Prevalence of Root Dilacerations in Central Anatolian Turkish Dental Patients

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ABSTRACT

Objective: *The aim of this study was to determine, retrospectively, the prevalence and distribution of the dilaceration of the root for each tooth-type in a sample of Central Anatolian Turkish population by using panoramic radiographs.*

Method: *Panoramic radiograhs of 6912 patients (3860 women and 3052 men, mean age 29.04 years, range, 15 to 50 years) were examined for the presence of root dilacerations. Chi-square test was also used to compare the prevalence of dilacerations between male and female subjects and upper and lower jaws.*

Results: *Data showed that 1108 (16.0%) of these subjects had one or more teeth that were dilacerated and these were detected in 466 (15.2%) males and 642 (16.6%) females. Statistical analysis (χ^2 test) showed a significant difference in the prevalence of dilaceration among male and female patients. Mandibular third molars were dilacerated most often (3.76%), followed by mandibular second molars (1.81%). Dilaceration was found in 1.23% of maxillary second premolars and 1.23% of mandibular second molars.*

Conclusion: *Root dilacerations are not uncommon among Turkish dental patients, and their early detection could be important in treatment problems associated with it. However, further larger scale studies are required to assess its prevalence in the general population in order to compare it with other ethnic groups.*

Keywords: Dilaceration, panoramic radiography, prevalence, Turkish population

Prevalencia de las Dilaceraciones Radiculares en Pacientes Dentales Turcos de la Región de Anatolia Central

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RESUMEN

Objetivo: *El objetivo de este estudio fue determinar retrospectivamente la prevalencia y distribución de la dilaceración radicular para cada tipo de diente en una muestra poblacional turca de Anatolia Central, usando radiografías panorámicas.*

Método: *Se examinaron las radiografías panorámicas de 6912 pacientes (3860 mujeres y 3052 hombres, edad promedio 29.04 años, rango 15 a 50 años) en busca de presencia de dilaceraciones de la raíz. También se usó la prueba de Chi-cuadrado para comparar la prevalencia de dilaceraciones entre los sujetos varones y hembras, y la mandíbula inferior y superior.*

Resultados: *Los datos mostraron que 1108 (16.0%) de estos sujetos tenían uno o más dientes dilacerados, detectados en 466 (15.2%) varones y 642 (16.6%) hembras. El análisis estadístico (prueba χ^2) mostró una diferencia significativa en la prevalencia de dilaceración entre los pacientes varones y las hembras. Los terceros molares mandibulares se hallaban dilacerados con mayor frecuencia (3.76%), seguidos por los segundos molares mandibulares (1.81%). Se halló dilaceración en 1.23% de los segundos premolares maxilares y 1.23% de los segundos molares mandibulares.*

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Conclusión: *Las dilaceraciones radiculares no son poco comunes entre los pacientes dentales turcos, y su detección temprana podría ser importante en el tratamiento de problemas asociados con ellas.*

Palabras claves: Dilaceración, radiografías panorámicas, prevalencia, población Turca

West Indian Med J 2012; 61 (6): 636

INTRODUCTION

The term dilaceration was first coined in 1848 by Tomes (1) who defined the phenomenon as the forcible separation of the cap of the developed dentine from the pulp in which the development of the dentine is still progressing. Later, it was defined as a disturbance in tooth formation that produces a deviation or curve in the linear relationship of a crown of a tooth to its root. In severe cases of dilaceration (where the crown is in an inverted direction, almost 90° with the root), the tooth is usually impacted and the crown is palpable in the labial sulcus (2). The determined prevalence of dilaceration depends largely on the subjective assessment of what is "normal" and what is "excessive" angulation. All teeth roots are curved to some degree, so the term dilaceration is reserved for instances of excess or abnormal root curvature that could complicate endodontic or exodontic procedure (3, 4).

Although the cause of root dilaceration is still not clear, studies have documented several possible causative agents and events (5–7). Smith and Winter (6) found that traumatic injury of the deciduous incisors can lead to dilacerations of the permanent incisors. Kolokithas and Karakasis (8) showed that trauma to the deciduous incisor causes a change in the axial inclination of the unerupted tooth.

Dilaceration may appear in both permanent and primary teeth, yet at much lower prevalence in the latter case (9–12). While some studies report no gender preference for dilaceration, others report a male to female ratio of 1:6 (10, 13). Malcic *et al* (14) reported a prevalence rate of 1.2% or 0.53% for maxillary central incisors on the basis of periapical and panoramic radiographs, respectively. Hamasha *et al* (15) examined 4655 teeth on periapical radiographs and found that 176 (3.78%) presented dilacerations. Maxillary central and lateral incisors had rates of 0.4% and 1.2%, respectively (15).

SUBJECTS AND METHODS

Panoramic radiographs from 8567 patients (4324 women and 4243 men, age range from 15 to 50 years) attending Kirikkale University Dental Faculty Hospital during the period July 2009 to August 2011 were reviewed for the presence of dilaceration. Digital panoramic radiographs were taken using PAX-UNI3D (Vatech Co, Králové-Březhrad, Czech Republic) digital radiography systems. Radiographic interpretation was undertaken in a dark room by two experienced examiners. Exclusion criteria included patients who were less than 15 years of age, records with poor quality radiographs and records with radiographs of only primary teeth. The final sample included 6912 patients (3860 women and 3052 men mean age, 29.04 years; range, 15 to 50 years).

A tooth was considered as having a dilaceration towards the mesial or distal direction if there was a 90 angle or greater along the axis of the tooth or root (14, 15). Orofacial direction of the dilacerations was determined by evaluating the bull's eye appearance of the root, which results from the root deviation of 90º or more (14). The deviation was assigned to either apical, middle, or the coronal third of the root. In multirooted teeth, a tooth was recognized as having the dilacerations of the root if at least one root showed dilaceration. Multirooted teeth were further divided according to the type of root and the number of roots showing dilacerations. In calculating the prevalence of dilaceration, the multirooted teeth having one or more dilacerated roots were counted as one case of dilacerations of the root (14, 15). After the dilacerations, positive radiographs were identified; the demographics, clinical characteristics, and radiographic features were assessed. The parameters of age, gender, jaw, tooth type and location were assessed for the dilacerated teeth.

The examiners were calibrated by having them read 100 radiographs separately, containing 10 different cases of dilacerated tooth before the investigation started. The examiners re-read together a sample of 1108 panoramic radiographs containing dilacerations two weeks after the first examination and a 100% agreement was obtained. Statistical analysis of the data was done using the Statistical Package for the Social Sciences (SPSS 15.0). Chi-square test was also used to compare the prevalence of dilaceration between male and female subjects and upper and lower jaws.

RESULTS

The study group comprised 3052 (43.95%) males and 3860 (56.05%) females with a mean age of 29.04 ± 8.68 years. The age range was 15 to 50 years and the number of total teeth examined was 192 150. Their radiographs showed that 1108 (16.0%) of these subjects had one or more teeth that were dilacerated and these were detected in 466 (15.2%) males and 642 (16.6%) females. Statistical analysis (χ^2 test) showed a significant difference in the prevalence of dilaceration among male and female patients.

Dilacerations were detected in 1504 teeth out of a total of 192 150 (0.78%). The prevalence of dilacerations amongst different tooth types is presented in Table 1. Mandibular third molars were dilacerated most often (3.76%), followed by mandibular second molars (1.81%). Dilaceration was found in 1.23% of maxillary second premolars and

Table 1: Distribution of the number of root dilaceration according to tooth type, gender and location

		Central incisor		Lateral incisor		Canine		First premolar		Second premolar		First molar		Second molar		Third molar	
		L*	R**	L	R	L	R	L	R	L	R	L	R	L	R	L	R
Male	Maxılla	0	2	8	8	10	4	34	8	30	14	8	8	14	20	16	10
	Mandıbula	0	0	2	2	8	8	24	42	28	36	10	12	50	44	72	106
	Total	0	0	10	10	18	12	58	50	58	50	18	20	64	64	88	116
Female	Maxılla	6	6	8	2	14	4	64	8	84	22	16	12	18	18	12	10
	Mandıbula	0	0	0	2	14	12	26	36	52	36	18	14	40	76	92	144
	Total	6	6	8	4	28	16	90	44	136	58	34	26	58	94	104	154

*left; **right

Table 2: Frequency of the prevalence of root dilaceration amongst different tooth types

Tooth	Number of teeth examamined	Number of dilaceration	Percentage of root dilaceration
Maxillary	**95994**	**498**	**4.14**
Central	12214	14	0.11
Lateral	12148	26	0.21
Canine	12227	32	0.26
First premolar	12124	114	0.94
Second premolar	12158	150	1.23
First molar	12023	44	0.37
Second molar	12132	70	0.58
Third molar	10968	48	0.44
Mandibular	**96156**	**1006**	**9.47**
Central	12465	0	0.00
Lateral	12398	6	0.05
Canine	12473	42	0.34
First premolar	12267	128	1.04
Second premolar	12311	152	1.23
First molar	11642	54	0.46
Second molar	11583	210	1.81
Third molar	11017	414	3.76
Total	**192150**	**1504**	**0.78**

1.23% of mandibular second premolars. Maxillary and mandibular anterior teeth were the least affected teeth, exhibiting dilacerations in approximately 1% of cases. Root dilaceration was not detected in mandibular central incisors (Table 2). The Figure shows examples of root dilacerations belonging to different tooth types on panoramic radiography.

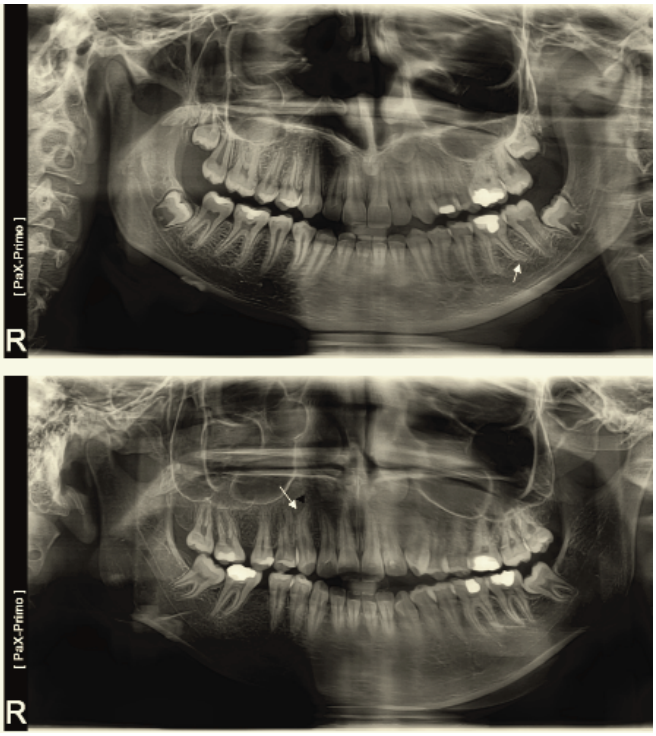

Figure: Examples of root dilacerations belonging to different tooth types on formed panoramic radiograph.

DISCUSSION

According to Toms definition, dilaceration is thus distinguished from the rarely used term flexion, which is defined as a tooth with a hooked or a bent root (16, 17). Stewart (2) has likened tooth dilaceration to the hand of a traffic policeman, whereas Moreau (18) used the term scorpion tooth for this condition.

Most publications concerning dilacerations are case reports (9–12) and only a few (14, 15, 19–21) have reported the prevalence of dilacerations, with the frequencies ranging from 0.32% to 98% of teeth.

The aetiology of this anomaly is controversial (14, 22). The most probable cause is mechanical trauma to the calcified portion of a developing tooth (23, 24). Among others are syndromes (22) and ectopic development of tooth germs (2, 14). However, when a dilacerated tooth is anteriorly located, trauma would seem a more likely factor (25). Otuyemi and Sofowora (26) reported a prevalence of 14.5% trauma to the anterior teeth in rural Nigerians. The effect of trauma depends on the age of occurrence and the trauma causes (27).

Review of the literature reveals a wide discrepancy in the prevalence of dilaceration in different populations. The results of the present study on a group of Central Anatolian Turkish dental patients have shown an overall prevalence of 16% for individuals and 0.78% for all teeth examined. Hamasha *et al* (15) found a prevalence of 17.0% for indi-

viduals and 1.2% for all teeth in Jordanian patients, whilst the results of Ezoddini *et al* (19) and Thongudomporn and Freer (21) were 15.0 and 1.8%, respectively in Iranian and Australian dental patients. These variations in prevalence between different populations may be due to ethnic variations, but may also be influenced by differences in the diagnostic tool used for interpretation of dilacerated teeth examined. Moreover, Miloglu *et al* (20) found out the prevalence of root dilacerations was 9.5% of all patients and 4.3% of all teeth examined by using periapical radiographs in the Eastern Anatolian population, which is inconsistent with our results. These contradictory findings may be explained by marked differences in the sample size and in the methods used.

Although Chohayeb (28) has reported that the frequency of dilaceration in upper lateral incisors is 98%, it is highly questionable whether 98% of teeth can be classified as having a large enough deviation to be classified as a dilaceration. It appears as though Chohayeb might have classified the distal curvature of the apical third of the root of the upper lateral incisors as being a dilaceration rather than considering it as the normal, or typical, anatomy of this tooth (19). The 0.21% prevalence of dilacerations of maxillary lateral incisors that we determined in this study was inconsistent with this finding.

In the present study, there was a significant difference according to gender ($p = 0.981$), which is similar to a recent report of Ezoddini *et al* (19). However, other studies reported that dilaceration occurred equally between males and females (15, 20, 21).

Our finding of a higher prevalence of dilaceration in the posterior teeth, especially the mandibular third molar, is consistent with that of Miloglu *et al* (20), Hamasha *et al* (15) and Malcic *et al* (14). In the present study, root dilacerations were shown to be more frequent in the mandibula than maxilla which was close to a previously reported study by Hamasha *et al* (15). However, it is reported that the prevalence is higher in the maxilla (14), although one other study noted that it was equally distributed between maxilla and mandible.

Although several studies have been carried out to explore the prevalence of root dilaceration, they have differed in methodology. Some have used periapical radiographs whilst others used panoramic and periapical radiographs together. Morever, some previous studies have used extracted teeth (29–33) to identify root dilaceration, which might have led to an underestimation of their frequency because teeth with curved roots can easily be fractured on extracting the teeth. It is impossible to compare the results of these studies related to gender and bilateral occurrences. This present study was based on the analysis of panoramic radiographs. Muhammed *et al* (34) did not find a statistically significant difference in detecting periapical pathology by using panoramic and intraoral radiographs. Current literature shows that where atypical anatomy is suspected, in addition to the conventional radiograph, modern radiographic techniques like helical or spiral computed tomography are being used for a proper diagnosis. Cone beam computed tomography might be an accurate, noninvasive, and practical method to reliably compare the results of studies relating to gender and bilateral occurrence of root dilacerations among different ethnic groups. Cone beam computed tomography images can also reveal the true nature of the tooth structures in three dimensions and allow for reliable angulations and distance estimates (16, 17). There-fore, it is a useful endodontic tool for clinicians treating or retreating teeth with dilacerated roots.

Root canal therapy is principally concerned with the elimination or prevention of pulpal and periapical disease (35). Knowledge of root anatomy is extremely important for locating and negotiating canals for thorough canal debridement and to prevent misdiagnosis as well as errors during instrumentation, all of which influence the success rate of endodontic treatment. Variations of root canal anatomy and root morphology as a function of race are well established (36). Diagnosing root dilacerations before commencing endodontic treatment is essential to allow proper and safe use of endodontic instruments within the curved roots (15, 28). Failure to recognize the multi-planar nature of the dilaceration is one of the factors that might contribute to the higher rate of unfavourable outcomes of endodontic treatment of single rooted teeth such as upper lateral incisors, compared with the number of unfavourable treatment outcomes in multi-rooted teeth (37). To overcome this problem, periapical radiographs that determine the direction of dilaceration are adequate (28). However, such diagnostic findings can be confirmed by a computed tomography scan, which can help to determine the exact position and angulation of the dilaceration (38). Few treatments are described in the literature for dilacerated maxillary incisor (39), with extraction or surgical/orthodontic treatment being the most common ones. However, long and expensive follow-up treatment (*ie* implants and orthodontic treatment) can be expected with these approaches.

The configuration of the root of a prospective abutment tooth has a significant influence on its potential load bearing capacity; hence, dilaceration can also affect the stability and longevity of an abutment (4). Finite element stress analysis has indicated that root dilaceration concentrates the stresses in the supporting structures if the dilacerated tooth is used as an abutment for a dental prosthesis, so this should be considered as a risk factor in abutment selection. This increased stress might affect the stability and longevity of the abutment tooth and hence also that of the prosthesis. Splinting the dilacerated abutment tooth to an adjacent tooth to obtain a multi-rooted abutment might be an approach to consider in some cases (4). Orthodontic movement of dilacerated teeth might cause severe irreversible resorption of the root, which can severely complicate the endodontic treatment of these teeth (40, 41).

CONCLUSION

In conclusion, prevalence of dilaceration in a sample of 6912 Turkish patients was 16.28%. Of the 192 150 teeth examined, 0.78% was dilacerated. Prevalence in the mandibular premolars was higher in both males and females compared to that in the maxilla. Females had a higher prevalence of dilaceration in comparison with males especially in the mandible.

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