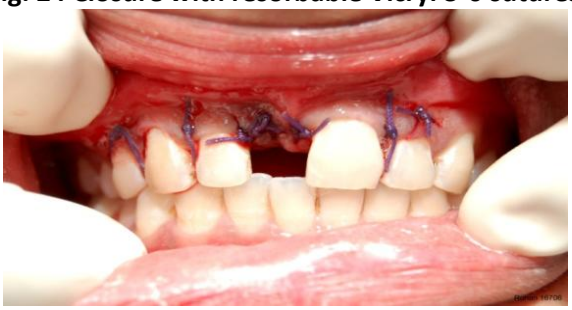


Fig. 24 Closure with resorbable Vicryl 3-0 sutures



Result: Results of the present study observed that, 10 patients were included for the study and were treated with endoosseous implants mainly endopore pressfit root form Implants, out of these, 5 were followed for 10 years, two for 7 years, 2 for 2 years and 1 for one year only.

The alveolar thickness and quality ranged from class IV to V, according to Cowood and Howell and according to Siebert class I defects were treated[2,3,26].

No complications were noticed during or after the surgery. The immediate and delayed post-operative period was uneventful. Implant placement in nine patients was done after a period of six months and in one patient simultanious bone grafting with implant placement was done [Fig. 13,17]. Patients' were

subjected to RVG/ OPG/ CT scan for evaluation as per the financial condition of patients. para-axial section of CT scan of two patients' showed significant increase in facio-palatal width from 1 to 2 mm preoperatively [Fig.2] and after grafting the width measured with caliper was 6 to 7mm [Fig.7]. In these patients 4.1/12mm Endopore implants were placed. Rest of the 8 patients were evaluated with RVG had showed increase in width around 6 to 8mm [Fig. 9,16].

Sufficient bone volume and density were achieved after bone grafting. In all the cases bone integration and remodeling had taken place satisfactorily. No signs of acute or chronic infection were noticed and optimum size and position of implant was possible considering the successful esthetic end result and emergence profile in all the patients. After six months of implant placement prosthetic restoration was delivered in esthetic zone with total patient satisfaction and all implants were stable and showed Osseo-integration [Fig.12,17]. One or two patients showed papilla regeneration along with Bio Oss and resorbable barrier membrane for GBR due to simultaneous soft tissue management.

The bone volume was stable in all the patients from the time of implant placement to abutment connection and no sign of resorption was observed with in the one year of implant and prosthesis placement. All the patients were clinically stable with no sign of soft tissue migration or mobility of implant or localized infection or inflammation, due to this Patients were very happy and satisfied.

Discussion: Adequate bone volume is the preliminary requirement for implant osteointegration[1,2,3,5]. Low density and reduced alveolar ridge is the primary cause for the implant failure in maxilla. Ridge augmentation by bone grafting is one of the choices for prosthetic restoration of edentulous maxillae for implant procedure.

Lekholm et. al., Tripplet et.al., Perrotet. et. .al. reported that ridge augmentation by bone grafting is one of the treatment of choice for the prosthetic rehabilitation of edentulous maxilla through implant procedure[2,18]. Several other studies also showed that bone grafting is beneficial.
Ideal bone graft material for augmentation is still a matter of interest to researchers, although autograft gives promising results in most of the patients but it involves donor site surgery and thus causes donor site morbidity[1,2,8,10,13]. Mixing autograft with allograft also requires donor site surgery that is why use of Bio Oss, an anorganic natural bone mineral with slowly resorbable bilayer biogide collagen membrane was used in this study[16,17,20,21,24,26,27]]. Bio Oss is highly osteoconductive thereby allowing bone regeneration to occur and over a period of time graft under goes physiologic remodeling and becomes incorporated into the surrounding bone[4,28].

In some studies conducted in animal models also reported that Bio Oss material become integrated and was subsequently replaced by new bone fulfilling the criteria of osteoconductive material. In addition to this a similar qualitative and quantitative degree of osteointegration around endoosseous implants was observed in both the large defects grafted with Bio Oss and the normal bone sites[4,12-24,28]. The use of Bio Oss in combination with a slowly resorbable collagen membrane [biogide–osteo health] showed that this bone mineral provided adequate space for regeneration to occur and adequate support of the membrane for successful GBR.

Zitzmann et.al. studied the use of Bio Oss with resorbable biogide membrane and nonresorbable expanded polytetra flouroethylene membrane [Gortex] in exposed implant sites. Result showed an average bone filled 92% in sites covered by the resorbable membrane. An average bone fill of 78% was observed in sites covered with nonresorbable membranes wound dehiscence or premature membrane removal occurred in a large percentage of sites covered with nonresorbable membranes compared to those treated with the resorbable membrane[4,2,24]. The result of this study indicates that buccal grafting of the faciopalatal local defect in anterior maxilla with Bio Oss and resorbable membrane provide basis for reliable bone volume for implant placement.

After reviewing the surgical outcome of other authors and comparing them with our study we came to the conclusion that in patients undergoing prosthetic restoration of Maxillary anterior is hindered by deficiency of alveolar bone volume, Bio Oss an anorganic bone mineral with slowly resorbable membrane can be the suitable graft material.

Conclusion: In the present study it was observed that Bio Oss in combination with biogide resorbable membrane provides effective augmentation in Sibert class I, buccal defect in anterior maxilla, Bio Oss in combination with Biogide resorbable membrane provides effective augmentation without the need for autogenous bone. This augmentation technique and graft material has eliminated the need for additional invasive harvesting surgeries. Therefore the results of present study concludes that buccal grafting of a local defect in the maxillary esthetic zone with Bio Oss and resorbable membrane provides reliable basis for optimum implant placement.

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