Review Article

Changes in Residual Alveolar Ridge Following Tooth Extraction & the Necessity of Placing Bone Graft Material in the Extracted Socket to Prevent Bone Resorption - A Review Article

MM Hossain[1], MS Aziz[2], M Asaduzzaman[3]

Abstract:

Alveolar bone resorption is frequently observed after tooth extraction. Preservation of alveolar dimensions after tooth extraction is crucial to achieve optimal esthetic and functional prosthodontic results. Attempts to reduce alveolar bone resorption have included atraumatic extraction, the placement of natural roots, root analogues, and immediate implants into the extraction socket, sometimes in combination with membrane or graft techniques. This article reviews the literature on healing of the alveolus and its dimensional changes after tooth extraction, and discusses socket preservation techniques that have been introduced to minimize these dimensional changes.

Keywords: alveolar ridge resorption, bone graft, tooth extraction, healing of extracted socket, pattern of ridge resorption.

Introduction:

Alveolar bone seems to play a key role in providing support to the teeth, which are anchored to the bone by periodontal fibers. The progressive alveolar bone resorption process occurs due to a loss of anatomic, biologic and mechanical factors. Mechanical stimulation of alveolar bone during mastication is crucial in keeping the teeth and underlying bone healthy.

Loss of alveolar bone may be attributed to a variety of factors, such as endodontic pathology, periodontitis, facial trauma and aggressive maneuvers during extractions. Thousands of teeth are still extracted annually in Bangladesh. Most extractions are done with no regard for maintaining the alveolar ridge.[1]

Tooth extraction and subsequent healing of the socket commonly result in osseous deformities of the alveolar ridge, including reduced height and reduced width of the residual ridge. The severity of the healing pattern may pose a problem for the clinician to place prosthesis like a dental implant.

1. Dr. Muhammad Muktadir Hossain, BDS, Lecturer, Department of Prosthodontics, Pioneer Dental College, Dhaka.
2. Dr. Md. Saful Aziz, BDS, Lecturer, Department of Dental Pharmacology, Pioneer Dental College, Dhaka.
3. Dr. Md. Asaduzzaman, Lecturer Department of Oral Anatomy & Physiology, Pioneer Dental College, Dhaka.

Address of Correspondence : Dr. Muhammad Muktadir Hossain, BDS, Lecturer, Department of Prosthodontics, Pioneer Dental College, Dhaka.

When tooth extraction is necessary, trauma should be minimized during the procedure and bone preservation should receive careful attention. The literature has shown that early bone loss can be significantly reduced by socket grafting. The process of socket grafting requires an understanding of wound healing and an appreciation of the biological properties of the products available for socket grafting.[2,3]

Healing of extracted socket

The first stage of healing is the formation of clot or coagulum. The socket fills with blood from the severed vessels, which contain proteins and damaged cells. These cells initiate a series of events that will lead to the formation of a fibrin network, which, along with platelets, forms a "blood clot" within the first 24 hours. Platelet retract the clot, expressing fluid so that it becomes harder & shrinks below the level of soft tissues, pulling any mobile soft tissue inwards to reduce the area of the clot exposed. Lysis of clot begins within two days caused by fibrinolytic enzyme plasmin. At day 4, capillaries & fibroblasts (granulation tissues) are growing into the blood clot from the periphery so that it is now fixed to the socket wall. Epithelium at the gingival margin undergoes hyperplasia & starts to grow over the intact clot. By 4-6 weeks, most parts of the alveolus are filled with woven bone, while the soft tissue becomes keratinized. The mineral tissue within the original socket is reinforced with layers of lamellar bone that is deposited on the previously formed woven bone. Although bone deposition in the socket will

continue for several months, it will not reach the coronal bone level of the neighboring teeth.[4,5,6,7]

Rate & Pattern of ridge resorption

The rate of resorption is most rapid in the first 2 years after extraction & can be as high as 4.5mm/year. Rate varies from 0.4mm/year to 2.9mm/year with an average of 1.36mm/year.

The resorption pattern is different in maxilla & mandible. The residual alveolar ridge resorbs downward & outward in mandible, whereas in maxilla resorption is upwards & inwards. As a result after several years maxilla becomes progressively smaller, whereas mandibular arch becomes wider. So there is a tendency of developing class III ridge relationship.[8]

Alveolar bone resorption and socket repair involve a complex cascade of events. Likewise, any successful ridge preservation technique is likely to have multiple mechanisms of action. Based on the current understanding of bone-implant interactions, several key concepts emerge for consideration.[9]

Alveolar ridge preservation technique and grafting materials

Alveolar ridge preservation (ARP) is a guided bone regeneration (GBR) application at the time of tooth extraction to control bone resorption. ARP is indicated after extractions to preserve original ridge dimensions and contours (hard and soft tissues), when immediate implant placement is not possible.[10]

The techniques for alveolar ridge preservation were introduced in the 1980s using hydroxyapatite in the form of root-shaped cones.[11,12]

Current methods to prevent ridge resorption include the use of particulate alloplasts, xenografts, autografts, allografts, and membranes manufactured from various materials, including those that are bioabsorbable or non-resorbable, naturally derived or synthetic. Most of these materials have been shown to be osteoconductive, providing a scaffold for the osteoblasts to migrate and form bone.[13,14,15]

Keys to successful extraction-socket grafting

According to Dr. Carl Misch, founder of the Misch International Implant Institute and one of the world's leading implantologists, some keys to successful bone grafting of extraction sites include: [16]

1. Atraumatic tooth removal;
2. An evaluation of the remaining walls of bone following the extraction, and evaluation of the size of the defect;
3. Asepsis and complete removal of granulomatous tissue;
4. Ensuring adequate blood supply to the graft site;
5. Graft containment and soft tissue closure;
6. Choice of an appropriate graft material;
7. Ensuring adequate time for healing.

Conclusion

Disuse atrophy of the alveolar ridge post-extraction is preventable through the use of grafts or implants. Grafts provide viable future options in cases where an implant is not an immediate option. Prosthodontic results are substantially improved and bone mass may be preserved for the subsequent placement of dental implants. Further studies are needed to evaluate the long-term effects of ridge preservation materials and to develop standardized protocols for their use.

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