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Socket Preservation By Means Of Guided Bone Regeneration Using "Sandwich Technique"- A Retrospective Study

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Abstract

Objective: To assess bone density in order to evaluate the efficacy and long term surgical outcome of Guided Bone Regeneration (GBR) which best does alveolar ridge preservation by providing necessary environment that allows the body to potentiate its natural healing potential and regenerate bone.

Materials And Method:

The study includes a total of 50 patients (26 males and 24 females, mean age 35.9, range 15-55 years), presenting with the need for tooth extraction from January 2019 to January 2020. The sockets were preserved using the bovine bone mineral sandwiched between the collagen membrane. Radiographs were taken pre-operatively and at subsequent intervals to assess the bone density.

Results: The average loss in bone density as seen at 50 sites after a week was 9.49 and increase in the average bone density seen at the end of the 3rd month was 18.79. This was found to be statistically significant [p=0.0001].7 patients presented with postoperative pain which subsided with the use of analgesics. No cases with post-operative infection, inflammation, swelling and graft rejection were noted.

Conclusion: Guided Bone Regeneration is a successful method of alveolar ridge preservation and that bovine bone mineral with a collagen membrane can be usefully utilized for this purpose.

Keywords: Alveolar ridge preservation, Guided Bone Regeneration, Hydroxyapatite bone graft

Introduction

Tooth extraction is one of the most widely performed procedures in dentistry today and it has been historically well documented that this procedure may induce significant dimensional changes of the alveolar ridge. The dilemma that clinicians face is how to manage tooth extractions to provide for the future placement of a dental

implant or to maximize ridge dimensions for the fabrication of a fixed or removable prosthesis. If performed inadequately, the resulting deformity can be a considerable obstacle to the esthetic, phonetic, and functional results that both our patients and we clinicians expect at this current time.[1]

Alveolar ridge resorption is a phenomenon observed following the removal of teeth in an otherwise healthy individual. The condition appears to be progressive and irreversible, resulting

in a host of prosthodontic, esthetic, and functional problems. Postextraction bone loss is accelerated in the first 6 months, followed by a gradual modeling and remodeling of the remaining bone, with as much as 40% of the alveolar height and 60% of alveolar width lost in the first 6 months.[2]

Various materials are used in modern dental and maxillofacial surgery for bone tissue substitution and reconstruction. All osteoplastic materials can be divided into four groups by origin: autogenic, allogenic, xenogenic and synthetic.

Synthetic resorbable materials were intended as an inexpensive substitute for natural bone.

Synthetic graft materials include various types of ceramics: tricalcium phosphate; bioglass; hydroxyapatite and its compositions with collagen, sulphated glycosaminoglycans such as keratin and chrondroitinsulphates as well as with sulphate and calcium phosphate.

Jaw deformities from tooth removal can be prevented and repaired by a procedure called *socket preservation*. The procedure begins with atraumatic tooth extraction. Every attempt is made to preserve the surrounding bone and soft tissue, with an emphasis on being careful not to fracture the delicate buccal plate. Next, a bone graft material is placed into the socket and covered with a resorbable or non-resorbable membrane and sutured. Most importantly, socket preservation helps to maintain the alveolar architecture and significantly reduces the loss of ridge width and height following tooth removal.[3]

The surgical procedure depends on the amount of available bone, the amount of augmentation necessary and patient related factors. The most common techniques include:

1. Guided Bone Regeneration
2. Block Grafts
3. Ridge Split/Expansion
4. Biologic Factors
5. Soft Tissue Augmentation

Sandwich technique as used in this study appears to enhance the outcomes of bone augmentation by using positive properties of each graft material and the barrier function of a collagen membrane. The barrier membrane would exclude unwanted soft tissue cells, prevent graft exfoliation, and enhance wound stability to promote uneventful healing. As no donor site surgery is necessary, this is an advantageous technique in terms of time saving, cost and, more importantly, less discomfort to the patient during and after surgery.

Materials And Method

The study was conducted on 50 patients (26 males and 24 females) with age between 15-55 years (mean 35.9) from January 2019 to January 2020 requiring socket preservation for future implant placement.

Patients suffering from renal or hepatic disease, heart disease, blood dyscrasia, previous or present gastric ulcers, known hypersensitivities, allergies, or idiosyncratic reactions to any study medications, pregnant or lactating females were excluded from the study.

Active infections at the site were treated prior to the procedure.

- The study protocol was explained to the patients in detail and their consent was obtained.

Following all aseptic protocols the procedure was performed under local anesthesia (Lignocaine 2% with epinephrine 1:80,000). A full-thickness buccal mucoperiosteal flap was carefully raised to preserve all the periosteum. Tooth extraction was then performed preserving the alveolar bone plates around the teeth. Tooth sectioning was done whenever was necessary. Thorough debridement of the extraction socket was accomplished with fine curettes. All visible granulation tissue was curetted from the socket. The socket was then gently flushed with sterile saline. Hemostasis was achieved.

The bone graft material was sandwiched between the collagen membrane and sutured. This prepared sandwich was then placed in the socket. The buccal periosteum was released at the buccal vestibule to allow the extension of the buccal flap for primary closure (eg.Figure.1, 2).

Figure 1: shows the basic minor oral surgical set of instruments and the material (hydroxyapatite bone graft , GBR membrane and resorbable suture material.

Figure 2 (A): shows the procedure of tooth extraction with placement of the prepared sandwich in the extraction socket and closure. (b) Shows the pre-operative RVG, extracted tooth, RVG showing the tooth socket before and after socket preservation.

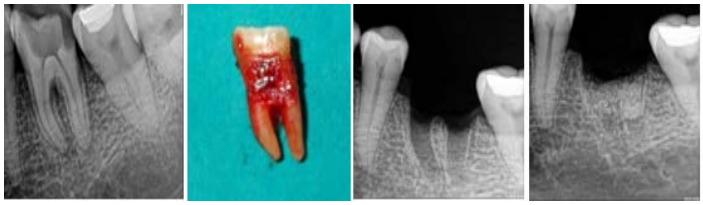


Figure 2 (B): shows the pre-operative RVG, extracted tooth, RVG showing the tooth socket before and after socket preservation.

Post-operatively patients were instructed to apply gentle pressure on the gauze pack over the operated site. The patients were instructed not to chew in the area for approximately 2 weeks.

Chemical plaque control with Chlorhexidinedigluconate solution (0.2% 1 minute, Tid) was instituted for the first postoperative week. Patients were instructed to brush their teeth with soft pediatric toothbrush from the second postoperative day.

Patients were prescribed a non-steroidal anti-inflammatory medication on an as needed basis for pain control.

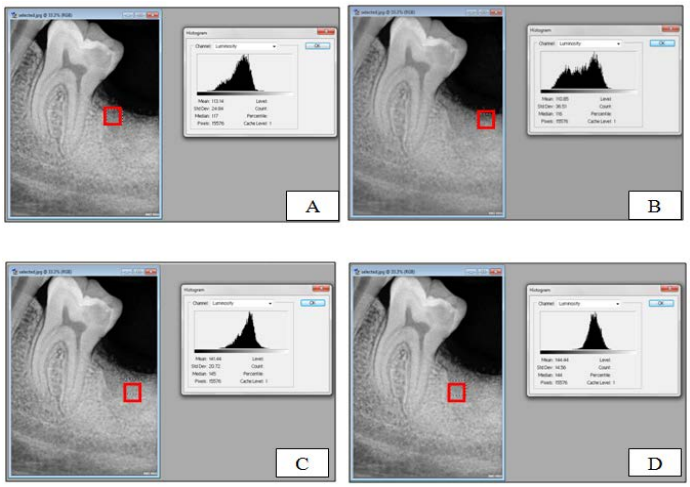
Assessment was done at the end of 1 week, 1 and 3 months based on the following parameters:

1. Pain (Visual Analogue Scale)[4]
2. Infection present/absent
3. Inflammation present/absent
4. Swelling present/absent
5. Graft accepted/rejected
6. Bone density[5]

Method of Data Collection (eg.Figure.3)

Pre-operative, intra-operative and post-operative RVG's were taken followed by 1week, 1 and 3 month RVG and the bone density was measured with the help of the histogram (Adobe Photoshop).[5]

The comparison between the pre and post-operative RVG measurements of bone density gave the results of the efficacy of the ridge preservation procedure.



Bone Density = (A+B+C+D) ÷4

Figure 3: shows bone density measurement by means of histogram (adobe photoshop) pixels ranging between 15000-16000

Results

50 extraction sockets were treated with Guided Bone Regeneration using "Sandwich Technique", in which, reduction in bone density was seen in first post-operative week followed by marked increase in bone density in the first and the third month post-operatively. (Figure 4, Table.1,2 and Graph 1)

There were 7 cases of post-operative pain at the surgical site (Table.1).

There were no cases with postoperative infection, inflammation, swelling at the surgical sites. (Table.1).

There were no cases with postoperative graft rejection (Table.1).

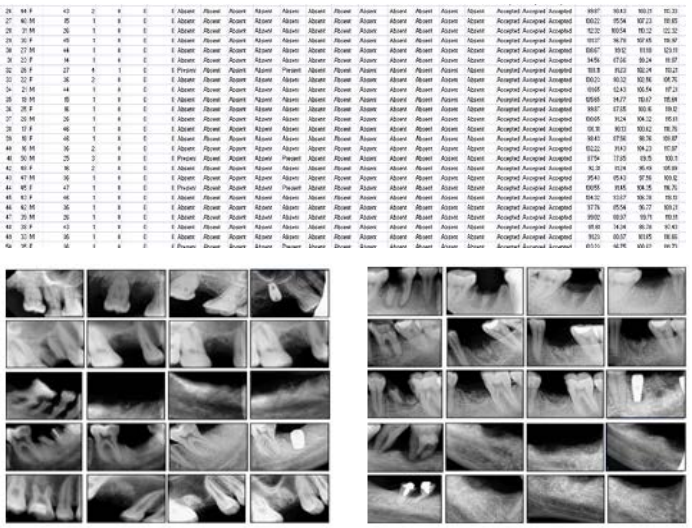
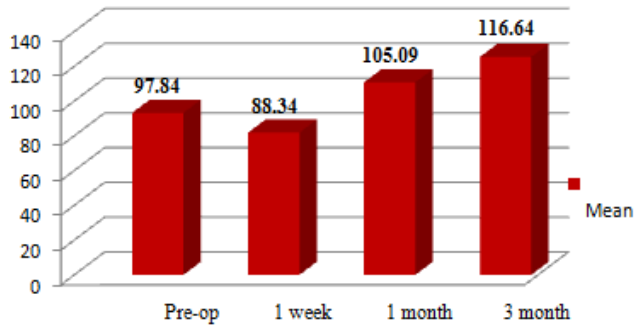


Figure 4: RVG shows bone density in the pre-op, 1week, 1 month and 3 month period.

Table 2: shows mean values of bone density at different time period.

Clinical Parameters	N	Mean	Std. Deviation	Paired t-test	Inference
Bone density (Pre-op)	50	97.844	9.72	0.0001	Significant
Bone density (1 Week)	50	88.344	9.69		
Bone density (1 Month)	50	105.09	12.36		
Bone density (3 Month)	50	116.64	13.12		

Graph 1: shows mean values of bone density at different time period.



Discussion

Ridge resorption following tooth extraction is a challenging situation for clinicians as there is deficiency of soft tissue as well as hard tissue. This changes has been well demonstrated in various animal studies under histological observation.[6]

There are 3-dimensional changes following freshly extracted socket with pronounced changes on the buccal aspect with greater loss of vertical and horizontal dimension. The role of bundle bone has been investigated in several animal experiments.[7]

When implants are planned, the maintenance of stable ridge volume will help in simplifying subsequent treatment and optimising clinical outcomes. Alveolar ridge preservation (ARP)/ Socket preservation (SP) are procedures specially designed to eliminate or limit the negative effect on post extraction resorption which aids and facilitates implant placement in ideal

prosthetic driven position for favourable esthetic outcome.[8]

The use of barrier membranes for bone regeneration has enhanced the surgeon's ability to reconstruct the deficient alveolus. Alveolar preservation or reconstruction is necessary for support, esthetics and function of any prosthodontic rehabilitation.

The use of membranes to guide bony tissue formation by separating the underlying bone from the overlying connective tissue and by creating a space into which the desirable bone cells can migrate has been termed "Guided Bone Regeneration".[9]The creation of a secluded space is basic to this concept. Bone is the target of regeneration.[10]

The principal of sealing off an anatomical site for improved healing of a certain tissue type and directing regeneration by some type of mechanical barrier has been used in experimental osseous facial reconstruction since the mid 1950's.

The concept of guided bone regeneration [GBR] has arisen from these early studies and depends on placing the membrane in direct contact with the surrounding bone surface, thereby placing periosteum on the outer surface of the membrane. The mucoperiosteal flap is repositioned and sutured to create a closed environment.

Linde et al,[11]in 1993, described the term "osteopromotion" as a means of sealing off an anatomic site for osteogenesis and bone formation while preventing interference from other nonosteogenic tissue types. This terminology is in accordance with earlier osteogenic designations, including osteoconduction, osteoinduction, and osseointegretion.

The results of our study of 50 patients and 50 extraction sockets, showed the difference between the preoperative and postoperative bone density to be statistically significant [p =0.0001]. This demonstrated the success of the combination of a collagen membrane along with a bovine derived bone graft in efficiently carrying out Guided Bone Regeneration at extraction sites.

Conclusion

Alveolar ridge resorption has long been considered an unavoidable consequence of tooth extraction. With today's esthetic conscious population, the days of simply extracting a tooth and replacing it later are unacceptable to

many patients. It is vital to preserve and maintain the edentulous ridge and normal gingival architecture.

Guided bone regeneration techniques and the use of bone replacement material have both been shown to enhance socket healing and modify the resorption process.

The results showed a statistically insignificant amount of bone loss at the treated sites, thus proving the efficacy of the combination of a collagen membrane with bovine bone graft in satisfactorily achieving alveolar ridge preservation by the process of GBR.

There was reduced bone density seen at first week with marked increase in bone density in the first and the third month, evidenced from the fact that all our patients have had prosthodontics replacement of their lost tooth/teeth with implants, fixed partial dentures, or removable partial dentures, without any problems related to retention.

It should also be noted that the available data are from studies within the 1990s. Long-term studies are needed to confirm the success rate of implants placed in regenerated bone. However, the role of absorbable collagen membranes in Guided Bone Regeneration will remain a fertile area for further exploration.

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