

The prevalence of root dilaceration among southern Jordanian population

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ABSTARCT

Objective: The aim of this study was to investigate the prevalence of root dilacerations in a group of Jordanian dental patients and assess the distribution of this anomaly among different types of teeth.

Material and methods: A cross-sectional study was conducted. Dental digital radiographical records (i.e. digital panoramic X-ray images) were examined for dental patients who were treated at the Dental Department, Prince Ali Ben Al-Hussien Hospital, Al-Karak, Jordan. All digital panoramic X-ray images were viewed using the Carestream software®. Other pertinent data such as age and gender were extracted from the patients' files. A p value < .05 was deemed statistically significant.

Results: The records of 1,004 patients were included in this cross-sectional study. The mean age of these patients was 35.6 ± 16.3 years. The patients included 497 males (mean age 36.9 ± 17 years) and 507 female patients (mean age 35 ± 15.7 years). A total of 27,229 teeth were examined, and 1,002 were excluded because of incomplete root formation, while 3,897 teeth were reported missing as stated in the examined records. The findings of this study reveal that the prevalence of dilaceration was 0.8% (225 teeth out of the total 27,229 teeth). In addition, more dilacerations were observed in mandibular arch (139 teeth) than maxillary jaw (86 teeth). Mandibular third molars (11.1%) were the most frequent dilacerated teeth, followed by maxillary third molars (2.3%), maxillary second premolars (1.3%), mandibular second molars (1.1%), and maxillary second molars (1%). Dilacerations were the most prominent in the apical third (51%), followed by the middle third of the root (46%), while the coronal third exhibited the least dilacerations (2.6%).

Although dilacerations were more common in female patients (76 patients, 56%) than male patients (60 patients, 44%), the difference was not statistically significant ($p = .177$).

Conclusions: Dilaceration is an uncommon dental anomaly. However, a proper diagnosis is crucial to increase the success of various dental treatments, reduce the burden of overlooked dilacerated teeth on the patients, and minimise medicolegal issues of failed or complicated dental procedures that may be required due to undiagnosed dilacerated teeth.

Keywords: Dilaceration, Dental Root, Root Morphology, Jordan.

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Introduction

Dilaceration is a deviation (i.e. bending) in the linear relationship of tooth crown in relation to its root or it is an angulation or sharp curve in the root or the crown of a developed tooth of 90 degrees or more.¹ The term was used for the first time by Tomes.²

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The most prevalent theory concerning the development of dilaceration is trauma to the primary teeth that can cause displacement of the calcified portion of the permanent teeth

In relation to the non-calcified portion.³⁻⁶ Another theory for the development of dilacerations in case of no history of trauma is idiopathic developmental disturbance.^{7,8} Dilaceration that affects the crown can be observed through visual inspection during clinical examination; however, radiographic assessment is needed to diagnose root dilaceration.⁹ Radiographic evaluation of root dilacerations is performed in two planes, and the dilaceration can be categorised as mesial, distal, or orofacial (i.e. buccal or lingual direction).¹⁰ The last one can be diagnosed once bull's eye appearance (a round opaque area with radiolucency in its central region) is detected.¹¹ Although dilaceration can manifest in both permanent and deciduous dentition, its prevalence is more in the former.¹² While some studies observed no gender predilection for this anomaly¹³, others reported a male to female ratio of 1:6.^{14,15} Diagnosis of dilaceration is vital before performing dental procedures including endodontic treatment³, surgical extraction¹⁶, and orthodontic treatment.¹⁷ In case of overlooked dilaceration, these procedures would be immensely demanding and susceptible to failure. Hence, adequate diagnosis and awareness of dilaceration prevalence are instrumental in providing effectual, high-quality, and safer dental treatment.

The aim of this study was to methodically investigate the prevalence of root dilaceration in a group of Jordanian dental patients and assess the distribution of this anomaly among different types of teeth.

Materials and Methods

A cross-sectional study was conducted at the prince Ali Ben Al Hussein hospital which is part from Jordanian Royal Medical Service (JRMS) hospitals. Prior to the start of the study, the requisite ethical approval was sought from and granted by the Human Research Ethics Committee at the JRMS, and all research steps were undertaken in accordance with the ethical principles of the Helsinki Declaration. Dental digital radiographical records (i.e. digital panoramic X-ray images) were examined for dental patients who were treated at the Dental Department, Prince Ali Ben Al-Hussien Hospital, Al-Karak, Jordan over a three-year period (from 2013-2015). All digital panoramic X-ray images were viewed using the Carestream software®. Other pertinent data such as age and gender were extracted from the patients' files. Exclusion criteria included dental digital panoramic X-ray images with inadequate quality and dental digital panoramic X-ray images of only primary teeth. In addition, teeth with incomplete root formation were excluded. Supernumerary teeth were not counted as examined teeth as they exceed the normal dentition count. Diagnosing criteria of root dilaceration was the following: a tooth was recognised as having mesial or distal root dilaceration if there was a deviation of 90 degrees or more from the normal long axis of the tooth. Orofacial direction of the dilacerations was determined by evaluating the bull's eye appearance of the root, which results from the root deviation of 90 degrees or more.

The deviations were assigned to either apical, middle, or the coronal third of the root. In case of multirooted teeth, a tooth was recognised as having the dilacerations of the root if at least one root exhibited dilaceration. Regarding the prevalence of dilaceration, multirooted teeth having one or more dilacerated roots were counted as a single case of root dilaceration. To minimise variability in the analysis of root dilacerations, meticulous examinations were conducted jointly by the first two authors of this study.

Statistical analysis: All data were amassed, coded, and statistically analysed using the Statistical Package for Social Sciences (SPSS 20; Chicago, IL, USA) Program. Patients' characteristics and the prevalence rate were reported using descriptive statistics. The distribution of dilacerations was assessed among the jaws and the teeth. The Pearson chi-squared (χ^2) test was used to evaluate the effect of gender on the prevalence of dilaceration. A p-value < .05 was considered statistically significant.

Results

The records of 1,004 patients were included in this cross-sectional study. Characteristics of included patients are succinctly presented in Table 1. The age range of the included patients was (19-52) with a mean of 35.6 ± 16.3 years. Patients were distributed approximately equally based on gender with 497 male patients (mean age 36.9 ± 17 years) and 507 female patients (mean age 35 ± 15.7 years). A total of 27,229 teeth were examined and 1,002 were excluded on the basis of the exclusion criteria of incomplete root formation (Table 2). Moreover, 3,897 teeth were reported as missing as specified in the examined records (Table 2). The findings of this study reveal that the prevalence of dilaceration was 0.8% (225 teeth out of the total 27,229 teeth). In addition, the dilacerations occurred more in the mandibular arch (139 teeth) than the maxillary arch (86 teeth). The distribution of dilaceration among teeth is encapsulated in Table 3. According to the results of this study (Table 3), mandibular third molars (11.1%) were the most frequent dilacerated teeth, followed by maxillary third molars (2.3%), maxillary second premolars (1.3%), mandibular second molars (1.1%), and maxillary second molars (1%). Root dilacerations were not detected in mandibular central incisors and mandibular canines (Table 3). Regarding the location of dilacerations along the root length, the results of this study (Table 4) reveal that dilacerations occurred predominantly in the apical third (51%), followed by the middle third of the root (46%), while the coronal third exhibited the least dilacerations (2.6%). The results of this study (Figure 1, Table 5) show that dilacerations were more common in female patients (76 patients, 56%) than male patients (60 patients, 44%). The difference was, however, not statistically significant based on chi-squared (χ^2) test ($p = .177$) (Table 5).

Table I: Characteristics of included patients.

	Participants (n)	Age (years) \pm SD
Male	497	36.9 ± 17
Female	504	35 ± 15.7
Total	1,004	35.6 ± 16.3

Table II: Distribution of examined teeth among arches and excluded teeth with reasons.

	Examined teeth	Incomplete root formation	Missing teeth
Maxillary	13,545 (84.3%)	492 (3.1%)	2,027 (12.6%)
Mandibular	13,684 (85.2%)	510 (3.2%)	1,870 (11.6%)
Total	27,229 (84.8%)	1,002(3.1%)	3,897(12.1%)

Table III: Distribution of the prevalence of root dilaceration amongst different tooth types.

Tooth	Number of examined teeth	Number of dilacerations			Percentage of total root dilacerations (%)
		Right	Left	Total	
Total	27,229	94	131	225	0.8
Maxillary	13,545	39	47	86	0.6
Permanent central incisor	1,903	1	2	3	0.2
Permanent lateral incisors	1,892	1	2	3	0.2
Permanent canine	1,906	0	1	1	0.1
First premolar	1,803	4	7	11	0.6
Second premolar	1,704	12	10	22	1.3
Permanent first molar	1,715	3	5	8	0.5
Permanent second molar	1,723	7	10	17	1.0
Third molar	899	11	10	21	2.3
Mandibular	13,684	55	84	139	1.0
Permanent central incisor	1,918	0	0	0	0.0
Permanent lateral incisors	1,938	0	1	1	0.1
Permanent canine	1,936	0	0	0	0.0
First premolar	1890	1	2	3	0.2
Second premolar	1,774	5	3	8	0.5
Permanent first molar	1,593	3	1	4	0.3
Permanent second molar	1,697	6	13	19	1.1
Third molar	938	40	64	104	11.1

Table IV: Distribution of the prevalence of root dilaceration according to the location in the tooth root (coronal, middle, and apical).

		Coronal	Middle	Apical	Total
Permanent central incisor	Upper	0	2	1	3
	Lower	0	0	0	0
Permanent lateral incisor	Upper	0	1	2	3
	Lower	0	0	1	1
Permanent canine	Upper	0	0	1	1
	Lower	0	0	0	0
First premolar	Upper	1	6	4	11
	Lower	0	0	3	3
Second premolar	Upper	0	10	12	22
	Lower	0	2	6	8
Permanent first molar	Upper	0	5	3	8
	Lower	0	0	4	4
Permanent second molar	Upper	0	6	11	17
	Lower	1	12	6	19

Third molar	Upper	1	9	11	21
	Lower	3	51	50	104
Total	Upper	2	39	45	86
	Lower	4	65	70	139
Total (Percentage)		6 (2.7%)	104(46.2)	115(51.1%)	225 (100%)

Table V: Distribution of dilacerations based on gender.

		Presence of dilaceration		Total
		No dilaceration	dilaceration	
Gender	Male	437	60	497
	Female	431	76	507
Total		868	136	1004
P-value*			.177	

*P-value based on chi-squared (χ^2) test.

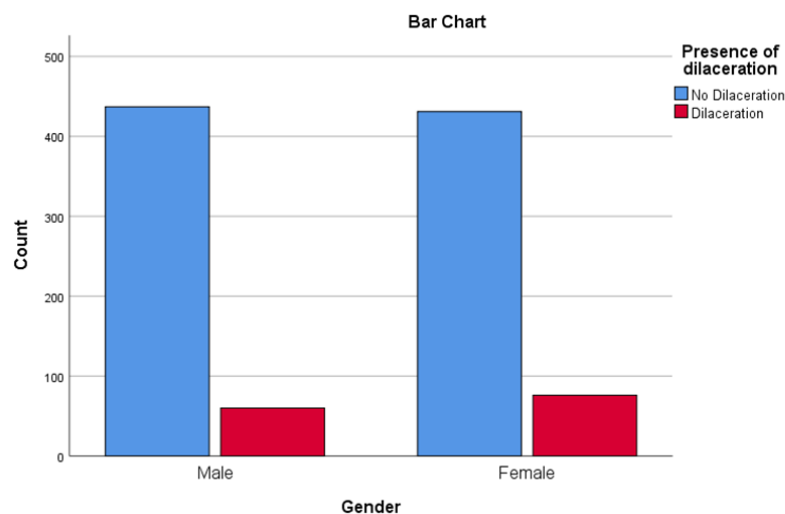


Figure 1: Distribution of dilacerations based on gender.

Discussion

Dilaceration is an unusual anomaly that can potentially affect the dental root and crown. Root dilaceration is diagnosed usually through radiographical examination.^{3,9} Hence, proper radiographic evaluation of dental patients is vital before performing any dental procedure, especially root canal treatment, extractions, and orthodontic treatment, as these dental treatments could be adversely impacted with any overlooked dilaceration. This study focused on evaluating the prevalence of root dilaceration among Jordanian patients

who had been treated at a JRMS hospital. Hamasha et al.⁹ considered dilaceration as a deviation of 90 degrees or more of the root from the normal axis of the tooth while Chohayeb¹⁸ considered a tooth or a root to have Dilaceration if there was a deviation of 20 degrees or more from the normal axis of the tooth. In this cross-sectional study, the diagnosis of dilacerations was predicated on the definition posited by Hamasha et al.⁹ due to its higher accuracy. It is a challenge to explore and negotiate root canal system in dilacerated teeth because of high degree of root curvature which can lead to many endodontic errors as ledging, transportation and zipping.³ The rate of endodontic errors such as ledging, transportation, and zipping can be higher in these teeth.³ In addition, a dilacerated root may be easily fractured during the surgical tooth extraction.^{8,17} The presence of the dilacerations during orthodontic tooth movement can make it complicated.¹⁹

With this study, we found that the prevalence of root dilaceration among Jordanian patients was 0.8%. Our result was fairly lower with the results of Ledesma-Montes et al. (1.6%)²⁰ and Thongudomporn et al. (1.8%)¹⁷, while it was higher than those reported by Malčić's et al. (0.32%)¹⁰ and Nabavizadeh et al. (0.3%)¹¹. Furthermore, the prevalence of dilaceration reported in this study was lower than that reported by Udoeye et al. (3%)²¹, Hamasha et al. (3.8%)⁹ Miloglu et al. (9.5%)²², and Ezoddiny et al. (15% of patient)²³. The variability in dilaceration's prevalence between the studies may plausibly be related to ethnic variations and variability in the diagnostic criteria and the radiographic evaluation methods that were used to diagnose dilaceration. Regarding the relationship between the presence of dilacerations and gender, the findings of this study reveal that there was no gender predilection for the presence of dilacerations. This is congruent with previous studies^{9,13,17,22}. In contrast, other studies^{21,24} reported that dilacerations occurred more commonly in females. The etiology of dilaceration is still disputable. If we regarded trauma to the primary teeth as the primary cause for the development of dilaceration, then we should detect more dilacerations in the anterior teeth. However, the results of this study were consistent with previous studies^{9,21,22,24} in that dilacerations were more common in the posterior area which is less affected by trauma. This finding can be explained by the proposal of development of dilacerations due to idiopathic developmental disturbances in tooth tissue calcification. We observed that dilacerations were more common in mandible. This result is congruous with the result reported by Hamasha et al.¹, while it is against the result reported by Udoeye et al.²¹ and Malcic et al.⁹, who found that dilacerations were more common in maxilla. Similar to the results of previous studies^{10,25}, this study showed that dilacerations occur more commonly in the apical third of the teeth which agrees with the result showed in the study of Miloglu O et al.²². Panoramic radiographs, used to diagnose dilacerations in many previous studies^{20,24,25}, were used to diagnose dilacerations in this study. The limitations of this study include the authors' inability to assess the trauma history of the included patients and the inability to investigate the associated syndromes and developmental anomalies. In this study diagnosis of dilaceration depends on panoramic view, while periapical is superior in diagnosis²¹. According to Jafarzadeh et al.³, certain syndromes and developmental anomalies have been associated with dilaceration, which include Smith-Magenis syndrome, the hypermobility type of Ehlers-Danlos syndrome, Axenfeld-Rieger syndrome, and congenital ichthyosis.

Conclusions

According to the results of this study, prevalence of dilaceration was 0.8% in Jordanian dental patients. Dilaceration is an uncommon dental anomaly. However, proper diagnosis is imperative to increase the success of various dental treatments, reduce the burden of overlooked dilacerated teeth on the patients, and minimise medicolegal issues of failed or complicated dental procedures that can be caused by dilacerated teeth.

References

1. **White S PM.** Oral radiology principles and interpretation. 4th ed. St. Louis, MI, USA: Mosby; 2000.
2. **Tomes J.** A course of lectures on dental physiology and surgery. Am J Dent Sci 1848 -7;8(4):313-350.
3. **Jafarzadeh H, Abbott PV.** Dilaceration: Review of an endodontic challenge. J Endod 2007 -09;33(9):1025-1030.
4. **Maragakis MG.** Crown dilaceration of permanent incisors following trauma to their primary predecessors. J Clin Pediatr Dent 1995;20(1):49-52.
5. **Kearns HP.** Dilacerated incisors and congenitally displaced incisors: Three case reports. Dent Update 1998 -10;25(8):339-342.
6. **von Gool AV.** Injury to the permanent tooth germ after trauma to the deciduous predecessor. Oral Surg Oral Med Oral Pathol 1973 -01;35(1):2-12.
7. **Andreasen JO, Sundström B, Ravn JJ.** The effect of traumatic injuries to primary teeth on their permanent successors. I. A clinical and histologic study of 117 injured permanent teeth. Scand J Dent Res 1971;79(4):219-283.
8. **Chadwick SM, Millett D.** Dilaceration of a permanent mandibular incisor. A case report. Br J Orthod 1995 -08;22(3):279-281.
9. **Hamasha AA, Al-Khateeb T, Darwazeh A.** Prevalence of dilaceration in jordanian adults. Int Endod J 2002 -11;35(11):910-912.
10. **Malčić A, Jukić S, Brzović V, Miletić I, Pelivan I, Anić I.** Prevalence of root dilaceration in adult dental patients in croatia. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006 -07;102(1):104-109.
11. **Nabavizadeh MR, Sedigh Shamsi M, Moazami F, Abbaszadegan A.** Prevalence of root dilaceration in adult patients referred to shiraz dental school (2005-2010). J Dent (Shiraz) 2013 -12;14(4):160-164.
12. **Yeung KH, Cheung RCT, Tsang MMH.** Compound odontoma associated with an unerupted and dilacerated maxillary primary central incisor in a young patient. Int J Paediatr Dent 2003 -05;13(3):208-212.
13. **Eversole LR.** Clinical outline of oral pathology: Diagnosis and treatment. : PMPH-USA; 2001.
14. **Stewart DJ.** Dilacerate unerupted maxillary central incisors. Br Dent J 1978 -10-17;145(8):229-233.
15. **McNamara T, Woolfe SN, McNamara CM.** Orthodontic management of a dilacerated maxillary central incisor with an unusual sequela. J Clin Orthod 1998 -05;32(5):293-297.
16. **Ph D, Dh L.** Dilaceration--a surgical/orthodontic solution. Br Dent J 1984 /01/01;156(1):16-18.
17. **Thongudomporn U, Freer TJ.** Prevalence of dental anomalies in orthodontic patients. Aust Dent J 1998 -12;43(6):395-398.

18. **Chohayeb AA.** Dilaceration of permanent upper lateral incisors: Frequency, direction, and endodontic treatment implications. *Oral Surg Oral Med Oral Pathol* 1983 -05;55(5):519-520.
19. **Tanaka E, Hasegawa T, Hanaoka K, Yoneno K, Matsumoto E, Dalla-Bona D, et al.** Severe crowding and a dilacerated maxillary central incisor in an adolescent. *Angle Orthod* 2006 -05;76(3):510-518.
20. **Ledesma-Montes C, Hernández-Guerrero J, Jiménez-Farfán M.** Frequency of dilaceration in a mexican school-based population. *J Clin Exp Dent* 2018 -07;10(7):e665-e667.
21. **Udoye CI, Jafarzadeh H.** Dilaceration among nigerians: Prevalence, distribution, and its relationship with trauma. *Dental Traumatology* 2009;25(4):439-441.
22. **Miloglu O, Cakici F, Caglayan F, Yilmaz A, Demirkaya F.** The prevalence of root dilacerations in a turkish population. *Med Oral Patol Oral Cir Bucal* 2010 -05-01;15(3):441.
23. **Ezoddini AF, Sheikhha MH, Ahmadi H.** Prevalence of dental developmental anomalies: A radiographic study. *Community Dent Health* 2007 -09;24(3):140-144.
24. **H C, Y B, Mm H, E T, T C.** Prevalence of root dilacerations in central anatolian turkish dental patients. *West Indian Med J* 2012 /09/01;61(6):635-639.
25. **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 12/;17(6):97-102.