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Changes in Alveolar Bone Dimension after Extraction Sockets and Methods of Ridge Preservation

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ABSTRACT

The alveolar process develops during tooth formation and goes through bone atrophy after a tooth or teeth are lost. This could happen because of periodontal disease, periapical pathologies, and mechanical trauma which cause loss of surrounding bone around the tooth. Thus, leads to the resorption of the alveolar ridge. Also, predisposing factors that affect alveolar bone loss following tooth extraction such as age, gender, systemic conditions, facial morphology, and functional stress on the extraction wound.

Post extraction complications include loss of function, a reduction in vertical height, horizontal width, insufficient bone for dental implants, and prosthodontics difficulties. It has been noted that the size of the residual ridge shrinks more quickly within the first six months. After extraction, the maxillary arch tended to have more horizontal resorption together with vertical bone resorption than the mandible. In order to achieve successful implant results, both the bone and soft tissue contour should be preserved as well as possible.

Alveolar Ridge Preservation (ARP) is considered as a Guided Bone Regeneration (GBR) technique for preventing ridge resorption succeeding tooth extraction. The aim is to provide the existing research on alveolar bone loss and tissue alterations in extraction sockets, the effects of age on bone resorption, and different Ridge preservation strategies.

Key words: Alveolar Bone, Extraction sockets, Ridge preservation, Methods

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INTRODUCTION

Resorption of the alveolar bone varies among individuals to individuals, sites to sites after extraction which leads to loss of function, insufficient bone for dental implants, and prosthodontics difficulties [1]. Resorption of mandibular ridge height is more than maxillary ridge height, while buccal ridge width loss is greater [2,3].

One of the most common dental treatments that result in the reduction of vertical ridge height is tooth extraction. This is particularly noticeable on the buccal aspect, according to reports [4-6]. This resorption process results in a narrower and shorter ridge [7]. The ridge is shifted to a more palatal/lingual position as a consequence of constriction of the blood clot and the existence of bundle bone at the crystal region. It has been also seen that periodontitis, periapical lesion, or trauma to the bone and teeth may have caused alveolar bone loss prior to tooth extraction [6-13].

The size of the residual ridge shrinks most quickly in the first six months, although resorption of bone in the residual ridge continues at a slower pace throughout life, resulting in depletion in the horizontal and vertical width of the jaw structure [13,14].

Extraction sites had a greater proportion of vital bone in the maxilla when they healed, whereas preservation sites had identical percentages of vital bone in the mandible and maxilla when they healed.

In general, after tooth loss, alveolar bone remodelling results in smaller alveolar ridge extent in horizontal and vertical planes. According to studies, ridge changes caused by tooth loss can cause a 40% to 60% bone loss in vertical and horizontal dimensions in as little as 3 months [14,15].

LITERATURE REVIEW

Age factor for alveolar bone: Amler, et al. looked at the role of age in wound healing after extraction. Individuals in their second decennium of life were in contrast to those in their sixth decennium or above in terms of healing time. After the first ten days of the post-extraction phase, no significant variance in the rate of healing between young and elderly individuals were observed; however, after ten days, the rate of tissue regeneration in younger individuals

began to accelerate as compared to older patients. In the same finding is seen after 20 days the rate of tissue regeneration began to accelerate. After 30 days, both young and elderly people had healed at the same rate. The length of active revitalization in younger and older people is dependent on the timing of donor [15,16].

Subjects over 50 years old had more horizontal and vertical resorption after extraction than those under the age of 50. In the age less than of 50 years, the ridge preservation approach compensated for the decrease in vertical ridge height, but not in the ≥ 50 years of age. The effect was similar for both age groups, although the ridge preservation effect was similar for both the age group [14,15].

Changes seen in tissue morphology of extraction sockets in humans

The ridge changes in tandem accompanied by the recovery of the soft as well as hard tissue wounds, but the remodelling procedure can carry on even after *de novo* bone creation in the socket has stopped [16,17].

Cardaropoli, et al. in his study he looked at how fresh extraction sockets healed in the coronal, central, and apical compartments over a 6 month period. The scientists found that the socket was pervaded with the woven bone after 4 weeks after recovery and that this immature bone was restored with lamellar bone and marrow after 2 months. The buccal wall of the socket had significant resorption at the same time as these intra alveolar healing activities. As a result, the height of the buccal wall of the socket was reduced by 2.5 mm on average when compared to the lingual wall [17,18].

Tissue generation following tooth extraction was also studied in human models. He came to the conclusion that the blood clot that had previously pervaded the socket's entry had been replaced with granulation tissue. Osteoid production began after one week of tissue modelling, and after about six weeks, the socket's periphery included islands of immature woven bone [18,19].

Johnson was the first to show that tooth extraction could result in a decrement in height and width of 2.5 to 7 mm and up to 3 mm. moreover, they came across that the majority of the variations happened in the first month, with a little extra drop in the ridge persisting for periods varies from 10 to 20 weeks [19,20].

Pietrokovski and Massler reached a similar conclusion, they noted that tissue devitalisation occurs more in the buccal wall of the molar area than in the aesthetic zone [20]. Schropp, et al. stated that a year after tooth extraction, the remnant alveolar ridge can shrink by up to 50% in width [16,17].

They theorized that because the bundle bone is part of the periodontium, removing a tooth leaves it useless, and resorption occur [6]. According to other researchers, the collapse of the buccal soft tissue resulted in significant buccal oral changes. Other authors, on the other hand, have studied that surgical trauma during tooth extraction may result in the periosteum's separation from the underlying bone surface. This could result in injury to the vessels and an initial inflammatory reaction, which will then mediate bone tissue resorption [21-25].

DISCUSSION

Various ridge preservation modalities

Numerous ridge preservation approaches have been proposed to influence bone remodelling after extraction. Routinely, Ridge preservation is described as a method performed at the time of tooth extraction with the goal of reducing exterior ridge resorption and optimizing bone growth within the socket (Table 1) [26-35].

Table 1: Shows various ridge preservation modalities.

Sr.no	Author (Year)	Title	Conclusion of study
1	Lauren A Brownfield, et al.	Alveolar Ridge Preservation (ARP) is a Guided Bone Regeneration (GBR) procedure aiming to control post-extraction ridge resorption.	No statistically significant differences were found in dimensional changes between groups after 10 to 12 weeks of healings. Bone loss in the vertical height was less likely to occur when the average buccal plate thickness was 1.3 mm
2	Daniele Cardaropoli, et al.	Socket preservation using bovine mineral and collagen	Socket preservation using bone material(bovine) and collagen membrane(porcine) considerably limits the amount of horizontal as well as vertical bone resorption when compared with the extraction of tooth alone
3	HammerleCH Schmid, et al.	A novel model system for the study of experimental guided bone regeneration in humans	The presented model system is suitable to study tissue physiology of bone regeneration in humans with minimal complications or adverse effects to the volunteers.
4	Lanka Mahesh, et al.	Alveolar ridge preservation with the socket plug technique utilizing an alloplastic bone substitute (Putty) or a particulate xenograft: A histological pilot study.	The amount of new bone regenerated was also statistically significantly greater in the alloplasts study group as compared to the xenograft group. Results suggest that ridge preservation using alloplastic (calcium phosphosilicate) bone substitute showed more timely graft substitution and increased bone

			regeneration when compared to a bovine bone xenograft.
5	Eric Todd Scheyer, et al.	A randomized, controlled, multicentre clinical trial of post-extraction alveolar ridge preservation	Treatments were demineralized allograft plus reconstituted and cross-linked collagen membrane (DFDBA)+(RECXC) or deproteinized bovine bone mineral with collagen plus native, bilayer collagen membrane (DBBMC+NBCM). DBBMC +NBCM provided better soft tissue healing and ridge preservation for implant placement.
6	G Avila-Ortiz, et al.	Efficacy of alveolar ridge preservation RCT.	The Control group includes tooth extraction and the experimental group received Alveolar Ridge Preservation using a combination particulate bone allograft with a non-absorbable membrane (dPTFE) following tooth extraction. Bone resorption was significantly greater in the control group. No significant differences with respect to soft tissue contour change were observed between groups.
7	Veronica J Lai, et al.	Ridge preservation following tooth extraction using xenograft (bovine) compared with xenograft (porcine)-RCT	Ridge preservation with the help of xenograft (porcine) results in dimensional stability with xenograft(bovine).
8	Yiping Wei, et al.	Ridge preservation in maxillary molar extraction sites with severe periodontitis: A prospective observational clinical trial	Ridge preservation can improve alveolar ridge dimensions and decrease the necessity of advanced regenerative procedures at implant placement compared to natural healing in the maxillary molar extraction sockets with severe periodontitis.
9	Brend Pjotr Jonker, et al.	Soft tissue contour and radiographic evaluation of ridge preservation in early implant placement: A randomized controlled clinical trial	Ridge preservation using a bone substitute (xenogenic) covered with a collagen matrix or a palatal graft, results in less bone resorption.

CONCLUSION

Studies have shown that by using various graft materials and techniques, Methods of ridge preservation limit the resorption of alveolar ridge width and provide gain in hard tissue ridge height when compared to extraction alone. Thus, it limits bone resorption and helps in the successful results of dental implant placement

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