

Prevalence of Root Dilaceration in a Subpopulation of Northeast Turkey

Türkiye'nin Kuzey Doğu Populasyonunda Kök Dilaserasyon Sıklığı

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ABSTRACT Objective: The aim of this study was to investigate the frequency and distribution of root dilaceration between genders and tooth types in a Turkish subpopulation. **Material and Methods:** This retrospective study was conducted by evaluating panoramic radiographs of 954 patients ranging in age from 18 to 35 years. All permanent teeth were investigated, and the data obtained were recorded in the maxilla and mandible according to gender and tooth type. Pearson's chi-squared test was used to determine the statistical differences between genders, and between maxilla and mandible. **Results:** Root dilacerations were found in at least 163 (17.1%) of 954 patients, with no statistical difference between the genders. A total of 253 out of 20114 teeth were found to have root dilacerations (1.25%). Root dilaceration was more prevalent in the maxilla (1.3%) than in the mandible (1.25%), with no statistical difference, and it was most commonly found in the mandibular third molar (6.2%). **Conclusion:** In this study, the prevalence of root dilaceration was 17.1% in patients and 1.25% in teeth. Root dilaceration was most commonly found in the mandibular third molar and in the maxillary lateral incisor in the anterior region.

Key Words: Prevalence; radiography, panoramic; tooth abnormalities

ÖZET Amaç: Bu çalışmanın amacı bir Türk populasyonunda cinsiyet ve diş tiplerine göre kök dilaserasyonunun sıklığını ve dağılımını belirlemektir. **Gereç ve Yöntemler:** Yaşları 18 ile 35 yıl arasında değişen 954 hastanın dijital panoramik radyografileri kullanılarak retrospektif bir çalışma yapıldı. Tüm kalıcı dişler incelendi ve elde edilen veriler cinsiyet ve diş tiplerine göre üst ve alt çenede kaydedildi. Erkek ve kadın hastalar arasında, alt ve üst çene arasında farklılığı belirlemek için Pearson ki-kare testi kullanıldı. **Bulgular:** 954 hastanın 163'ünde kök dilaserasyonu bulundu (%17,1) ve cinsiyetler arasında istatistiksel farklılık yoktu. 20114 dişin 253'ünün kök dilaserasyonuna sahip olduğu bulundu (%1,25). Kök dilaserasyonunun sıklığı üst çenede (%1,3) alt çeneden (%1,25) yüksekti ve farklılık istatistiksel olarak önemli değildi. Alt 3. azı dişlerinin en çok etkilenen dişler olduğu bulundu (%6,2). **Sonuç:** Kök dilaserasyonunun sıklığı, hastaların %17,1'inde ve dişlerin %1,25'inde gözlemlendi. Kök dilaserasyonu alt 3. azı dişlerinde çok yaygındı. Ön bölgede üst yan kesici dişlerde daha sıkı.

Anahtar Kelimeler: Prevalans; radyografi, panoramik; diş anomalileri

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Dilaceration is a disturbance in tooth formation that produces a sharp bend or curve in the linear relationship of the crown of a tooth to its root; it is an angulation or sharp bend of 90° or greater in the root or crown of a developed tooth. Most cases are idiopathic, and radicular dilaceration is not defined clinically in most cases. One or more teeth

may be affected by dilaceration.¹ The etiology of this anomaly is not exactly known. Some researchers suggest that an acute mechanical injury to the primary predecessor tooth causes dilaceration in the underlying developing succedaneous permanent tooth, which is the most accepted etiology, but others believe that dilaceration may be a true developmental anomaly that is not related to a history of traumatic impact.²⁻⁵

Dilaceration can occur anywhere along the length of the tooth, such as the crown, the cementoenamel junction, along the root, or the root apex.⁶ Radiographic examination is required to diagnose dilaceration of the root, while dilaceration of a crown can be visually observed in the mouth.⁷ The definition of root dilaceration varies among authors. As some authors consider a tooth to be dilacerated when there is a mesial or distal tilt of the root and the angle is 90° or greater in relation to the tooth or root axis, while others consider a tooth dilacerated when its apical deviation is 20° or greater in relation to the normal tooth axis.^{1,7,8} However, the direction of radiographically evaluated dilacerations of roots can be read in two planes.⁶

Dilaceration may be seen in both permanent and primary teeth, but it is seen more frequently in permanent teeth, in posterior teeth more than anterior teeth, and bilaterally in some patients.^{6,9,10} In a previous study, the prevalence of dilaceration was reported as 0.32%-0.98%.^{8,9} Malcic et al. reported that root dilaceration is observed most often in the apical third of incisors and the middle third of molars.⁶ Thongudomporn and Freer reported that in orthodontic patients, dilaceration is the least frequent of the five dental anomalies.¹¹

Because dilaceration influences the treatment outcome of teeth that require endodontic care, diagnosing root dilaceration is important during root canal treatment;¹² it has been proposed that failure to diagnose root dilaceration contributes to a higher rate of endodontic treatment failures.^{8,11} Furthermore, if the tooth is to be extracted for another reason, its removal without a preoperative radiograph can be complicated;¹ therefore, diagnosing dilaceration is also important during ortho-

dontic treatment.¹¹ The aim of this study was to investigate the frequency and distribution of root dilaceration between genders and among tooth types in the northeast subpopulation of Turkey.

MATERIAL AND METHODS

This retrospective study was performed by evaluating the digital panoramic radiographs of 954 randomly selected dental patients admitted with various dental complaints to the Department of Restorative and Endodontics, Faculty of Dentistry, Recep Tayyip Erdoğan University, Rize, Turkey. Patients (or families) were initially informed about the study and signed consent forms were obtained. All panoramic radiographs were taken by an experienced radiologist with the same orthopantomograph (OP200 D; Instrumentarium Dental, Tuusula, Finland). Inclusion criteria included records with high-quality radiographs showing images of all teeth and patients 18-35 years of age. Exclusion criteria included unerupted teeth, supernumerary teeth, and teeth with internal or external resorption.

The radiograph images of 20,114 teeth were examined by one examiner with at least five years' experience in restorative and endodontic treatment to identify dilacerations. A tooth was considered as having mesial or distal root dilaceration if there was a deviation with an angle of 90° or greater from the normal long axis of the tooth, according to criteria defined by Hamasha et al.⁷ The radiographs were digitalized at an effective resolution of 22 Ip/mm (1100 dpi), and the roots were evaluated by one examiner using Image CliniView™ DICOM software. Orofacial direction of the dilacerations was determined by evaluating the bull's eye appearance of the root, which is caused by the root deviation of 90° or greater.^{6,7} The deviation was assigned to the either apical, middle, or coronal third of the root. Multirrooted teeth were considered to have root dilaceration if at least one root was dilacerated. In evaluating the prevalence of dilaceration, multirrooted teeth with one or more dilacerated roots were counted as one case of dilaceration of the root. A sample of 80 radiographs was re-examined by the same examiner 20 days

later, and an agreement of 100% was obtained. The data were recorded in the maxilla and mandibula according to tooth type and gender.

Pearson's chi-squared test was used to determine statistical difference between genders and between maxilla and mandible ($p < 0.05$). Statistical analyses were performed using SPSS version 18.0 (SPSS, Chicago, IL).

RESULTS

This study included 954 patients, 567 (59.4%) females and 387 (40.5%) males, with a mean age of 25.9 ± 5.26 years. Of the 954 patients, 163 (17.1%) were found to have one or more dilacerated teeth. The prevalence of root dilaceration was higher in the female patients (98, 17.2%) than in the male

patients (65, 16.7%), but this difference was not statistically significant ($p = 0.84$) (Table 1).

A total of 253 of 20,114 teeth were found to have root dilacerations (1.25%). The distribution of dilaceration according to tooth type was showed in Table 2. The prevalence of root dilaceration was higher in the maxilla (1.3%) than in the mandible (1.25%), with no statistical difference ($p = 0.492$). Root dilaceration was found most frequently in the mandibular third molar (6.2%), followed by the maxillary third molar (2.4%), maxillary second molar (2.05%), mandibular second molar, and maxillary second premolar (1.9%). Mandibular lateral incisors had the lowest prevalence of root dilacerations (0.2%). The Figure 1 shows images of root dilacerations on formed panoramic radiography.

TABLE 1: Distribution of dilacerations between genders.

	Female (%)	Male (%)	Total (%)	p
Patients without dilaceration	469 (82.7)	322 (83.2)	791 (82.9)	0.844
Patients with dilaceration	98 (17.2)	65 (16.7)	163 (17.1)	
Total	567 (100)	387 (100)	954 (100)	

TABLE 2: Prevalence and distribution of dilacerated teeth according to jaws.

Tooth type	Number of teeth examined	Number of teeth with root dilaceration	(%)	p
Maxilla	10461	137	1.3	0.492
Central incisor	1596	9	0.5	
Lateral incisor	1344	24	1.7	
Canine	1576	10	0.6	
First premolar	1203	8	0.6	
Second premolar	1356	26	1.9	
First molar	1154	12	1.03	
Second molar	1267	26	2.05	
Third molar	965	24	2.4	
Mandible	9653	116	1.2	
Central incisor	1366	4	0.2	
Lateral incisor	1421	2	0.1	
Canine	1545	6	0.3	
First premolar	1250	11	0.9	
Second premolar	1086	11	1.01	
First molar	984	7	0.7	
Second molar	1156	22	1.9	
Third molar	845	53	6.2	
Total	20114	253	1.25	



FIGURE 1: Examples of root dilacerations on formed panoramic radiographs.

DISCUSSION

Radiographic investigation is the most appropriate method for diagnosing root dilaceration.¹ In the present study, dilaceration of the roots was evaluated using digital panoramic radiographs. Muhammed et al. reported no statistical differences in detecting periapical pathoses between panoramic and intraoral radiographs.¹³ However, Grondahl et al. and Ahlqwist et al. reported that panoramic radiographs are not as precise as periapical radiographs in epidemiological studies.^{14,15} In addition, Malcic et al. reported that periapical radiographs are more sensitive for diagnosing dilacerated maxillary central incisors.⁶ The use of panoramic radiographs to diagnose root dilacerations

is insufficient in the cases of labial/buccal and lingual/palatinal dilacerations.¹¹ Panoramic radiographs show the entire mouth area, and panoramic images are excellent for screening all teeth. In this study, only mesial and distal dilacerations were evaluated. To determine root canal curvature more precisely, cone beam computed tomography could be used in future epidemiologic studies.

Colak et al. evaluated the prevalence of root dilaceration using panoramic radiographs and reported a prevalence of 16% in 6912 subjects, which is similar to our results (17.1%).¹⁶ Using periapical radiographies, Hamasha et al. found root dilaceration in 17.0% of patients and in 3.78% of teeth,⁷ while their prevalence rate in patients was similar

to ours, their prevalence rate in teeth was higher than ours. In addition, Ezoddini et al. and Thongudomporn et al. reported root dilaceration rates of 15.0% and 1.8%, respectively, using panoramic radiographies.^{11,17} On the other hand, Miloglu et al. evaluated the prevalence of root dilacerations in a Turkish population using periapical radiography and reported that its prevalence was 9.5% in patients and 4.3% in teeth.¹⁸ These conflicting results can be explained by local environmental influences, racial differences, selected age groups, and different sample sizes.

In this study, statistical analysis showed no differences in the prevalence of root dilacerations between genders, in accordance with Miloglu et al., Colak et al., Karataş et al., and Hamasha et al. However, Ezoddini et al. showed that the prevalence of root dilaceration was significantly higher in males than in females.^{7,16-19} On the other hand, our findings show a similar prevalence of root dilaceration in the maxilla (1.30%) and mandible (1.25%), consistent with the studies of Nabavizadeh et al. and Miloglu et al., but not with those of Hamasha et al. and Malčić et al.^{6,7,18,20} Some studies have reported that the prevalence of root dilaceration is most common in posterior teeth, particularly third molars, which is in accordance with our results.^{6,7,21}

There is controversy regarding the etiology of dilaceration; the oldest and most widely proposed theory is trauma to the primary tooth.^{17,21} Andreasen et al. reported that the major etiologic factor in dilaceration was ectopic development of the

tooth bud.²² On the other hand, Jafarzadeh and Abbott reported in their review that dilaceration is associated with some syndromes and abnormalities, such as Smith–Magenis syndrome, Ehlers–Danlos syndrome, Axenfeld–Rieger syndrome, and congenital ichthyosis.²³

Exploration and negotiation of the root canal system is difficult in dilacerated teeth, due to the high degree of curvature. The rate of endodontic errors such as apical cavitation and instrument breakage can be higher in these teeth;²³ therefore, complete biomechanical debridement of canals, elimination of microorganisms, and obturation becomes difficult. The radiographic diagnosis of dilaceration can help dentists prevent these errors.²⁴ Dilacerated roots may complicate tooth removal, particularly if the dentist has not examined a preoperative radiograph.¹¹ In addition, orthodontic treatment can cause root resorption in dilacerated teeth.²⁵

CONCLUSION

In this study, 163 (17.1%) of 954 patients were found to have one or more dilacerated teeth. The prevalence of root dilaceration was higher in female patients (98, 17.2%) than in male patients (65, 16.7%), but this difference was not statistically significant ($p=0.84$). The prevalence of root dilaceration was higher in the maxilla (1.3%) than in the mandible (1.25%), also with no statistical difference. In addition, root dilaceration was found most commonly in the mandibular third molar.

REFERENCES

- White SC, Pharoah MJ. The evolution and application of dental maxillofacial imaging modalities. *Dent Clin North Am* 2008;52(4):689-705, v.
- Kearns HP. Dilacerated incisors and congenitally displaced incisors: three case reports. *Dent Update* 1998;25(8):339-42.
- Maragakis MG. Crown dilaceration of permanent incisors following trauma to their primary predecessors. *J Clin Pediatr Dent* 1995;20(1):49-52.
- Chadwick SM, Millett D. Dilaceration of a permanent mandibular incisor. A case report. *Br J Orthod* 1995;22(3):279-81.
- Stewart DJ. Dilacerate unerupted maxillary central incisors. *Br Dent J* 1978;145(8):229-33.
- 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; 102(1):104-9.
- Hamasha AA, Al-Khateeb T, Darwazeh A. Prevalence of dilaceration in Jordanian adults. *Int Endod J* 2002;35(11):910-2.
- Chohayeb AA. Dilaceration of permanent upper lateral incisors: frequency, direction, and endodontic treatment implications. *Oral Surg Oral Med Oral Pathol* 1983;55(5):519-20.
- Tiecke RW, Calandra JC, Stuteville OH. *Pathologic physiology of Oral Disease*. 1st ed. St Louis: MO: Mosby; 1959. p.1-480.

10. Lin L, Dowden WE, Langeland K. Bilateral dilaceration J Endod 1982;8(2):85-7.
11. Thongudomporn U, Freer TJ. Prevalence of dental anomalies in orthodontic patients. Aust Dent J 1998;43(6):395-8.
12. Jafarzadeh H, Abbott PV. Ledge formation: review of a great challenge in endodontics. J Endod 2007;33(10):1155-62.
13. Muhammed AH, Manson-Hing LR, Ala B. A comparison of panoramic and intraoral radiographic surveys in evaluating a dental clinic population. Oral Surg Oral Med Oral Pathol 1982;54(1):108-17.
14. Gröndahl HG, Jönsson E, Lindahl B. Diagnosis of periapical osteolytic processes with orthopantomography and intraoral full mouth radiography--a comparison. Sven Tandlak Tidsskr 1970;63(10):679-86.
15. Ahlqwist M, Halling A, Hollender L. Rotational panoramic radiography in epidemiological studies of dental health. Comparison between panoramic radiographs and intraoral full mouth surveys. Swed Dent J 1986;10(1-2):73-84.
16. Colak H, Bayraktar Y, Hamidi MM, Tan E, Colak T. Prevalence of root dilacerations in Central Anatolian Turkish dental patients. West Indian Med J 2012;61(6):635-9.
17. Ezoddini AF, Sheikhha MH, Ahmadi H. Prevalence of dental developmental anomalies: a radiographic study. Community Dent Health 2007;24(3):140-4.
18. Miloglu O, Cakici F, Caglayan F, Yilmaz AB, Demirkaya F. The prevalence of root dilacerations in a Turkish population. Med Oral Patol Oral Cir Bucal 2010;15(3):e441-4.
19. Karataş E, Topcuoğlu HS, Arslan H, Erdoğan Ş, Ezmeci B. Prevalence of root dilaceration in an east anatolian endodontic patient population. Turkiye Klinikleri J Dental Sci 2012; 18(1):28-32.
20. Nabavizadeh M, 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; 14(4):160-4.
21. Udoye CI, Jafarzadeh H. Dilaceration among Nigerians: prevalence, distribution, and its relationship with trauma. Dent Traumatol 2009; 25(4):439-41.
22. 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):219-83.
23. Jafarzadeh H, Abbott PV. Dilaceration: review of an endodontic challenge. J Endod 2007; 33(9):1025-30.
24. Topouzelis N, Tsaousoglou P, Pisoka V, Zouloumis L. Dilaceration of maxillary central incisor: a literature review. Dent Traumatol 2010;26(5):427-33.
25. 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; 76(3):510-8.