Journal of Dentomaxillofacial Radiology, Pathology and Surgery

Summer 2021, Volume 10, Number 3

Research Paper: A comparison of Prevalence of Dilaceration in Mandible and Maxilla Using Cone Beam Computed Tomography in an Iranian Population

Farzane Ostovarrad[1], Abbas Shokri[2], Niloufar Tashayyodi[3*], Mahsa Zolfaghari[4], Soophia Yaghoobi[3]

[1]*Assistant Professor,Department of Oral and Maxillofacial radiology, dental school, Guilan university of Medical sciences, Rasht, Iran*

[2]*Department of Oral and Maxillofacial radiology, dental school, Hamedan university of Medical sciences, Hamedan, Iran*

[3] *Postgraduated Student,Department of Oral and Maxillofacial radiology, dental school, Guilan university of Medical sciences, Rasht, Iran*

[4]*Department of Oral and Maxillofacial radiology, dental school, Guilan university of Medical sciences, Rasht, Iran*

Use your device to scan and read the article online

Citation: Farzane Ostovarrad, Abbas Shokri, Niloufar Tashayyodi, Mahsa Zolfaghari. A comparison of Prevalence of Dilaceration in Mandible and Maxilla Using Cone Beam Computed Tomography in an Iranian Population. Journal of Dentomaxillofacial Radiology, Pathology and Surgery. 2021; 10(3):20-26. http://dx.doi.org/10.32598/3dj.7.4.145

http://3dj.gums.ac.ir

Article info:
Received: 2021/08/15
Accepted: 2021/08/25

Keywords:
Prevalence
Cone-Beam Computed Tomography

ABSTRACT

Introduction: dilaceration is a disturbance in tooth formation that produces a sharp bend or curve in the tooth. this anomaly has a negative effect on the treatment of root canals, orthodontics and surgery. The aim of this study was to determine the prevalence of root dilaceration using Cone Beam Tomography (CBCT).

Materials and Methods: In this study, a total of 206 CBCT images(5434teeth) were analyzed for having dilaceration. The images were evaluated at the Multi Planner section in the coronal and axial view to find mesiodistal dilaceration and in the sagittal view to find buccolingual dilaceration. Deviation of more than 20 degrees of one-third of the apical part of the root in the longitudinal axis of the tooth was considered as dilaceration. Deviation of 20 to 40 degrees, was considered as mild dilaceration, deviation of 41 to 60 degree was considered as moderate dilacerations and deviation more than 61 degrees was considered as severe dilacerations. The data were analyzed by SPSS software version 21 and statistical analysis was performed by Chi Square test.

Results: showed that dilaceration was found in 69.4% of radiographic images and 7.5% of teeth. The most common intensity and direction in teeth with dilacerations were mild dilacerations (62.9%) and distal dilaceration (59.8 %), respectively. The prevalence of dilaceration was not definitely different in the sex and age ($P>0.05$), but its prevalence was significantly higher in maxilla than the mandible and in the maxillary right quadrant than the other quadrants($P<0.05$). dilaceration was more common in posterior teeth and was more prevalence in maxillary second molars, mandibular second molars and mandibular first molars teeth respectively, which was statistically significant in type and number of teeth($P<0.05$).

Conclusion: according to the results of this study, dilaceration has a significant prevalence that shows the necessity of radiographic examination to determine the dilacerations, which is important to prevent complex problems during dental treatment

*** Corresponding Author:**
Niloufar tashayyodi.
Address: Department of Oal and Maxillofacial radiology, dental school, Guilan university of Medical sciences, Rasht, Iran.
Tel: +98-31- 33486428
E-mail: Dr.n.tashayyodi@gmail.com

Journal of Dentomaxillofacial Radiology, Pathology and Surgery

Introduction

Dilaceration is in anomaly described as a deviation angle of 20 degrees or above from the longitudinal axis of the tooth in the apical zone of the root. However, in its severe and less common cases, the crown forms a reverse angle of more than 90 degrees to its root1&2.the causes for dilaceration has not yet been clearly explained and there is ongoing debate regarding that3. The most commonly accepted reason in the literature is trauma while other factors, such as genetics, evolutionary anomaly, formation of scar, severe infection of root, lack of space, effect of unanatomical structure, the proximity to cyst or tumor, radiotherapy, and mechanical interference have also been mentioned; there has not been sufficient evidence for them however4,5.the highest rate of dilaceration prevalence is found in maxillary incisors with 52%; in some other sources it was mentioned to be in mandibular third molar with 12.8%1.in case of need for surgical, endodontic, or orthodontic treatments, teeth with dilaceration need to be properly diagnosed and treated since they have been known to cause complications in regular dental treatments6,7.dilaceration result in a great increase of stress during occlusal forces to the teeth and this affects the stability and longevity of the dental prosthesis8.the prognosis of dilaceration treatment depends on the severity of the case: while in its mild forms, treatment is not considered a necessity, the more serious cases may call for surgical exposures and orthodontic movements; and in truly severe cases, treatments would be more complex and may result in extraction of the tooth3. Radiography is necessary to monitor the condition of root development, angle of dilaceration, determination of the shape, and position of the root3. Although mesial and distal aberrations of the roots are easily recognizable in periapical and panoramic radiography9, buccal and lingual ones are not clearly visible in these two-dimensional radiography. Also, in periapical radiography, the final results can be affected due to the location of the teeth in the bone, their abnormal placement in the panoramic, and depending on the position of focal trough. Thus, there is a need for 3D radiography to determine the shape and position of these roots accurately5. CBCT is a three-dimensional imaging system, and with less doses than CT, it is widely used in most fields of dentistry today10.because of the importance of the subject, the aim of this article is to determine the frequency of root dilaceration by using cone beam computed tomography in an Iranian population.

Materials and Methods

In this descriptive cross-sectional study 206 CBCT scans of patients (mean age: 16.04 ± 5.17 years), including 98females and 108 males, were selected from the archives of CBCT images of a maxillofacial radiology clinic located in west central of Iran from 2016 to 2017. Inclusion criteria: cases with the following conditions were not entered into the study: no tooth root development, facial and maxillofacial lesions, Anodontia, maxillofacial fractures or wire and plate. exclusion criteria were as follows: teeth with hypercementosis and other lesions which made observing the teeth borders difficult. An assigned code of Ethical Committee of Guilan University of Medical Sciences for this research was IR.GUMS.REC.1396.382. "All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Declaration of Helsinki". Informed consent was obtained from all patients for being included in the study. The CBCT images were taken by SoredexTM, Cranex3D®, Tussuula, Finland by selecting a 6*8 cm^3 field of view and Volex size 200 µm (KVP: 90, MA:10, T: 14.2) first, sharpness and contrast were adjusted for a more accurate examination of the images. A maxillofacial radiologist having >10 years of experience selected in MPR images in all three plans of coronal, axial, and sagittal in which the root of tooth was clearly visible in the image. In the coronal view mesiodistal and in sagittal view buccolingual dilacerations. The dilaceration was defined based on 1/3 of apical root deviation from the longitudinal axis of the tooth: 20 to 40 degrees

Ostovarrad F, et al. A comparison of Prevalence of Dilaceration in Mandible and Maxilla Using Cone Beam Computed Tomography in an Iranian Population. Journal of Dentomaxillofacial Radiology, Pathology and Surgery. 2021; 10(3):20-26. http://dx.doi.org/

of deviation of angle was considered mild, 41 to 60 degrees was moderate, and 61 degrees and more was severe(11) (Fig1&2). All of the mentioned measurements were done by two oral and maxillofacial radiologists. Interobserver agreement was reported as 96% (Kappa test).

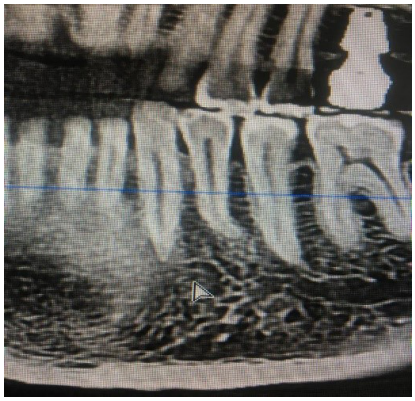

Fig1: an example mesiodistal dilaceration

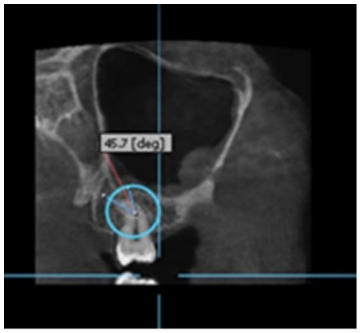

Fig2. An example buccolingual dilaceration

All the gathered data was entered separately for the examined teeth in a form where information such as age, sex, individuals, tooth number, and presence and direction and intensity of dilaceration were recorded. Data were entered into SPSS V.21 software. The level of significance was ≤ 0.05. In order to compare dilacerations based on sex, age, and other factors, chi-square test, and for comparing them regarding mandible or maxilla, quadrant, type, and number of tooth MC Nemar's test was used.

Results

In this study, 206 CBCT radiography samples (5434 teeth) were examined. The majority of cases were between 31 to 50 years (60.7%). Mean and standard deviation of samples were 26.34±4.5. out of the total sample size (206 individuals), 69.4% (143) had at least one dilacerated tooth with 95% confidence interval (75.4% - 62.9%). The results of intraclass correlation (ICC) showed high level of agreement between the two observers' measurements (ICC: 0.945). Also, there was a great internal agreement between the observers (ICC: 0.961).

In 7.5% (410 teeth) of the 5435 studied cases, dilaceration was observed with a 95% confidence interval (6.9%-8.3%).

Table-1: A comparison of distribution of intensity of dilaceration based on orientation

			Intensity of dilaceration			Sum	
			Mild	Moderate	severe		
Orientation	Mesial	Number	13	9	4	26	P=0.001*
		Percentage	50%	34.6%	15.4%	100%	
	Distal	Number	168	67	10	245	
		Percentage	68.6%	27.3%	4.1%	100%	
	Buccal/labial	Number	25	25	6	56	
		Percentage	44.6%	44.6%	10.7%	100%	
	Lingual/palatal	Number	52	26	5	83	
		Percentage	62.7%	31.3%	6%	100%	
Sum		Number	258	127	25	410	
		Percentage	62.9%	31%	6.1%	100%	

The prevalence of dilaceration in women was found to be 72% which is higher than in men (66%), but according to Chi-square test, the difference was not statistically significant (p=0.36). Based on table 1, the most common orientation for dilacerated teeth was the distal with 59.8% of the whole cases (245 teeth out of 5434). The mild intensity was the most frequent

type in mesial, distal, and lingual/palatal orientations (50%, 68.6%, and 62.7% respectively). In buccal/labial mild and moderate orientations were tied at 44.6 percent. The highest level of dilaceration was observed in under 30-year-old group (73.8%), but based on Chi-square test, considering the prevalence of dilaceration in other group , it was not statistically significant (p=0.64). Comparing the distribution frequency of root dilaceration based on the involved jaw showed that its prevalence to be more in maxilla than mandible (58.7%) and the difference was meaningful based on chi-square test (p=0.001). Moreover, the presence of dilaceration on the right half of maxilla was more than other quadrants, and according to chi-square test, this was also significant (p<0.001).

Based on table 2, the frequency of tooth dilaceration was evaluated considering type and number of teeth, with the most prevalent type being posterior teeth, especially the molars; and also based on the number of teeth, number 7 (second molar) was the most dilacerated one. This is statistically meaningful based on the chi-square test (p <0.001) and the least prevalence of dilaceration was observed in the anterior teeth, especially number 1 (central).

Table 2: a comparison of prevalence of dilaceration based on jaw and tooth number

			Prevalence of dilaceration						
			Negative		Positive		Total		
			Number	Percentage	Number	Percentage	Number	Percentage	
Maxilla	Tooth number	1	368	14.9	7	2.5	375	13.7	
		2	346	14	21	7.6	367	13.4	
		3	354	14.3	28	10.1	382	13.9	
		4	320	13	21	7.6	341	12.4	
		5	289	11.7	31	11.2	320	11.7	
		6	254	10.3	57	20.7	311	11.3	
		7	247	10	89	32.2	336	12.2	
		8	291	11.8	22	8	313	11.4	P=0.001*
Mandible	Tooth number	1	398	15.6	2	1.5	400	14.9	
		2	385	15.1	2	1.5	387	14.4	
		3	398	15.6	4	3	402	14.9	
		4	335	13.1	12	9	347	12.9	
		5	318	12.4	13	9.7	331	12.3	
		6	233	9.1	34	25.4	267	9.9	
		7	265	10.4	38	28.4	303	11.3	
		8	223	8.7	29	21.6	252	9.4	

In multiple factor analysis (table 3) based on logistic regression model of factors related to dilaceration, the data suggested that among the studied variables of age, sex, type of tooth, number of teeth, and quadrant, the latter one was recognized to be the most important factor (P<0.001); the possibility of dilaceration in right quadrant of maxilla was 1.73 times higher than that of left mandible (reference group). Left maxilla was 1.79 times higher than reference group, but relative odds of right mandible compared to left mandible were not statistically significant (p=0.078). Also, the possibility of dilaceration in canine teeth compared to incisors (reference group) and premolar teeth to incisors were 1.99 times and 2.85 times higher, respectively. The chances were found to be 1.8 times higher in molars than incisors (the reference group).

Ostovarrad F, et al. A comparison of Prevalence of Dilaceration in Mandible and Maxilla Using Cone Beam Computed Tomography in an Iranian Population. Journal of Dentomaxillofacial Radiology, Pathology and Surgery. 2021; 10(3):20-26. http://dx.doi.org/

Table 3: Multiple factor analysis of various causes of dilaceration

	B	S.E	P*	Odds ratio	95% Insurance level	
					Lower limit	Upper limit
Quadrant			0.0001			
Maxilla, right	0.0547	0.015	0.0001	1.729	1.288	2.32
Maxilla, left	0.0581	0.0152	0.0001	1.789	1.328	2.407
Mandible, right	-0.321	0.182	0.078	0.726	0.508	1.026
Mandible, left	Reference group			1		
Tooth type			0.0001			
Canine	0.69	0.254	0.007	1.993	1.21	3.281
Premolar	1.049	0.214	0	2.854	1.876	4.343
Molar	2.097	0.191	0	8.144	5.602	11.841
Incisor	Reference group			1		
Width from origin (constant value)	-4.103	0.208	0	0.017		

Discussion

This study found the prevalence of dilaceration to be 69.4%, meaning that, approximately, 70 people out of every 100, have it in at least one of their teeth (regardless of its severity). This was consistent with Luke's(12) study of 425 panoramic radiography samples done in the U.A.E (61.4% prevalence). On the other hand, Bilge(13), in Turkey, investigated 1200 panoramic radiography samples and reported a 16.3% frequency for dilaceration . Colak(1) performed the research on 6900 samples and declared the rate to be 16%. It should be mentioned, however, that his inclusion criteria was a tougher one and he considered a tooth dilacerated only if the angle of root deviation from the longitudinal axis of the tooth was 90 degrees. Thus , the results achieved from these two studies(1,13) were different from the present one and the Luke's(12). The reason for the mentioned discrepancy can be due to difference in definition of dilaceration, dissimilar measurement methods, no inclusion of buccolingual dilaceration, and the difference in ethnic background, and number of subjects studied(14). One of the strong points of the current study can be using CBCT, since it is able to identify dilaceration in teeth in all directions – even buccolingual ones – with the highest accuracy and lowest errors compared to other radiography methods. In their studies, Walia(15) and Mahesh(16), also considered the use of CBCT a must for identifying dilaceration .

For performing the present study, a total of 5434 teeth were examined, 410 had dilaceration and most were in mild forms (69% of the total dilacerations), followed by moderate and severe forms, respectively (table 1 and 2). The classification criteria for intensity of dilaceration in various studies have not been the same. Here, angles of 20 to 40 degrees were considered mild, 41 to 60 degrees moderate, and 61 degrees and more severe. Without considering such grouping and methods of measurement, Silva(3) reported mild, moderate, and severe dilaceration as 73%, 17.0%, and 9%, respectively, which is consistent with the results of the present study in terms of order of dilaceration distribution based on intensity3.

In this study, most of the dilacerations were found in the distal direction (59.8%) and this can be attributed to the natural tendency of the root end of most teeth to be distal which causes majority of them to form in this direction. In other studies, however, they were not possible to be identified since due to the use of 2D radiography they were not able to find buccolingual dilacerations and thus the results could not to be taken for granted. Nevertheless, Silva(3) cites a rate of 95.1% for distal dilacerations and that is most consistent to the study at hand. But this higher percentage can be due to lack of observation, and disregarding

buccolingual dilacerations. In the current research, 72.2% of females and 66.3% of males had dilaceration and although the frequency of observation was higher among women, this was not statistically significant. There was also no meaningful difference in the prevalence of dilaceration in different age groups. Colak(1) in Turkey, announced a meaningfully higher occurrence in women compared to men. In the present study, the prevalence of dilaceration in two different quadrants was investigated and the highest frequency was in the right maxilla, with 0.49% of images showing at least one or more in that quadrant. Left maxilla, left mandible and right mandible were next, respectively, which shows a significant and meaningful difference. According to Gaikwad's(17) study in India, the highest incidence of tooth dilaceration was in the maxillary lateral, and mandibular third, and first molars, respectively, while anterior mandibles had the lowest number in that study. In their research, Nabavizadeh(6) and colleagues concluded that dilaceration was more frequent in the mandibular second molars, followed by first molar of maxilla and first molar of mandible. Colak(1), also, reported mandibular third and second molars to have the highest prevalence of dilaceration. Miloglu et al(2) too, reported its most frequent occurrence in posterior teeth and mentioned the mandibular third molar as the most affected tooth. On the other hand, Miloglu(2) found cases of dilaceration neither in maxillary and mandibular central incisors nor in mandibular lateral. While Silva(3) reported the highest prevalence of dilaceration in maxillary lateral incisors. In the present study, dilaceration in posterior teeth was observed in 11.1% of entire cases which was more than anterior teeth with a 2.8 percentage. This difference was not only statistically meaningful, but also important regarding the relation between dilaceration and trauma. Since its higher prevalence in posterior teeth can dismiss the hypothesis that considers trauma as the leading cause of dilaceration and this may lead to a theory for its happenstance independent from trauma. Similar to the current study, Nabavizadeh(6) in Shiraz, Iran, and Miloglu(2) and Çolak (1) in Turkey, considered the higher prevalence of dilaceration in posterior teeth rejecting trauma as its major cause since trauma occurs more frequently in the anterior teeth. With regard to the mentioned points, the origin of dilaceration can be attributed to developmental disorders, although this calls for further investigation. In this study, the highest prevalence was in maxillary second molars (21.7% of dilacerated teeth) and second to fourth place went to mandibular second, first, and third molars, respectively. In terms of number of teeth, number 7 had the highest prevalence of dilaceration with 19.9% of the cases and the lowest were observed in mandibular central and lateral incisors, mandibular canine and maxillary central incisors respectively (0.48% of dilacerated teeth). The lower right central tooth was the only one with no dilaceration.

Conclusion

In the present study, using CBCT, the prevalence of root dilaceration in an Iranian subpopulation was investigated. Finally, it was calculated to be present in 69.4 % of the samples and 7.5% of the teeth. Also, there were no significant differences between women and men, and between age groups. The most common intensity and direction were the mild and distal, respectively. Dilaceration was more common in the posterior teeth, especially in the maxillary second molar, mandibular second molar and mandibular first molar. The results also show that dilaceration is more likely to be found in the maxilla, especially in the maxillary right quadrant than in other regions. And before starting medical treatment, it is advisable to provide radiography for identifying dilaceration in order to prevent complications during treatment process. CBCT is also recommended if more accurate data is needed regarding the shape and position of the tooth.

References

1. Çolak H, Bayraktar Y, Hamidi M, Tan E, Çolak T. Prevalence of root dilacerations in Central Anatolian Turkish dental patients. West Indian Medical Journal. 2012;61(6):635-9.https://doi.org/10.1100/2012/804278

2. Miloglu O, Cakici F, Caglayan F, Yilmaz A-B,

Demirkaya F. The prevalence of root dilacerations in a Turkish population. Med Oral Patol Oral Cir Bucal. 2010;15(3):e441-e4.https://doi.org/10.4317/medoral.15.e441

3. Silva BFd, Costa LED, Beltrão RV, Rodrigues TL, Farias RLd, Beltrão RTS. Prevalence assessment of root dilaceration in permanent incisors. Dental Press Journal of Orthodontics. 2012;17(6):97-102.https://doi.org/10.1590/S2176-94512012000600020

4. Neto JV, de Pinho Costa S, Estrela C. Orthodontic-surgical-endodontic management of unerupted maxillary central incisor with distoangular root dilaceration. Journal of endodontics. 2010;36(4):755-9.https://doi.org/10.1016/j.joen.2009.12.032

5. Hecht RS. Root Shape Frequency and Direction of Dilaceration: a CBCT Study: University of Southern California; 2013.

6. Nabavizadeh M, Shamsi MS, Moazami F, Abbaszadegan A. Prevalence of root dilaceration in adult patients referred to Shiraz dental school (2005-2010). Journal of Dentistry. 2013;14(4):160.

7. Mahesh R Ki, Sivakumar M. Dilaceration and Eruption Disturbances in Permanent Teeth: A Sequelae of Trauma to Their Predecessors-Diagnosis and Treatment Using Cone Beam CT. Journal of Clinical and Diagnostic Research. 2014;5:10-2.

8. Celik E, Aydinlik E.eefect of a dilacerated root on stress distribution to the teeth and supporting tissue. Journal of prosthetic dentistry.1991;65:771-7.https://doi.org/10.1016/S0022-3913(05)80010-1

9. Van Elslande D, Heo G, Flores-Mir C, Carey J, Major PW. Accuracy of mesiodistal root angulation projected by cone-beam computed tomographic panoramic-like images. American Journal of Orthodontics and Dentofacial Orthopedics. 2010;137(4):S94-S9.https://doi.org/10.1016/j.ajodo.2009.02.028

10. Estrela C, Bueno MR, Sousa-Neto MD, Pécora JD. Method for determination of root curvature radius using cone-beam computed tomography images. Brazilian Dental Journal. 2008;19(2):114-8.https://doi.org/10.1590/S0103-64402008000200005

11. Topouzelis N, Tsaousoglou P, Pisoka V, Zouloumis L. Dilaceration of maxillary central incisor: a literature review. Dental Traumatology. 2010;26(5):427-33.https://doi.org/10.1111/j.1600-9657.2010.00915.x

12. Luke AM, Kassem RK, Dehghani SN, Mathew S, Shetty K, Ali IK, Pawar AM. Prevalence of dental developmental anomalies in patients attending a Faculty of Dentistry in Ajman, United Arab Emirates. Pesquisa Brasileira em Odontopediatria e Clinica Integrada.2017;17(1):1-5.https://doi.org/10.4034/PBOCI.2017.171.38

13. Bilge NH, Yeşiltepe S, Ağırman KT, Çağlayan F, Bilge OM. Investigation of prevalence of dental anomalies by using digital panoramic radiographs. Folia morphologica.2018;77(2):323-8.https://doi.org/10.5603/FM.a2017.0087

14. White SC, Pharoah MJ. White and pharoah's oral radiology e-book: principles and interpretation. Elsevier Health Sciences; 2014.

15. Walia PS, Rohilla AK, Choudhary S, Kaur R. Review of dilaceration of maxillary central incisor: A mutidisciplinary challenge. International journal of clinical pediatric dentistry. 2016;9(1):90.https://doi.org/10.5005/jp-journals-10005-1341

16. Mahesh R, Kanimozhi IG, Sivakumar M. Dilaceration and eruption disturbances in permanent teeth: a sequelae of trauma to their predecessors-diagnosis and treatment using Cone Beam CT. Journal of clinical and diagnostic research: JCDR. 2014;8(5):ZD10.

17. Gaikwad DR. Dilaceration… A Frequency Encountered challenge in Dental Treatment. International Journal of Advaned Research.2016;4(9):872-5https://doi.org/10.21474/IJAR01/1555