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Case Report

Guided bone regeneration in anterior maxillary zone: A 3-year case report

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ABSTRACT

The challenging concept of "reconstructive esthetic implant dentistry," and its prime goal of achieving a functional and esthetically pleasing rehabilitation of the mouth, has finally reached where the nature could be mimicked. Commonly confronted issues of insufficient bone volume and thread exposure warrant bone augmentative procedures. Bone reconstruction should restore bone volume in both horizontal and vertical directions. Besides autogenous grafts being the golden standard of augmentation, various bone substitutes have been used with promising results. The main rationale in guided bone regeneration (GBR) techniques is the creation of space for matrix producing cells if significant volumes of bone are to be achieved. This case report highlights the technique of using allograft and alloderm on the principles of GBR technique with satisfactory clinical results.

Key words: Alloderm, GBR, mineross

Delayed implant placement has been a safe and predictable option since several years, but its associated disadvantages especially the shrinking or atrophy of the volume of the tissues (hard and soft) can lead to an esthetic hazard. With the ever increasing demand of maxillary anterior esthetics – the most challenging area of the mouth – enough attempts have been made and are still undergoing for the time to come to master this zone in terms of the best possible esthetics. The birth of immediate implants, that is, at the time of extraction, or the immediate delayed, that is, implants that are placed 4–6 weeks after extraction and initial soft tissue healing, was a major leap to compensate the residual bone volume shrinkage. Then came the innovation of science to be called as "soft and hard tissue augmentation." Along with this evolved the methods to achieve the same.

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GUIDED BONE REGENERATION: THE SAVIOR

Definition

Guided bone regeneration (GBR) is an established technique that uses barrier membranes to direct growth of new bone at sites having insufficient bone volumes or dimensions for function and prosthesis placement.

Predictable regeneration requires high level of technical skill and the basic understanding of the bone biology. The application of barrier membranes to promote bone regeneration was first described by Hurley[1] in orthopedic research. However, the clinical potential of this technique was recognized in 1980 for periodontal regeneration. Melcher designed the basic principles of guided tissue regeneration (GTR) and outlined the necessity of excluding the unwanted cells from healing sites to allow growth of desired tissue.[2]

Based on the promising results in periodontology, researchers started to evaluate the potential of this technique – often called GBR – to regenerate the bone defects in the alveolar process around implants. Lazzara[3] was the first author to publish reports of human cases using Gore-Tex membrane around

implants, followed by Nyman and Lang.[4] Goal of GTR is to regenerate bone, cementum, and periodontal ligament but only goal of GBR is to regenerate bone. GBR procedures are even more predictable than GTR because the osseous regeneration in GTR occurs in a hostile healing environment. GBR membranes are used to separate the tissues during healing, retard apical migration of the epithelium to the site, maintain the necessary space for bone-in-growth (tenting), and protect the graft material in the defect. Primarily it is of two types: resorbable and nonresorbable.

BASIC PRINCIPLES OF GBR

The pass principle

This principle[16] is an acronym outlining the fundamental rationale and stages of successful barrier membrane regeneration, both for bone and other tissues, and is a guide to the physiological processes central in tissue regeneration.

- *Primary wound closure* to ensure undisturbed and uninterrupted wound healing,
- *Angiogenesis* to provide necessary blood supply and undifferentiated mesenchymal cells, space maintenance/creation to facilitate adequate *space* for bone in growth, and
- *Stability of* the wound and implant to induce blood clot formation and uneventful healing events.

Applications of GBR

GBR has been recommended for isolated localized bone defects or defects associated with dental implant placement. Defects associated with dental implants may be divided into several categories: dehiscence defects, residual intraosseous defects, fenestration defects, and extraction socket defects. Each of these defects can adversely affect the prognosis of an implant through the lack of bone volume and quality. For a successful bone regeneration to happen, large bony defects require an underlying grafting material and a cell occlusive membrane. An osteoconductive bone grafting material and its ability to support the overlying membrane serves as a matrix for the in-growth of vascular and bone-forming cells.[6]

CASE REPORT

The patient presented with history of avulsed tooth in respect to 21 and 22, and intruded 11 secondary to a road traffic accident [Figures 1 and 2]. Radiographs were taken. Bone mapping was done and revealed compromised buccolingual width.

Intraoral assessment

Average buccolingual soft tissue width of 4 mm and alveolar bone width of 2.2 mm were found. Preliminary treatment plan was made. Stage 1 surgery was done with extraction of 11 [Figures 3 and 4] under local anesthesia to be followed by immediate implant (4.6/12 tapered internal Biohorizon, AL, USA), immediate delayed implant placed in respect to 21, 22 (3.8/12 tapered internal Biohorizon, AL, USA), following manufacturer's protocol. Good primary stability was attained, but all three implants had buccal threads visible [Figures 5a and 5b]. GBR technique was performed using Mineross and Alloderm (Biohorizon, AL, USA). Nylon suturing (4-0 Ethicon, JandJ) was done [Figure 6]. Immediate provisional appliance (Essix appliance) was given.

At 48 hours recall pinpoint exposure of the Alloderm was seen [Figure 7]; no attempt was made to resuture the area and the patient was instructed in proper oral hygiene home care.

After an uneventful healing period of 4 months, stage 2 surgery of uncovering of implants was done with tissue punch with a palatal orientation of the punch to maximize the attached tissue remaining in the area critical for prosthetic emergence [Figure 8]. Healing abutments were screwed in. At 2 weeks, impression was recorded for full PFM crowns. Prosthetic design included the use of angled abutments in all three implants because of implant angulations secondary to bone topography. PFM crowns were cemented [Figure 9].

RESULTS

Three-year postoperative radiograph shows good and stable crestal bone levels around the implants [Figure 10].

DISCUSSION

The necessity for augmenting the volume of bone is obvious in that implant stability requires optimum contact of the implant with bone over a sufficiently large surface area to ensure good osseointegration.[7]

The soft tissue characteristics are equally important as the adequate keratinized mucosa is known to absorb the mechanical stress and retard the inflammatory process. This can be achieved by using the resorbable/nonresorbable barrier membranes and bone substitutes to enhance bone regeneration.[8] Review of literature indicated that implants in grafted bone are successful.[9]

Alloderm (Life Cell Corporation, Biohorizons, AL) was initially developed as skin allograft in burn patients.[10] It is an acellular connective tissue regenerative matrix derived from human cadaver skin used in oral plastic surgical procedures, for example, mucogingival problems (gingival recession, reduced attached gingival, shallow vestibule depth) and ridge augmentation techniques.[11,12]

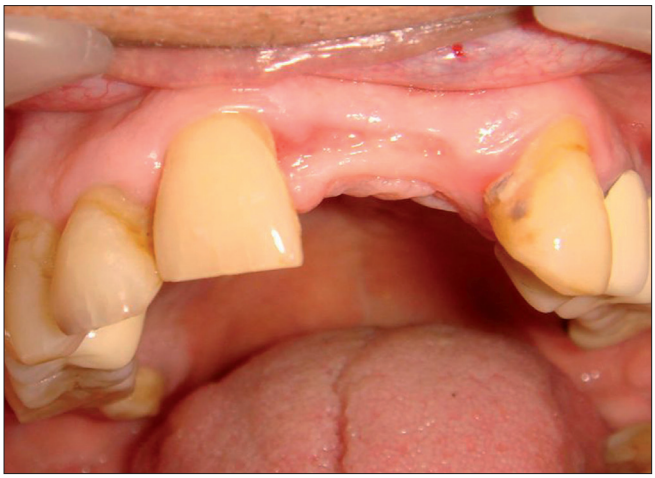

Figure 1: Preoperative – buccal view

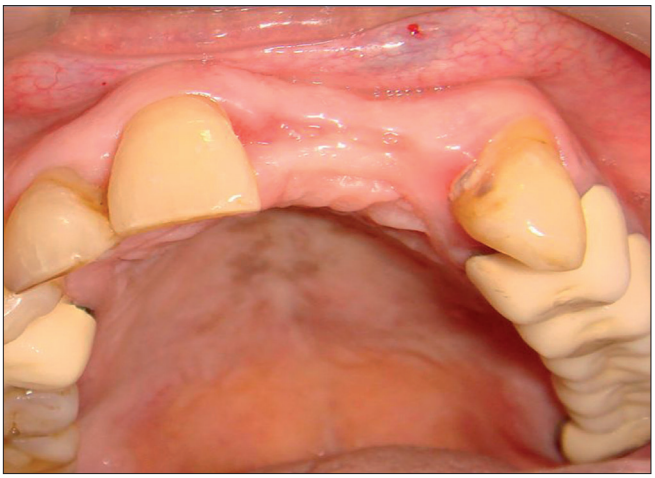

Figure 2: Preoperative – buccolingual view

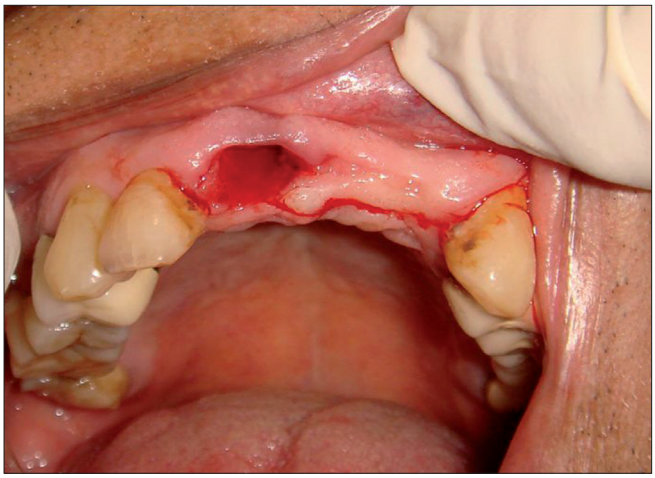

Figure 3: Eleven extracted

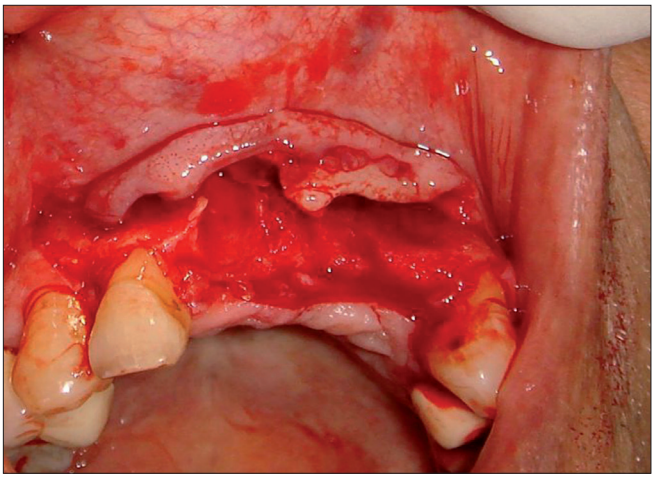

Figure 4: Buccal reflection of flap

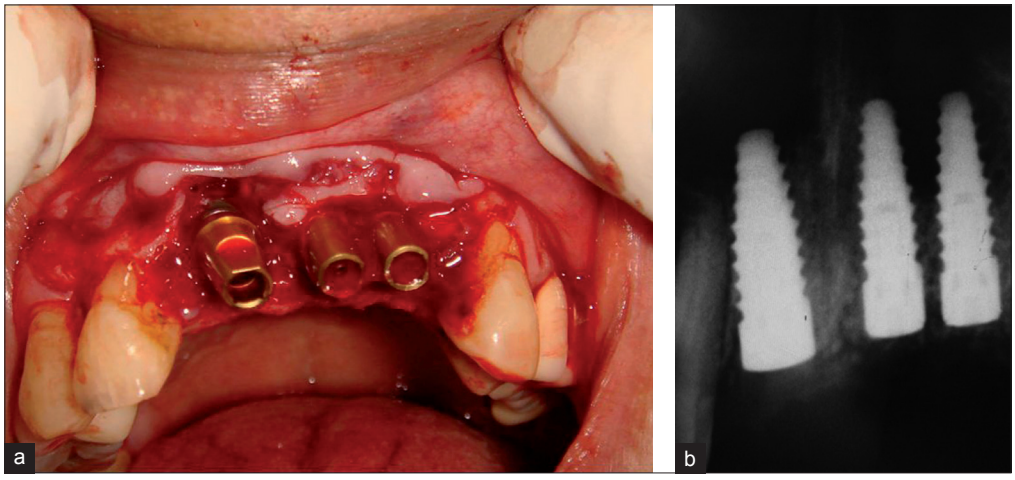

Figure 5: (a) Biohorizons tapered internal implants: (a) clinical and (b) radiograph

Mineross (Biohorizons, AL) is a mixture of mineralized allograft containing cortical and cancellous chips.

Immediate and immediate delayed implants appear to be predictable treatment modalities with survival rates comparable to implants with healed alveolar ridges.[13]

Factors influencing the success of GBR have multiple variables. Maxillary implants show more bone fill (95%)

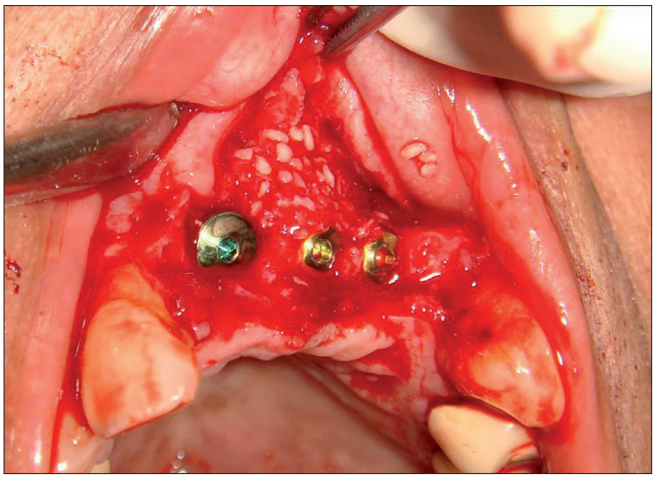

Figure 6: Mineross placed

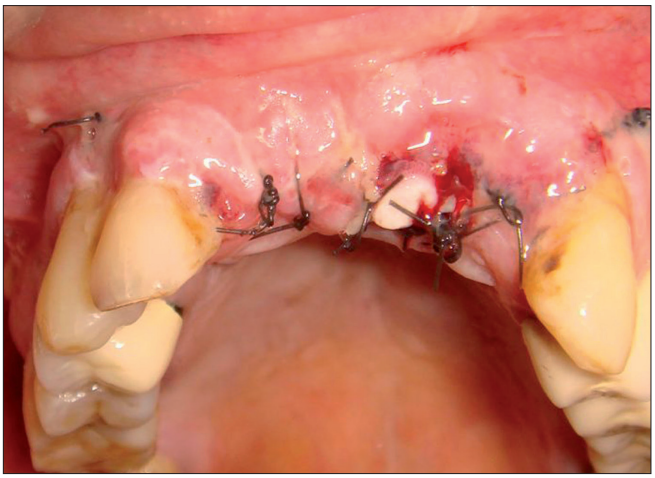

Figure 7: Postoperative – 48 hours

Figure 8: Postoperative – 6 months

Figure 9: PFM crowns cemented

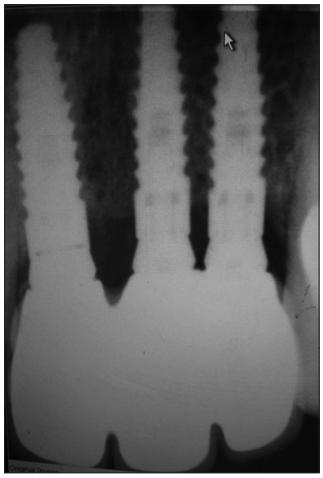

Figure 10: Postoperative – 3 years

compared to mandible (78%). Insertion of provisional restoration is more favorable. Immediate and immediate delayed implants showed the best results with 92% bone fill when compared with long-term delayed implants with 80% bone fill; early implant placement timings seem to be preferable due to alveolar ridge preservation, more favorable defect morphology.[14]

High predictable levels of implant survival have been seen in sites treated with GBR versus the untreated ones.[15] Immediate delayed implants when placed after 4–6 weeks of soft tissue healing phase in extraction sites in esthetic zone, combined with simultaneous GBR, resulted in excellent hard and soft tissue contours.[16]

CONCLUSION

GBR in implant dentistry is very well documented.[12,15,16] This is the first case report with alloderm and allograft along with the use of tapered implants, in immediate and delayed immediate implant placement.

Successful postoperative buccal augmentation was achieved. Final soft tissue buccolingual width of 6.2 mm and hard tissue width of 4.5mm were appreciable.

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