ISSN : 2949 - 9100

International Journal of Health and Dentistry Care (IJHDC)

IJHDC : Health and Dental Publication
Available Online at: www.ijhdc.com
Volume – 2, Issue – 2, March - April - 2023, Page No. : 22 - 26

Reconstruction of Anterior Sinus Wall in Maxillary Fractures - A Multivariate Analysis

[1]Detruson C P, Laboratory of Oral Diseases & National Clinical Research Center for Oral Diseases, Karolinska Institute, Sweden.

[2]Judin R D, Laboratory of Oral Diseases & National Clinical Research Center for Oral Diseases, Karolinska Institute, Sweden.

Corresponding Author: Detruson C P, Laboratory of Oral Diseases & National Clinical Research Center for Oral Diseases, Karolinska Institute, Sweden.

Citation This Article: Detruson C P, Judin R D, "Reconstruction of Anterior Sinus Wall in Maxillary Fractures - A Multivariate Analysis", IJHDC – March – April - 2023, Volume. – 2, Issue - 2, P. No. 22 – 26.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: Assessment of the lateral wall thickness of the maxillary sinus is very important in decision making for many surgical interventions. The association between the thickness of the lateral wall of the maxillary sinus and the dental status is not well identified.

Objectives: To compare the thickness of the lateral wall of the maxillary sinus in individuals with and without teeth to determine if extraction of the teeth can lead to a significant reduction in the thickness of the maxillary sinus lateral wall or not.

Material and Methods: In a retrospective study on fifty patients with an edentulous space, the thickness of the lateral wall of the maxillary sinus, one centimeter above the sinus floor in the second premolar (P2), first molar (M1) and second molar (M2) areas was determined by cone beam computed tomography scans(CBCTs) and a digital ruler in Romexis F software (Planmeca Romexis 2.4.2.R) and it was compared with values measured in fifty dentated individuals. Three-way analysis of variance was applied for comparison after confirmation of the normal distribution of data.

Results: The mean of the wall thickness in each of these points was lower in patients with edentulous spaces; however it was not significant. There was no association between gender and the thickness of the lateral wall of the maxillary sinus, but location was associated with different thicknesses.

Conclusions: The differences in the thickness based on the location and dental status necessitates assessment of the wall thickness of the maxillary sinus in addition to the current evaluation of bone thickness between the sinus floor and the edentulous crest before maxillary sinus surgery.

Keywords: CBCT, PNS, Xray, Wall.

Introduction

Most midfacial injuries cause substantial defects of bone in the anterior walls of the maxillary sinus as it consists of fine/slender bone with less strength due to the load over it during normal functions such as mastication is moderate. Bone defects causes the disruption of the inner sinus lining mucosa with alterations in ventilation and aeration of the sinus leading to secondary complications such as sinusitis, pressure sensibility with pain in cranial proclination, long standing purulent secretion, recurrent rhinitis, and edema of the cheek. Such extensive bone defects can result in soft tissue prolapse/herniation into the sinus along with the formation of soft tissue and facial asymmetry with alterations in facial contour, unnecessary septa development, formation of cysts and chronic sinusitis, also altered sensations or paraesthesia of the infraorbital nerve, chronic facial pain, displacement of the orbital floor. To avoid these above functional and aesthetic complications along with displeasure, reconstruction of maxillary sinus anatomically with large defects of the maxillary sinus walls is necessary to preserve the lumen of the sinus as well as the contours of the face. Reconstruction of the walls of the maxillary sinus results in conservation of respiratory epithelium and sufficient restoration of ventilation and drainage of the maxillary sinuses.

Materials and Methods

In a retrospective study on fifty patients with an edentulous space, the thickness of the lateral wall of the maxillary sinus, one centimeter above the sinus floor in the second premolar (P2), first molar (M1) and second molar (M2) areas were determined by cone beam computed tomography scans(CBCTs) and a digital ruler in Romexis F software (Planmeca Romexis 2.4.2.R) and it was compared with values measured in fifty dentated individuals. Three way analysis of variance was applied for comparison after confirmation of the normal distribution of data.

Study group was recognized as patients with midfacial fracture undergoing reconstruction of anterior sinus wall and control group was patients with midfacial fracture involving anterior sinus wall but not undergoing the reconstruction.

Inclusion criteria

1. Patients diagnosed with midfacial fractures involving the anterior wall of maxillary sinus.
2. Patients above the age of 18years
3. Willing individuals (both male and female) with an informed consent.

Exclusion Criteria

1. Medically compromised patients.
2. Patients with associated bone pathology.
3. Patients with pre-existing maxillary sinusitis prior to the trauma.
4. Patients with previous history of midface trauma.

This study followed the Declaration of Helsinki in medical protocol and ethics. Also, the study was approved by the Regional Ethical Review Board of Sanjay Gandhi Institute of Trauma and Orthopaedics.

Presurgical evaluation including thorough clinical examination, case history, photographs and radiographic analysis of the patient was done.

Under general anesthesia, the maxillary vestibular incision was employed to expose the fracture site. The fracture was reduced into its anatomical position. In the study group, reconstruction of the fractured anterior sinus wall was done with titanium mesh along with it if zygomaticomaxillary buttress is involved fixation with the titanium plates and screws of 2mm size. In the control group, routine fixation of the buttress was

followed without the reconstruction of the anterior wall. Titanium mesh was cut according to the site of the defect and adapted well to the sinus wall, fixation was done with the 6 mm screws of 2mm or 1.5 mm size. Closure was done in layers.

Patients were evaluated post-operatively for below signs of maxillary sinusitis to assess clinical outcome post reconstruction of traumatized anterior sinus wall in both the groups.

Results

The healing was satisfactory in all the patients. No major intra-operative or post-operative complications were noted. Study group had 15 patients with 9 male and 6 female, control group had 20 patients with 15 male and 5 female. The patients were in the age group of 20- 50 years. All the patients were followed up to the duration approximately of 3-5 months.

The statistical analysis was done by frequency distribution, Chi square test to evaluate the p value and bar graphs. The clinical and radiological parameters that were evaluated for maxillary sinusitis were greater in the control group than the study group.

Infraorbital facial pain with tenderness

In this study, the infraorbital facial pain and tenderness in the cheek/malar region was assessed by palpation of the cheek region and was recorded to be higher in control group when compared to study group. At 1st week pain was seen in 12 patients (80%) of control group whereas in 8 patients (66.7%) in study group, at 4th week in 7 patients (46.5%) in control group and 1 patient (8.3%) which was statistically significant ($p < 0.05$) in study group. 2 patients (13.3%) and 1 patient (8.3%) had infraorbital facial pain at 3 months post-operative which was comparative and not much statistical difference.

Discussion

Maxillary sinus injuries are consistently noted in the midfacial trauma due to high impact injuries. In our study the midfacial injury cases were due to road traffic accidents mainly. Lefort and zygomaticomaxillary complex cases had associated fracture of anterior maxillary sinus wall. The maxillary sinus walls are thin as they do not bolster up immense occlusal load, during normal functions the load transmission is craned by the perinasal and zygomatic buttress**.** The ensuing complications post traumatic injury to the maxillary sinus walls are unwanted septa development, formation of cysts and chronic sinusitis, there are also sensory disturbances of the infraorbital nerve, chronic facial pain, displacement of the orbital floor and even possible alterations in the facial contour.

Clinical examination is one of the utilarian methods in the diagnosis and subsequent follow-up of complications of maxillary sinus fractures, including sinusitis. The extant of symptoms such as infraorbital facial pain, nasal or postnasal leaking, pressure sensibility, sensitivity to changes of weather, edema of the lower lid, pain on cranial proclination and nasal blockage is correlated to sinusitis.

The radiologic examinations give more objective results in the diagnosis of complications of maxillary sinus fractures. Although plain radiographs can show fractured regions, thickening of sinus mucosa, foreign bodies, and radio-opacification of sinuses, CT can reveal more subtle and comprehensive findings related to the complications of maxillary sinus fractures. The exhaustive characteristic feature of maxillary sinus such as 2 or 3 dimensional volumatic analysis, the area of bone defect, the place of mucosal thickening, locations of foreign bodies, minute soft tissue herniation and the causes of

sinus opacification can be evaluated in axial, sagittal and coronal view in computed tomographic radiographs.

The maxillary sinus mucosa has a commendable regenerative potential except in cases of large loss of bone continuity. The injured maxillary sinus lining has the ability to be completely reformed by regeneration with ciliated columnar epithelium and membrane with glands within 3-5 months but disparity in time for complete wound healing exits due to extent of mucosal damage of sinus.

Conclusion

Even though maxillary sinusitis resolves within 3-6 months of time in almost all cases as sinus mucosa has innate high regenerative potential. When there is a larger bone defect of the sinus wall, reconstruction can be considered along with the reduction and fixation of midfacial fracture for avoidance of symptoms of sinusitis such facial pain, rhinitis, pressure changes on cranial proclination, maxillary posterior teeth pain during the healing post-operative phase in addition to maintenance of integrity of infraorbital nerve that would assuage the paraesthesia of cheek region. Along with this, the reconstruction of anterior maxillary sinus in midfacial fracture restricts the soft tissue prolapse into the sinus which results in better aesthetic outcome of the midface region.

References

1. Al-Bokhamseen M., Salma R., Al-Bodbaij M. Patterns of maxillofacial fractures in Hofuf, Saudi Arabia: A 10-year retrospective case series. Saudi Dent. J. 2019;31:129–136. doi: 10.1016/j.sdentj.2018.10.001.

2. Top H., Aygit C., Sarikaya A., Karaman D., Firat M.F. Evaluation of maxillary sinus after treatment of midfacial fractures. J. Oral Maxillofac. Surg. 2004;62:1229–1236. doi: 10.1016/j.joms.2003.12.034.

3. Ballon A., Landes C.A., Zeilhofer H.F., Herzog M., Klein C., Sader R. The importance of the primary reconstruction of the traumatized anterior maxillary sinus wall. J. Craniofac. Surg. 2008;19:505–509. doi: 10.1097/SCS.0b013e318163f2ea.

4. Anchez-Perez A., Boracchia A.C., Lopez-Jornet P., Boix-Garcia P. Characterization of the Maxillary Sinus Using Cone Beam Computed Tomography. A Retrospective Radiographic Study. Implant Dent. 2016;25:762–769. doi: 10.1097/ID.0000000000000485.

5. Ballon A, Lands CA, Zeilhofer HF, Herzog M, Klein C, Sader R. The importance of the primary reconstruction of the traumatized anterior maxillary sinus wall. Journal of Craniofacial Surgery. 2008 Mar 1;19(2):505-9.

6. Norlander T, Forsgren K, Pontus Stierna JK, Carlsöö B. Cellular regeneration and recovery of the maxillary sinus mucosa: an experimental study in rabbits. Acta Oto-Laryngologica. 1992 Jan 1;112(sup492):33-7.

7. Top H, Aygit C, Sarikaya A, Karaman D, Firat MF. Evaluation of maxillary sinus after treatment of midfacial fractures. Journal of oral and maxillofacial surgery. 2004 Oct 1;62(10):1229-36.

8. Bell RM, Page GV, Bynoe RP, Dunham ME, Brill AH. Post-traumatic sinusitis. The Journal of Trauma. 1988 Jul 1;28(7):923-30.

9. Jun BC, Song SW, Park CS, Lee DH, Cho KJ, Cho JH. The analysis of maxillary sinus aeration according to aging process; volume assessment by 3-dimensional reconstruction by high-resolution CT scanning. Otolaryngology—Head and Neck Surgery. 2005 Mar;132(3):429-34.

10. Ellis III E, Potter JK. The effects of trauma on the maxillary sinus. Oral and Maxillofacial Surgery Clinics of North America. 1999 Feb 1;11(1):165-79.

11. Forsgren K, Kumlien J, Stierna P, Carlsöö B. Regeneration of maxillary sinus mucosa following surgical removal: experimental study in rabbits. Annals of Otology, Rhinology & Laryngology. 1993 Jun; 102 (6): 459-66.

12. Zachariades N, Papa vassiliou D, Papa Demetriou I. The alterations in sensitivity of the infraorbital nerve following fractures of the zygomaticomaxillary complex. Journal of Cranio-Maxillofacial Surgery. 1990 Oct 1;18(7):315-8.

13. Fogaça WC, Fereirra MC, Dellon AL. Infraorbital nerve injury associated with zygoma fractures: docu mentation with neurosensory testing. Plastic and recon structive surgery. 2004 Mar 1;113(3):834-8.

14. Kurita M, Okazaki M, Ozaki M, Tanaka Y, Tsuji N, Takushima A, Harii K. Patient satisfaction after open reduction and internal fixation of zygomatic bone fractures. Journal of Craniofacial Surgery. 2010 Jan 1;21(1):45-9.

Legend Figures

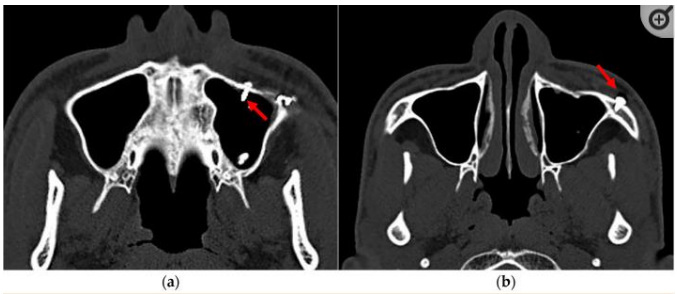
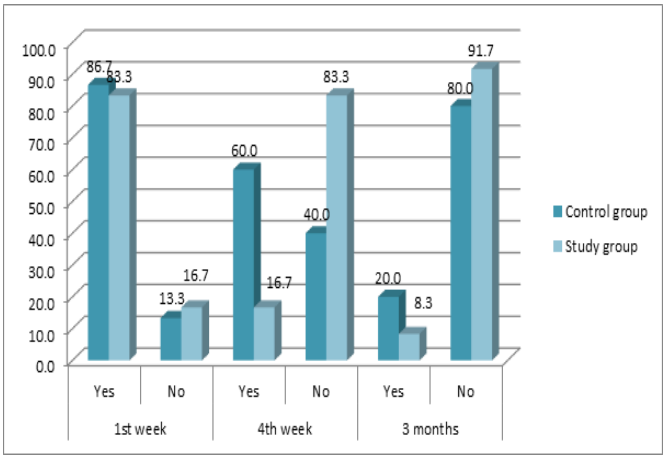


Figure 1: Implant penetration into the maxillary sinus. (**a**) The arrow indicates the implants (screws) penetrated the maxillary sinus. (**b**) The arrow indicates the implants (screws) within the maxillary sinus wall.

Figure 2: Post-operative PNS x-ray taken at 3 months showing no major signs of maxillary sinusitis.



Graph. 1: The percentage of mucosal thickening of maxillary sinus in both the groups.