

Original Article

BIOLOGICAL BASIS FOR ROOT DILACERATION: PREVALENCE AND CLINICAL SIGNIFICANCE

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ABSTRACT

BACKGROUND: Trauma has been implicated in root dilaceration though current hypothesis tend to focus more on root shear displacement. This study aimed at determining the actual prevalence and location of root dilacerations in extracted permanent molar teeth.

METHODS: Over a period of 10 years, 2765 extracted permanent teeth collected for the teaching of oral biology to dental students were examined. The permanent molars were identified based on some clinical indices and each tooth was examined for occurrence of root dilaceration using a calibrated student's set protractor. The severity of root dilaceration was graded into mild, moderate and severe. The location of root dilaceration was classified as cervical, middle and apical.

RESULTS: There were 1,352 (48.9%) permanent molars with root dilaceration of 274 (9.9%) among the 2765 extracted teeth in this study. Root dilaceration was more in the lower molars ($n=162$, 12.0%) than the upper molars ($n=112$, 8.3%) among the permanent molars in this study. There was mild dilaceration of the roots of the lower most frequent location was the apical portion of the roots of the lower ($n=128$, 79.0%) and upper ($n=83$, 74.1%) permanent molars. The most frequent location was the apical portion of the roots of the lower ($n=143$, 88.3%) and upper ($n=104$, 92.9%) permanent molars.

CONCLUSION: This study observed a relatively higher prevalence of root dilaceration among extracted teeth compared to findings from previous clinical studies using periapical radiograph.

Key words: Permanent-molar, root-dilaceration, prevalence, clinical significance

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INTRODUCTION

Dilaceration is the result of a developmental anomaly in which there has been an abrupt change of more than 20° in the axial inclination between the crown and the root of a tooth. The possible causes of dilaceration are controversial. Root dilaceration is usually attributed to trauma to the primary dentition. This is due to the proximity between the deciduous root apex and the permanent tooth germ. The occurrence of injury during odontogenesis especially, during morphodifferentiation may cause displacement of the calcified portion of the rest of the tooth. This continues its development in a new position, and in direction, creating an unusual angle.^{1,2} It is seen in both deciduous and permanent dentitions,³ especially in the posterior teeth in the maxillary area.

Trauma associated tooth root dilaceration is less prevalent than atraumatic dilaceration observed on posterior teeth. Therefore the hypothesis that trauma is a primary cause of tooth root dilaceration is limited because it is inadequate to clarify instances of tooth root dilaceration that seem to be initiated at the midroot level or apically, and a delayed eruption.⁴

A root deviation can be considered root dilaceration when the angle between the root and the long axis of the tooth is equal to or greater than 20° .⁵ In different races, variations do exist in the pattern of dilacerations. Malcic et al⁶ in a study in Croatian population revealed that posterior teeth were more affected. Colak et al⁷ in a Turkish population showed that mandibular molars were most dilacerated and reconfirmed by Miloglu et al⁸ and Bodumlu et al.⁹ In Nigeria, Udonye and Jafarzadeb¹⁰ were in agreement that posterior teeth, especially the maxillary posterior teeth were more dilacerated, with predilection for females. Given the impossibility of preventing this abnormality and the need to increase its understanding, evaluation of the prevalence of root dilacerations in permanent molars is very important.

This biological anomaly poses challenges in surgical,¹¹ endodontic³ and orthodontic procedures.¹² This study aimed at determining the actual prevalence, severity and location of root dilacerations in extracted permanent molar teeth.

METHODS

This is a descriptive study of 2765 deceased teeth collected for the teaching of tooth morphology in oral biology to dental students. These teeth were extracted in the Department of Oral and Maxillofacial Surgery, University of Benin Teaching Hospital, Benin City, Nigeria. The teeth were preserved in 10% buffered formalin solution, in line with Centre for Disease Control and Prevention guidelines for infection control of extracted teeth used for research and teaching.^{13,14}

These teeth were collected over a 10-year period. The permanent molar teeth were sorted into upper and lower molars. The clinical indices used for identification of permanent molars were: two roots that were mesio-distally flattened for lower permanent molars and three divergent roots for upper permanent molars. Each tooth was examined for occurrence of root dilaceration. The deviation greater than 20° formed by the roots in relation to the long axis of the tooth were considered as dilaceration.¹⁵ Classification of dilacerations in accordance with the degree of curvature as mild, moderate or severe, a method similar to Schneider,¹⁶ and Erlich, et al¹⁷ in which the angle formed by the midline of the tooth long axis and deviated segment were used.¹⁸

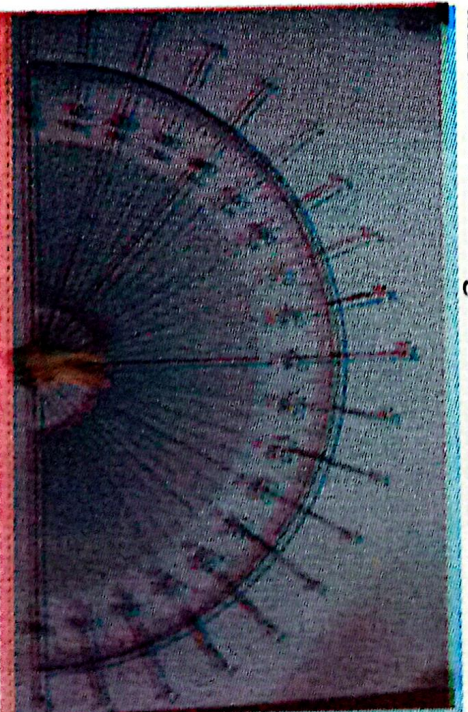


Figure 1: Calibrated student set protractor with dilacerated tooth root

A study diagram was made out of a scanned 10° interval calibrated student set protractor on a paper with lines extending from the vertical axis on which the dilacerated angle was measured (Figure 1) and classified. The severity of root dilaceration was graded according to Santana, et al¹⁹ into mild ($20-40^\circ$), moderate ($41 - 60^\circ$), severe curvature degree ($\geq 61\%$). The location of root dilaceration was classified as cervical, middle and

apical.²⁰ Analysis was simple exploratory with the construction of single frequency table and result histograms.



Figure 2: Dilacerated root of upper and lower permanent Teeth



Figure 3: Sectioned lower permanent molar with root canal demonstrated in a dilacerated root

RESULTS

There were 1,352 (48.9%) permanent molars with root dilaceration in 274 (9.9%) of the permanent molars among the 2,765 extracted teeth in this study. Root dilaceration was more in the lower molars (n=162, 12.0%) than the upper molars (n=112, 8.3%) among the permanent molars in

this study [Table 1]. There was mild dilaceration of the roots of the lower (n=128, 79.0%) and upper (n=83, 74.1%) permanent molars (Table 1) [Figure 2]. The most frequent location was the apical portion of the roots of the lower (n=148, 88.3%) and upper (n=104, 92.9%) permanent molars (Table 3) [Figure 3].

Table 1: Percentage of dilacerated permanent molars in 1,352 teeth examined

Permanent Molar	Number	%
Lower molars	969	71.2
(a) Dilacerated	162	12.0
(b) Non-Dilacerated	807	59.2
Upper Molars	383	28.8
(a) Dilacerated	112	8.3
(b) Non-Dilacerated	271	20.5

Total Dilacerations	274	20.2
Total Permanent Molars	1,352	100

DISCUSSION

Tooth formation occurs in the 6th week intrauterine life with the formation of primary epithelial band. Tooth anomalies occur when there is perversion of normal physiological process of development which includes initiation, proliferation, histo-differentiation, morpho-differentiation and apposition. Dilaceration usually an anomaly of morpho-differentiation advanced bell stage.^{1,2}

This study observed a relatively higher prevalence (9.9%) of root dilaceration among extracted teeth compared to findings from clinical studies using periapical radiographs.^{17,18,20} Periapical radiograph is the usual means of assessing preoperatively the anomaly of the root region.

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Table 2: Severity of root dilaceration of the permanent molars

Permanent Molar	Number of Dilacerations	Mild ($20^{\circ} - 40^{\circ}$)	Moderate ($41^{\circ} - 60^{\circ}$)	Severe ($>60^{\circ}$)
Lower Molar	162 (100%)	128 (79.0%)	29 (17.9%)	5 (3.1%)
Upper Molar	112 (100%)	83 (74.1%)	20 (17.9%)	9 (8.0%)

Table 3: Location of root dilaceration of the permanent molars

Permanent Molar	Number of Dilacerations	Cervical	Middle	Apical
Lower Molar	162 (100%)	14 (8.6%)	5 (3.1%)	143 (88.3%)
Upper Molar	112 (100%)	6 (5.3%)	2 (1.8%)	104 (92.9%)

This is a mere estimate of root orientation rather than absolute, especially in the periapical region, whereas, this study demonstrated actual root dilaceration of extracted permanent molar teeth. There was more root dilacerations in the lower permanent molars compared to the upper permanent molars. This is in tandem with previous reports by Jafarzadeh and Abbott,³ and Malic et al.⁸ that root dilaceration is common in the posterior teeth. Mild dilaceration was also predominant in the lower and upper permanent molars. The location of dilaceration was more in the apical region in the lower and upper molars. These findings are in agreement with the report by Feltosa et al.¹⁸

Dilaceration undoubtedly is a great clinical challenge in endodontics especially in root canal preparation, fillings and other related treatments.³ Also, surgical treatment is modified depending on the severity of root dilaceration. Surgical excision is required to treat severe root dilaceration, while surgical exposure (apically repositioned flap) and orthodontic traction may be necessary, especially for dilacerated impacted anterior (incisal) tooth. The orthodontic methods required may be to close the space or keep it open until the patient reaches

an age for definitive treatment with either implants or prosthodontic.¹²

In conclusion, this study observed a relatively higher prevalence of root dilaceration among extracted teeth compared to findings from clinical studies using periapical radiograph; as a three dimensional radiographic view was not possible. The knowledge of the percentage frequency of root dilaceration, supported by radiographic findings may be useful in guiding preoperative planning required to avoid endodontic, orthodontic and surgical complication during clinical procedures.

Conflict of Interest: None declared

REFERENCES

1. Brin I, Fulk SA, Bassat YB, Zilberman Y, Trauma to primary incisors and its effect on the permanent successor. *Pediatric Dent*, 1984; 6(2): 78-82.
2. Las Karis G: Dental anatomy: Atlas of Colourful oral disease of childhood and adolescence, Porto Alegre. Sao Paulo: Ed, Santos; 2000:2-25.
3. Jafarzadeh H, Abbott PY. Dilaceration: review of an endodontic challenge. *J. Endod*. 2007, 33(9): 1025-1030.
4. Standerwick RG. A possible etiology for the dilaceration and flexion of permanent tooth roots

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- relative to bone remodeling gradients in alveolar bone. *Orig Hypoth*. 2014;5(1):7-10
5. Topenzelis N, Tsousoglou P, Piskva V, Zoulounis L. Dilaceration of maxillary central incisors: a literature review. *Den Traumatol* 2010 26(5): 427-433.
6. Maleic A, Jakic S, Bizovic V, Miletic I, Pelivan I, Anic I. Prevalence of root dilaceration in adult dental patients in Croatia. *Oral Surg. Oral Med. Oral Pathol. Oral Radiol. Endod.* 2006; 102(1): 104-109.
7. Colak H, Bayraktar Y, Hamidi MM, Tan E, Colak T. Prevalence of not dilaceration in Central Anatolian Turkish Dental patients. *West Indian Med. J.* 2012; 61(6): 635-639.
8. Mitoğlu O, Cakici F, Caglayan F, Yilmaz AB, Demirkaya F. The prevalence of root dilaceration in a Turkish population. *Med. Oral Pathol. Oral Cir. Bucal.* 2010; 15(3): 441-444.
9. Bodrumlu, E, Gunduz K, Avesver H, Cicek E. A retrospective study of the prevalence and characteristics of not dilaceration in a sample of the Turkish population. *Oral Radiol.* 2013; 29: 27-32.
10. Udonye CI, Jafarzadeh H. Dilaceration among Nigerians: Prevalence, Distribution, and its relationship with trauma. *Dent. Traumatol* 2009; 25 (4): 439-441.
11. Wei YJ, Lin YC, Kaung SS, Yang SF, Lee SY, Lai Yi. Esthetic periodontal surgery for impacted dilacerated maxillary central incisors. *Am J. Orthod. Dentofacial Orthop.* 2012; 142(4): 546-551.
12. Chew MT, Meng-Ann M. Orthodontic-surgical Management of an Impacted Dilacerated Maxillary Central Incisor: A Clinical Case Report. *Pediatr Dent.* 2004; 26:341-344.
13. Kumar M, Sequeira PS, Peters S, Bhar GK. Sterilization of extracted human teeth for educational use. *Indian J. Med. Micro.* 2005; 23 (4): 25-28.
14. Lee JJ, Nattey-Morbell A, Cook A Jr, Pimeta LA, Leonard R, Ritter AV. Using extracted teeth for research: The effect of storage medium and sterilization on dentina. *Bond Strength J. Am. Assoc.* 2007; 138(12):1599-1603.
15. Chohayeb AA. Dilaceration of permanent upper lateral incisors: Frequency, direction and endodontic treatment implication. *Oral Surg. Med. Oral Pathol.* 1983; 55: 519-520.
16. Schneider SW. A comparison of canal preparation in Straight and curved root canals. *Oral Surg.* 1971;32(2): 271-275.
17. Erlich T, Perreira MF, Panalis J. Prevalence of root tearing through periapical radiographic examination, with a sample of Greater Sao Paulo. *Rev. Post Grad.* 2001; 8(2): 129-137.
18. Feltosa BS, Dantas LCE, Beltran KY, Lenos TR, Farias RL, Beltran KTS. Prevalence assessment of root dilacerations in permanent incisors. *Ent. Press. J. Orthod.* 2012;17(6): 97-102.
19. Santana EJB, Consolato A, Tarano Determination of prevalence morphological dilacerations. *Rv. Fac. Odontol UFBA.* 1992; 12 (13): 40-52.
20. Nabavizadeh MR, Sedigh Shamsi M, Moazam Abbaszadegan A. Prevalence of Root Dilaceration Adult Patients Referred to Shiraz Dental School (2005-2010). *J Dent Shiraz Univ Med Sci* 14(4): 160-164.