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The Evaluation of Alveolar Ridge Preservation Efficiency In Minimizing Maxillary Sinus Pneumatization Following Extraction of Maxillary Posterior Teeth; A Case Report.

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Abstract-
Maxillary sinus pneumatization is a normal physiological mechanism during development aiding in the increase of the sinus volume [(1)]. Alveolar bone resorption happens as a defect in the horizontal and vertical dimension of the bone [(2)]. Apart from the normal sequence resorption of bone, posterior maxillary teeth when extracted have also intra sinus resorption due to the downward expansion of the maxillary sinus [(3)]. The absence of bone is believed to be due an outcome of two processes. The first is the resorption of the maxillary alveolus [(4)] and the second is the maxillary sinus pneumatization [(3)]. Thus, the process of restoring the edentulous posterior maxilla with an implant supported prosthesis could be very challenging. It has been proclaimed that Alveolar Ridge Preservation (ARP) helps in preserving the anatomy of the alveolar ridge by decreasing the bone resorption that occurs to the socket walls [(5,6)]. Since ARP intraorally confines the bone alveolus volume's loss, therefore it might also constrain the sinus pneumatization that occurs after maxillary tooth extraction. This study aims to investigate if ARP significantly reduces maxillary sinus pneumatization following extraction of maxillary posterior teeth.

Index Terms- *Maxillary Sinus; Pneumatization; Alveolar Ridge Preservation*

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I. INTRODUCTION

Pneumatization of the maxillary sinus is a normal physiological process explaining the expansile nature of the sinus that occurs with aging [(1).] Its prevalence is around 50% of the population extending between the roots or adjacent teeth [(7)]. The cause of the pneumatization is unknown, however it has been linked to many factors either hereditary [(8)], previous sinus surgery [(9)] and extraction of maxillary posterior teeth [(3)].

The development and maintenance of the shape and volume of the alveolar bone is highly dependent on the presence of teeth [(10)]. Therefore, when these teeth are lost, their support to the bone is lost as well leading to noticeable changes in the alveolar process [(11)].

The use of Cone Beam Computed Tomography (CBCT)has allowed us to compare between volumetric changes in the maxillary sinuses associated with extractions with or without ARP.

II. Case Presentation

A 26-year-old male patient presented with a need to extract his decayed maxillary left first molar. The patient is medically free with no significant drug history, genetic background, or psychosocial history.

Preoperative Preparation:
Patient's History
Clinical Examination
Intra-Oral examination

- The status of the tooth requiring extraction is checked.
- Percussion to the tooth needed for extraction to exclude the possibility of the presence of periapical acute infection.
- Palpation at the vestibule corresponding to the tooth to be extracted to exclude any fistula indicating chronic infection.

Radiographic assessment
Radiographic assessment using CBCT was done to assess:

A. Maxillary Sinus free lesions.
B. Maxillary Sinus approximation which was 3 mm or less between the root apex and the sinus floor.
C. Presence of intact buccal and palatal walls.
D. Absence of periapical infection.

Preparation for surgery

- Strict oral hygiene measures were advised to the patient one week before surgery.
- Local anesthesia of amide group Articaine 4% with vasoconstrictor Epinephrine 0.01mg/ml was given buccally and palatally before extraction.
- Atraumatic extraction of the maxillary posterior tooth was done with the aid of luxators.
- Separation of the roots was done by using curved apexo elevator for luxation and then delivery using bayonet forceps.
- Gentle curettage of the socket from the bottom of the socket up to the gingival margin to preserve the integrity of the buccal and palatal plates of bone was done.
- Intra operative clinical assessment after extraction was done to ensure the absence of oroantral communication by doing the Valsalva maneuver as well as to ensure the absence of excessive or abnormal bleeding.
- Irrigation of the socket was done using saline.
- Xenograft was mixed with saline and placed in extraction socket (Figure 1) followed by coverage with collagen plug (Figure 2) where margins of the collagen membrane are tacked below margins of buccal and palatal mucoperiosteum after slight elevation of the mucoperiosteum then stabilized by cross over 4-0 Polyglycolic Acid coated, braided sutures (Figure 3)

Figure (1): Application and packing of the bone graft inside the sockets.

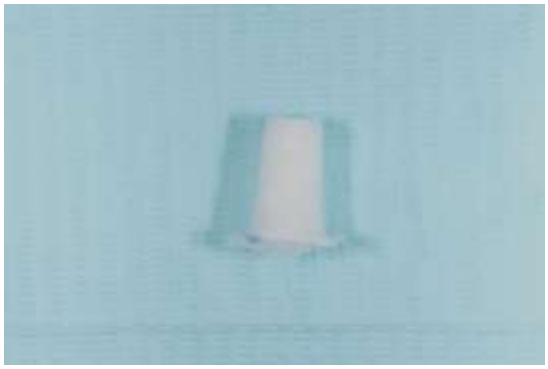


Figure (2): Collagen Plug Before Application.

Figure (3): Cross over vicryl sutures over xenograftand collagen membrane

Follow up

- Post Extraction instructions were given. Patient was instructed to rinse their mouth with antiseptic mouthwash 3 times a day starting from the second day postoperatively and continued for 2 successive weeks.
- Amoxicillin/Clavulanic acid 875mg/125mg oral tablet was given twice daily for 5 days postoperatively
- Postoperative analgesic was prescribed for 5 days as an analgesic and anti-inflammatory.
- The Patient was evaluated based on the following timeline, 3, 7, 14, 30 days after extraction,
- Cone Beam Computerized Tomographies (CBCT) were done on two different occasions, immediate post-operative (T0) and 6 months post-operative to evaluate and compare the new three-dimensional status of the alveolar ridge plus the degree of sinus pneumatization. (T1).

III. DISCUSSION

Reports suggest that ARP following the maxillary posterior tooth extraction decreases bone resorption of the socket walls leading to the maintenance of the alveolar ridge anatomy [16,17]. ARP can be done by various techniques with different types of grafting materials either in the maxilla or mandible [18]. Previous Studies on such topic were done in retrospective studies based on the two-dimensional radiographs [3], which do not provide the images in a Bucco-Palatal cross section and maybe mistaken by image distortion [19]. Measurements were performed based on CBCT superimposition, the accuracy of this procedure is highly dependent on the precision of the superimposition of CBCT done immediate post-Operative (T0) and CBCT done 6 Months Post-Operative.Maxillary regional CBCT superimposition is currently considered as an accurate and reliable method [20].

It is of utmost importance to consider ARP after extraction of maxillary posterior teeth because of its efficacy in maintaining an Alveolar Bone Height.

IV. RESULTS

Radiological assessment.

Measurements were done on the CBCT for the following variables at immediate postoperative and 6 months postoperative after applying Superimposition. **(Figure 4)** to **(Figure 7)**

1. BCL: Bone Crest Level
2. SFL: Sinus Floor Level

3. RBH: Residual Bone Height
4. Buccal Plate Height.
5. Palatal Plate Height.

Figure (4): Immediate postop CBCT Vertical assessment

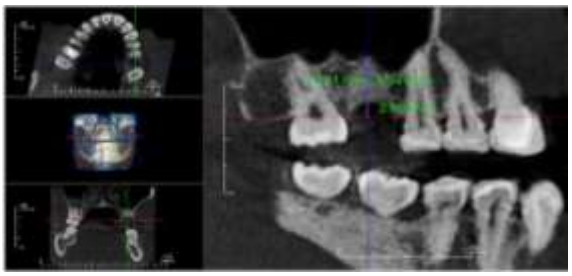
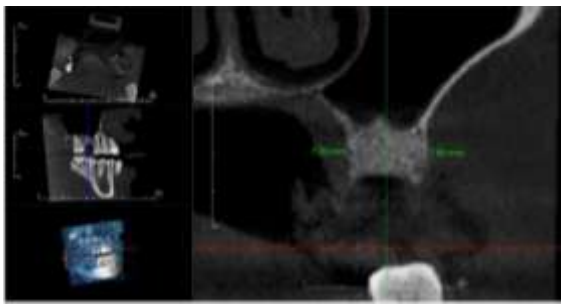
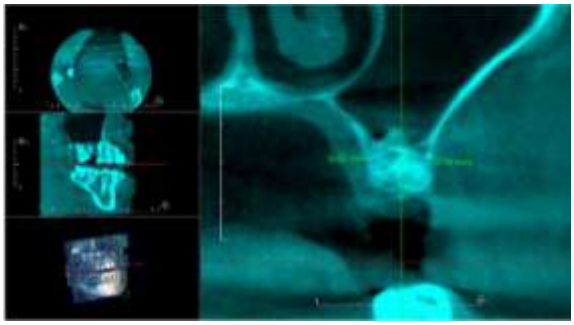


Figure (5): Immediate postop CBCT Vertical assessment

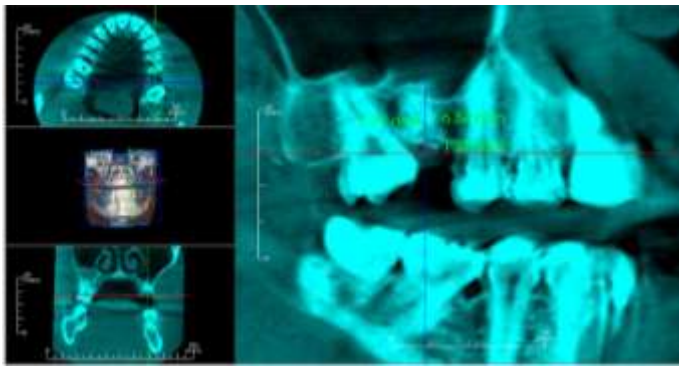


BCL:2.55mm **SFL:**10.91 mm **RBH:**8.34**BP:** 7.88 **PP:**7.2

(Figure 6): 6 months postop CBCT Vertical assessment



BCL: 2.59mm **SFL:** 11.03 mm **RBH:** 2.59 mm



(Figure 7): 6 months postop CBCT Coronal assessment
Buccal Plate: 6.19mm **Palatal Plate:** 6.01mm

V. CONCLUSION

Within the limitations of this study, it can be suggested that ARP using xenograft (Bio-Oss®) and Collagen Plug (Collacone®) done after extraction of Maxillary Posterior Teeth in the Study Group seemed to reduce the Maxillary Sinus Pneumatization.ARP using xenograft (Bio-Oss®) and Collagen Plug (Collacone®)

done after extraction of a Maxillary Posterior Tooth has decreased the Crestal Bone Resorption. ARP using xenograft (Bio-Oss®) and Collagen Plug (Collacone®) done after extraction of Maxillary Posterior Teeth in the study case maintained adequate Residual Bone Height. The effect of the ARP in reducing the resorption of the Crestal Bone and maintenance of the Residual Bone Height was more efficient than its effect in reducing the Maxillary Sinus Pneumatization.

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