ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF RESEARCH IN PHARMACEUTICAL SCIENCES

Published by JK Welfare & Pharmascope Foundation Journal Home Page: https://ijrps.com

Alveolar bone defects in adults reporting for orthodontic treatment - A CBCT study

Akriti Tiwari, Ravindra Kumar Jain*, Remmiya Mary Varghese

Department of Orthodontics and Dentofacial Orthopaedics, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai – 600077, Tamil Nadu, India

Article History:

Received on: 30 Sep 2020
Revised on: 02 Dec 2020
Accepted on: 04 Dec 2020

Keywords:

prevalence,
dehiscence,
fenestrations,
alveolar bony dehiscence

ABSTRACT

Identifying alveolar bony fenestration and dehiscence preceding orthodontic treatment, especially arch expansion, is needed. An unrevealed and undiagnosed buccal alveolar bone defect leads to treatment relapse and further loss of bony support. The aim of this study was to determine the extent of posterior alveolar bony dehiscence and fenestration in adults undergoing orthodontic treatment. A total of 20 subjects in the age range 18-35 years were selected for this study randomly and their CBCT records were retrieved from the Department of Orthodontics, Saveetha dental college. All statistical analysis was performed using SPSS. Chi-square test was used to determine the association of extent of fenestrations and dehiscence between males and females. Females presented with wider and extensive dehiscence defects than males ($p=0.019$, $p<0.05$). On the other hand, there was a statistically non-significant association of fenestration severity between males and females. ($p=0.178$, $p>0.05$) Within the limits of this study, it was observed that females presented with more severe bony alveolar dehiscence than males.

*Corresponding Author

Name: Ravindra Kumar Jain
Phone: +919884729660
Email: ravindrakumar@saveetha.com

ISSN: 0975-7538

DOI: https://doi.org/10.26452/ijrps.v11iSPL3.3644

Production and Hosted by

IJRPS | https://ijrps.com

INTRODUCTION

Diagnosis of alveolar bony defects such as fenestration and dehiscence before orthodontic treatment is beneficial for orthodontists due to several reasons (Leung *et al.*, 2010). Studies have reported that the incidence of alveolar bone dehiscence and fenestration may cause a gingival recession, decrease bony support of teeth (Zachrisson and Alnaes, 1974; Xu *et al.*, 2013). An unrevealing and undiagnosed buccal alveolar bone defect leads to a greater potential for treatment relapse (Rothe *et al.*, 2006). This leads to unaesthetic finishing of orthodontic treatment and can lead to tooth sensitivity (Samantha and Sridharan, 2016). Orthodontic treatment if not carried out properly, can lead to fenestration and dehiscence (Arvind and Jain, 2020).

Recognition of alveolar bony dehiscence and fenestration was not feasible with traditional 2-dimensional imaging (Krishnan *et al.*, 2015). With the advent of CBCT, it's now possible to view these defects three-dimensionally (Christopher *et al.*, 2018). Timock et al. reported that the precision and reliability of the buccal bone height, as well as thickness measurements from CBCT, are sustainable and appropriate (Timock *et al.*, 2011; Vikram *et al.*, 2017; Jain *et al.*, 2014). Studies have examined the alveolar bony dehiscence using CBCT in patients with cleft lip and palate and those undergoing rapid maxillary expansion and in different malocclusions (Buyuk *et al.*, 2016; Baysal *et al.*, 2013; Yagci

et al., 2012).

However, there has not been significant literature examining alveolar bony defects in adults undergoing orthodontic treatment (Kamisetty *et al.*, 2015; Viswanath *et al.*, 2015). It's essential that orthodontists should know the anatomical limits of tooth movement to make them aware of potential periodontal problems that could worsen during orthodontic treatment (Coşskun and Kaya, 2019; Hwei and Thomas, 2014). CBCT has shown to have high specificity and negative predictive value for dehiscence as well as fenestration but a low positive predictive value (Sun *et al.*, 2015). Leung et al. reported that CBCT value has relatively high accuracy in diagnosing dehiscence and fenestration (Leung *et al.*, 2010). Orthodontists using bony defects data as a precaution prior to treatment should be viewed as an exaggeration to the side of caution rather than giving misinformation. Given that CBCT users comprehend the extent of its accuracy, clinicians can still use the bony defect information within the boundaries of the overestimation limit (Murugesan and Jain, 2020).

The aim of this study was to determine the prevalence of posterior alveolar bony dehiscence and fenestration in adults undergoing orthodontic treatment.

MATERIALS AND METHODOLOGY

Study design

This was a retrospective study. 20 Adults subjects aged from 18 to 35 years old were chosen from DIAS and their CBCTs were retrieved. Only subjects in whom good quality CBCT were available

Inclusion criteria

1. Class 1 malocclusion subjects with minimum crowding
2. Subjects undergoing orthodontic treatment without any missing posterior teeth except for third molars

Exclusion criteria

1. Obvious pathologies like cyst or tumor, bony pathologies and congenital defects
2. Multiple carious lesions, restoration, abfraction, or abrasions.
3. History of previous orthodontic treatment.

After applying the inclusion and exclusion criteria, 10 males and 10 females were included in the study.

Sampling method

To minimize sampling bias, simple random sampling was carried out. The investigator A.T. did not have access to the demographic information of the subjects CBCT DICOM files until the study had not been completed.

Bony defect measurement method

All CBCT images were observed and measured using dolphin imaging 11.8 premium software by the same investigator (A.T). The image was aligned using the FH line in such a way that the FH plane is parallel to the floor and the midsagittal plane was perpendicular to the FH plane. The posterior quadrant was observed in a multiplanar view with magnification up to 3 times. Once enlarged, the posterior segment was aligned anteroposteriorly on the axial view.

For the lesion to be identified as dehiscence, it had to be equal to or greater than 2mm in the vertical distance from CEJ. This was done in order to eliminate counting normal bone level as dehiscence, which is usually 1.5-2mm below the CEJ. There was no minimum requirement lesion size to be counted as fenestration. If any amount of bone was denuded on root surface but was not found to be continuous to the marginal bone, it was counted and measured as a fenestration.

Statistical Analysis

All statistical analysis was performed in SPSS. A Chi-square test was done to determine the association of the alveolar bony defects between males and females.

RESULTS AND DISCUSSION

A tooth was counted as the one with bony defect when there was the presence of a defect on one side, either mesial or distal, or on both sides. Table 1 depicts the mean widths and standard deviation of bony defects. Table 2 depicts the association of extent of fenestrations and dehiscence in males and females. Figure 1 and Figure 2 represents the association of fenestration and dehiscence in males and females.

In Figure 1, The X-axis represents the width of the dehiscence and Y-axis represents gender. Pearson's chi-square value- 5.49, p value-0.019(<0.05) hence its statistically significant. In Figure 2 The X-axis represents the width of the fenestration and Y-axis represents gender. Pearson's chi-square value-1.818, p-value-0.178(>0.05) hence its not signifi-

Table 1: Mean width of fenestration and dehiscence of genders in the study population

Gender		N	Mean width
Fenestration	Males	10	3.08∓1.02
	Females	10	3.61∓.93
Dehiscence	Males	10	4.09∓.99
	Females	10	5.18∓.70

Table 2: Association of dimensions of fenestrations and dehiscence among both genders in the study population

		Value	df	Asymptotic Significance (2 sided)
Pearson's chi-square	Dehiscence	5.495	1	0.019
	Fenestration	1.818	1	0.178

cant.

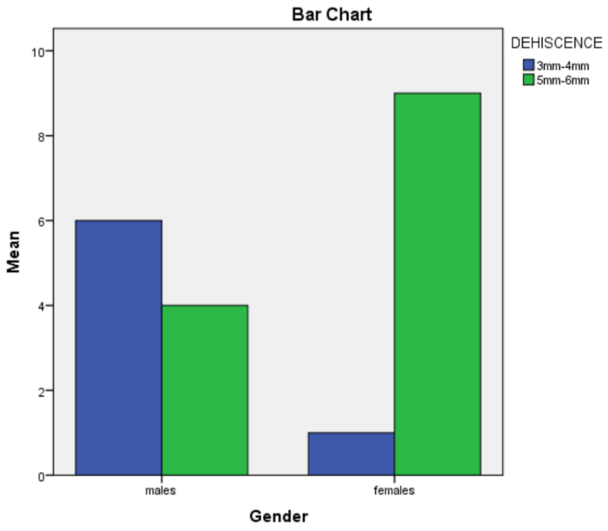

Figure 1: The association of gender and frequency of dehiscence.

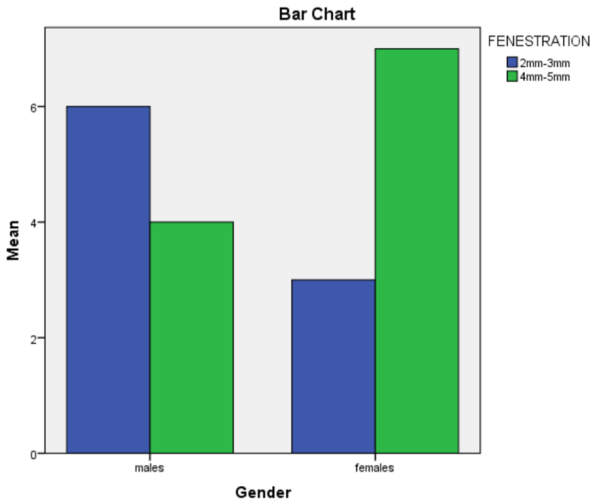

Figure 2: The association of gender and frequency of fenestration.

In the present study, all measurements were done on CBCTs patients requiring orthodontic treatment. On studying the extent of fenestration and dehiscence in males and females, it was reported that there was a significant association of more severity and extent of dehiscence in females than in males. There was no statistically significant association of extent of fenestration between males and females. With regard to patient selection, growing patients had not been included in the study because previous studies have reported that hormonal and functional changes associated with age influence cortical bone thickness (Usui *et al.*, 2007; Papadopoulos, 2014). In our study, CBCT was used since it is the imaging of choice in orthodontics nowadays since a 3-dimensional view of the entire dentition and craniofacial structures but due radiation concerns, CBCT should not routinely be considered in orthodontics (Meena and Kowsky, 2014).

Rupprecht et al. conducted a prevalence study of dehiscence and fenestration in modern American skulls and reported that African-American males and Caucasian females were significantly more likely to have dehiscences, while African-American females were significantly more likely to have fenestrations but this was a craniometric study whereas the present study involved CBCT (Leung *et al.*, 2010). Similarly, Ana et al. reported that the percentage of teeth with considerable bone loss was higher in females, but was not significantly associated (Malčić *et al.*, 2011). Choi et al. reported that adults in crossbite reported higher prevalence to total bony defects and dehiscence, but an association was not

performed between males and females (Choi *et al.*, 2020).

The overall consensus in the available literature on this topic agrees with the findings of the present study. The limitation of this study was a small sample size. Since this was a retrospective study, the settings of the CBCT images could not be controlled. As dehiscence and fenestrations do not have a specific geometric shape, changing the orientation of the image can lead to a slight change in the measurements on measuring vertical diameter.

Future scope indicates that investigations should be carried out pre-and post-orthodontic treatment. Study larger sample size, more no. of teeth should be evaluated, and type of malocclusion should be taken into consideration.

CONCLUSION

Within the limitations of this study, it can be concluded that in females dehiscence defects were wider than males, but no gender association was seen for fenestration.

Funding Support

The authors declare that they have no funding support for this study.

Conflict of Interest

The authors declare that they have no conflict of interest for this study.

REFERENCES

Arvind, T. P., Jain, R. K. 2020. Skeletally-anchored forsus fatigue resistant device for correction of Class II malocclusions -a systematic review and meta- analysis. *Orthodontics and Craniofacial Research*.

Baysal, A., Uysal, T., Veli, I., Ozer, T., Karadede, I., Hekimoglu, S. 2013. Evaluation of alveolar bone loss following rapid maxillary expansion using cone-beam computed tomography. *The Korean Journal of Orthodontics*, 43(2):83.

Buyuk, S. K., Ercan, E., Celikoglu, M., Sekerci, A. E., Hatipoglu, M. 2016. Evaluation of dehiscence and fenestration in adolescent patients affected by unilateral cleft lip and palate: A retrospective cone beam computed tomography study. *The Angle Orthodontist*, 86(3):431–436.

Choi, J. Y., Chaudhry, K., Parks, E., Ahn, J. H. 2020. Prevalence of posterior alveolar bony dehiscence and fenestration in adults with posterior crossbite: a CBCT study. *Progress in Orthodontics*, 21(1):8.

Christopher, J. P., Marimuthu, T., C, K., Devadoss, P., Kumar, S. M. 2018. Prevalence and measurement of anterior loop of the mandibular canal using CBCT: A cross sectional study. *Clinical Implant Dentistry and Related Research*, 20(4):531–534.

Coşskun, İ., Kaya, B. 2019. Appraisal of the relationship between tooth inclination, dehiscence, fenestration, and sagittal skeletal pattern with cone beam computed tomography. *The Angle Orthodontist*, 89(4):544–551.

Hwei, P. C., Thomas, J. T. 2014. Role of Periodontal Therapy in Rapid Tooth Movement. *IOSR Journal of Dental and Medical Sciences*, 13(2):62–65.

Jain, R. K., *et al.* 2014. Comparison of Intrusion Effects on Maxillary Incisors Among Mini Implant Anchorage, J-Hook Headgear and Utility Arch. *Journal of Clinical and Diagnostic Research (JCDR)*, 8(7):21–24.

Kamisetty, S. K., *et al.* 2015. SBS vs Inhouse Recycling Methods-An Invitro Evaluation. *Journal of Clinical and Diagnostic Research (JCDR)*, 9(9):4–8.

Krishnan, S., Pandian, S., Kumar, S. A. 2015. Effect of Bisphosphonates on Orthodontic Tooth Movement—An Update. *Journal of Clinical and Diagnostic Research (JCDR)*, 9(4):1–5.

Leung, C. C., Palomo, L., Griffith, R., Hans, M. G. 2010. Accuracy and Reliability of Cone-Beam Computed Tomography for Measuring Alveolar Bone Height and Detecting Bony Dehiscences and Fenestrations. *American Journal of Orthodontics and Dentofacial Orthopedics: Official Publication of the American Association of Orthodontists, Its Constituent Societies, and the American Board of Orthodontics*, 137(Supple 4):109–119.

Malčić, A. I., Vodanović, M., Matijević, J., Mihelić, D., Mehičić, G. P., Krmek, S. J. 2011. Caries prevalence and periodontal status in 18th century population of Požega-Croatia. *Archives of Oral Biology*, 56(12):1592–1603.

Meena, N., Kowsky, R. D. 2014. Applications of Cone Beam Computed Tomography in Endodontics: A Review. *Dentistry*, 4(7):1–9.

Murugesan, A., Jain, R. K. 2020. A 3D Comparison of Dimension of Infrazygomatic Crest Region in Different Vertical Skeletal Patterns: A Retrospective Study. *International Orthodontics / College European D'orthodontie*, 1761-7227(20):30112–30113.

Papadopoulos, A. M. 2014. Skeletal Anchorage in Orthodontic Treatment of Class II Malocclusion E-Book: Contemporary Applications of Orthodontic Implants, Miniscrew Implants and Mini Plates. First edition. Elsevier Health Sciences. ISBN:

9780723438335. 312pg.

Rothe, L. E., Bollen, A.-M., Little, R. M., Herring, S. W., Chaison, J. B., Chen, C. S.-K., Hollender, L. G. 2006. Trabecular and cortical bone as risk factors for orthodontic relapse. *American Journal of Orthodontics and Dentofacial Orthopedics*, 130(4):476–484.

Samantha, C., Sridharan, S. 2016. Comparison of perception of smile by orthodontists and other specialty dentists: A questionnaire study. *International Journal of Orthodontic Rehabilitation*, 7(3):92–96.

Sun, L., Zhang, L., Shen, G., Wang, B., Fang, B. 2015. Accuracy of cone-beam computed tomography in detecting alveolar bone dehiscences and fenestrations. *American Journal of Orthodontics and Dentofacial Orthopedics: Official Publication of the American Association of Orthodontists, Its Constituent Societies, and the American Board of Orthodontics* , 147(3):313–323.

Timock, A. M., Cook, V., McDonald, T., Leo, M. C., Crowe, J., Benninger, B. L., Covell, D. A. 2011. Accuracy and reliability of buccal bone height and thickness measurements from cone-beam computed tomography imaging. *American Journal of Orthodontics and Dentofacial Orthopedics*, 140(5):734–744.

Usui, T., Uematsu, S., Kanegae, H., Morimoto, T., Kurihara, S. 2007. Change in maximum occlusal force in association with maxillofacial growth. *Orthodontics and Craniofacial Research*, 10(4):226–234.

Vikram, N. R., *et al.* 2017. Ball Headed Mini Implant. *Journal of Clinical and Diagnostic Research (JCDR)*, 11(1):2–3.

Viswanath, A., Ramamurthy, J., Dinesh, S. P. S., Srinivas, A. 2015. Obstructive Sleep Apnea: Awakening the Hidden Truth. *Nigerian Journal of Clinical Practice*, 18(1):1–7.

Xu, G., Ren, S., Wang, D., Sun, L., Fang, G. 2013. Fabrication and Properties of Alkaline Lignin / Poly (Vinyl Alcohol) Blend Membranes. *BioResources*, 8(2).

Yagci, A., Veli, İ., Uysal, T., Ucar, F. I., Ozer, T., Enhos, S. 2012. Dehiscence and fenestration in skeletal Class I, II, and III malocclusions assessed with cone-beam computed tomography. *The Angle Orthodontist*, 82(1):67–74.

Zachrisson, B. U., Alnaes, L. 1974. Periodontal condition in orthodontically treated and untreated individuals. II. Alveolar Bone Loss: Radiographic Findings. *American Journal of Orthodontics*, 44(1):48–55.