

The Extend of Root Angulation in Patients visiting a Dental School in South Kerala: A Panoramic Radiographic Study

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ABSTRACT

Objective: To study the prevalence of root angulation through radiographic evaluation using panoramic radiographs and to record the extent of angulation among various teeth.

Materials and methods: Panoramic radiographs of 506 patients within the age group of 18 to 70 years (196 males and 310 females) were subjected to a retrospective study for estimating the prevalence of root angulations of various teeth. The root angulations in mesial or distal direction from 20° onwards were measured. To test the statistical significance, Chi-square test was used. Data analysis was carried out using SPSS (Statistical Package for the Social Sciences) software, version 14.

Results: From the 506 conventional panoramic radiographs screened, a total of 16,192 teeth were examined. Root angulations to the mesial or distal directions were seen in 269 teeth (1.66%). Maxilla (2.43%) showed more prevalence as compared to mandible (0.89%). Individual tooth analysis revealed that maxillary lateral incisors showed the highest percentage of angulation (6.12%). Mandibular incisors, maxillary and mandibular first molars showed the least percentage of angulation (0.29%). Highest degree of root angulations among individual teeth was seen in mandibular first and second premolars (81-90°). No statistically significant differences were observed between males and females (females: 34.8%; males: 29.1%, $p = 0.21$).

Conclusion: Root angulation was most prevalent in the maxillary lateral incisors. The highest degree of root angulation was seen in the mandibular arch, among the mandibular premolars. Angulated roots of teeth influence the planning and execution of their extraction, endodontic, orthodontic and prosthodontic treatments. Orthopantomographs may be routinely employed to evaluate root angulations in large populations and when time and economic constraints are present.

Keywords: Root angulation, Dilaceration, Panoramic radiographs, Orthopantomographs.

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INTRODUCTION

Almost all teeth have roots with an angulation at some point along the long axis. An abnormal angulation or bend in the root or less frequently in the crown of a tooth is referred to as 'dilaceration'.¹⁻³ Angulation of a crown can be observed

in the mouth; however, radiographic examination is mandatory to evaluate the root angulations. Diagnosing a dilaceration is critical as severely angulated roots of teeth may complicate dental treatment viz; root canal treatment, extraction and orthodontic treatment.^{4,5} Only few studies have reported the prevalence of dilaceration in multiple permanent teeth in adults.^{4,6,7} Most of the published articles are case reports of dilacerations pertaining to a single permanent tooth.⁸⁻¹⁰ The objective of this study was to investigate the prevalence of root angulation using panoramic radiographs and to record the extent of angulation among individual teeth.

MATERIALS AND METHODS

A retrospective study was carried out using panoramic radiographs of 506 patients between the age group of 18 and 70 years. Orthopantomographs (conventional) made in the past 2 years in the Department of Oral Radiology, Pushpagiri College of Dental Sciences, Thiruvalla, were evaluated. Out of the total 800 orthopantomograph (OPGs) screened only 506 were considered for the study. The exclusion criteria included patients who were less than 18 years of age at the time of radiographic examination, patients with mixed dentition, those who were undergoing or had undergone orthodontic treatment, and those without the full complement of teeth. Poor quality radiographs were also excluded. A single examiner analyzed all radiographs with a magnifying lens and an X-ray viewer. The long axis of each tooth was determined using a ruler, aligned along the pulp of the tooth. A protractor was used to measure the angle made by the root to the long axis of the tooth. Root angulations in mesial or distal direction starting from 20° were measured. The data was entered and analyzed using the computer program Statistical Package for the Social Science (SPSS), version 14. The mean and standard deviation of age of the subjects and percentage of other variables were calculated. Chi-square test was used to compare data among the groups.

RESULTS

Out of 506 conventional panoramic radiographs screened, 196 (38.7%) belonged to males and 310 (61.2%) to females, between the age groups 18 and 70 years with mean

of 36.6 years (SD: 14.4). Of the 506 OPGs, 165 patients had root angulations (32.6%). Out of 16,192 teeth examined, root angulations were detected in 269 teeth (1.66%). Root angulations were seen significantly more in the maxilla (2.43%) than in the mandible (0.89%; $p = 0.000$). No statistically significant difference was observed between males (29.1%) and females (34.8%; $p = 0.21$). The age group of 21 to 30 years showed maximum number of persons with root angulations and least number was observed in the 61 to 70 years age group (Table 1). The prevalence of root angulation among the various teeth in maxilla and mandible is presented (Table 2). Maxillary lateral incisors showed root angulations most often (6.12%; Fig. 1) followed by maxillary canine (3.8%) and mandibular first premolar (2.17%). Maxillary and mandibular first molars (0%) and mandibular central incisor (0.29%) showed the least prevalence. Tables 3 and 4 show prevalence of varying degrees of root angulations among the various teeth in the maxilla and mandible. In maxillary arch, severe root angulations ($>60^\circ$) were observed among laterals, canines and second premolars. Moderate angulations ($40-60^\circ$) were seen in maxillary central, lateral, canine, first and second premolar and third molar teeth. Mild angulations ($20-40^\circ$) were seen in maxillary laterals, canines, centrals, first and second premolars, and second and third molars. In the mandibular arch, severe root angulations ($>60^\circ$) were observed in first and second premolars (Fig. 2). Moderate angulations ($40-60^\circ$) were observed in mandibular laterals, first premolar, second premolar and third molar teeth. Mild angulations ($20-40^\circ$) were observed in mandibular centrals, laterals, canine, premolars and molars. The 90° angulations were observed only in mandibular first and second premolars.

DISCUSSION

Periapical radiographs are considered the most appropriate means to diagnose dilacerated teeth, but in a third world country, taking full mouth diagnostic periapical radiographs for all patients may be neither viable nor practical. Taking an OPG may be more desirable. Periapical radiographs may

be subsequently employed when and where deemed necessary. OPGs used in this study were taken for a variety of purposes including full mouth dental screening and diagnosis of dental problems. Root angulations in mesial or distal directions were assessed. Three dimensional examinations of root variations using cone beam computed tomography (CBCT) may provide a comprehensive picture,¹¹ but may not be available as a routine diagnostic tool. Varying extents of root angulations may dictate the dental treatment plan. The term 'dilaceration' is an angulation or sharp curve in the root or the crown of a

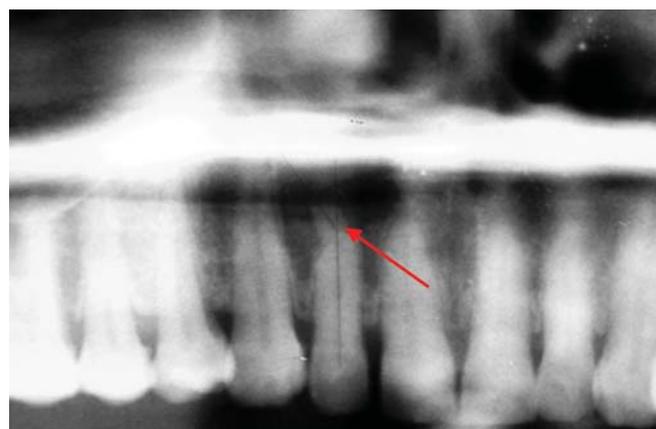


Fig. 1: Cropped panoramic image photograph of a patient showing root angulation in the maxillary lateral incisor

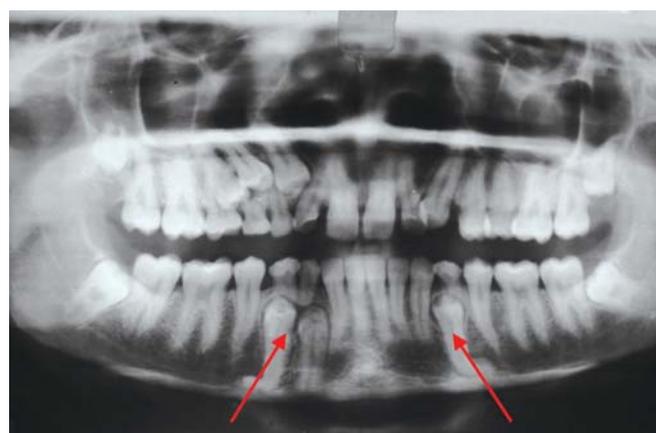


Fig. 2: Cropped panoramic image photograph of a patient showing severely angulated unerupted mandibular premolars

Table 1: Root angulation in different age groups

Age group (years)	Number of patients screened	Number of patients having root angulations	Percentage
18-20	94	33	35.1
21-30	107	43	40.1
31-40	104	25	24
41-50	83	34	40.9
51-60	57	28	49.1
61-70	61	2	3.2
Total	506	165	12.07

Table 2: Root angulation among various teeth in maxilla and mandible

Tooth type	Number of teeth examined	Number of maxillary teeth with root angulations	Percentage	Number of mandibular teeth with root angulations	Percentage
Central incisor	1,012	12	1.18	3	0.29
Lateral incisor	1,012	62	6.12	7	0.69
Canine	1,012	39	3.8	13	1.28
First premolar	1,012	22	2.1	22	2.17
Second premolar	1,012	24	2.3	11	1.08
First molar	1,012	0	0	3	0.29
Second molar	1,012	16	1.5	5	0.49
Third molar	1,012	22	2.1	8	0.79
Total	8,096	197	2.43	72	0.89

Table 3: Root angulation in degrees among various teeth in the maxilla

Tooth type	Number of teeth with root angulation	Number of angulated root with degrees						
		20-30°	31-40°	41-50°	51-60°	61-70°	71-80°	81-90°
Central	12	6	5	1	0	0	0	0
Lateral	62	38	22	1	0	1	0	0
Canine	39	28	8	1	1	1	0	0
First premolar	22	12	9	1	0	0	0	0
Second premolar	24	16	5	1	1	1	0	0
First molar	0	0	0	0	0	0	0	0
Second molar	16	7	6	2	1	0	0	0
Third molar	22	10	8	2	2	0	0	0

Table 4: Root angulation in degrees among various teeth in the mandible

Tooth type	Number of teeth with root angulation	Number of angulated root with degrees						
		20-30°	31-40°	41-50°	51-60°	61-70°	71-80°	81-90°
Central	3	3	0	0	0	0	0	0
Lateral	7	4	2	1	0	0	0	0
Canine	13	9	4	0	0	0	0	0
First premolar	22	15	4	2	0	0	0	1
Second premolar	11	8	2	0	0	0	0	1
First molar	3	0	3	0	0	0	0	0
Second molar	5	1	3	1	0	0	0	0
Third molar	8	1	3	1	2	1	0	0

developed tooth. Its prevalence in various races is different. The etiology of dilaceration was considered to be due to mechanical trauma to the calcified portion of the tooth during its formation.^{8,12} However, current studies support the view that dilaceration may be a true developmental anomaly that is not related to history of trauma.^{3,9,13}

Angulation of root complicates endodontic treatment. Severe angulations can preclude endodontic therapy and necessitate extraction.⁴ Transalveolar extractions may be preferred to conventional extractions in dilacerated teeth.⁵ Orthodontic tooth movement of a dilacerated tooth may be different from a conventional rooted tooth and may result in variable treatment time frame.⁵ However, a dilacerated tooth may be a better abutment for fixed prosthodontic treatment.¹⁴

In the literature, only few articles reported the prevalence of dilaceration^{4,6,7} and the rest were case reports of dilacerations in primary or permanent teeth.⁸⁻¹⁰ The study

by Hamasha et al⁴ used periapical radiographs to record dilacerations alone. Whereas, this study used OPG as a practical tool and is the first to attempt description of the prevalence and distribution of root angulation above 20° among different types of teeth. Hamasha et al,⁴ in their study, considered a root angulation as dilaceration if the angle was 90° or more. The prevalence of dilacerated teeth was 3.78%. Mandibular third molars were dilacerated most often (19.2%) followed by mandibular first molars (5.6%). In maxilla, second premolars were dilacerated most often (4.7%). Maxillary anterior teeth and mandibular incisors were least affected (1%). In our study, prevalence of teeth with root angulations was 1.66% and root dilaceration (90° or more) was 0.012%. Root angulations were seen mostly in the maxilla ($p = 0.000$) unlike the one reported by Hamasha et al⁴ of mandibular predominance of dilacerations. Maximum number of root angulations were seen in maxillary laterals (6.12%) followed by maxillary canines

(3.8%). Maxillary first molars (0%) followed by mandibular central incisors (0.29%), mandibular first molars (0.29%) were the least affected. The 90° angulations were observed only in mandibular first and second premolars. This study did not notice any statistical difference between the genders ($p = 0.21$). Since there exists a difference in root angulation values in studies from two different populations, more studies may be necessary to know the exact prevalence, if any, of individual tooth angulation in different populations.

CONCLUSION

Root angulation of teeth influences the planning and execution of dental treatment to varying extents. OPGs may be routinely employed as an initial screening/diagnostic modality and further followed up using periapical radiograph if and when necessary. Use of OPGs to evaluate root angulations may be more practical in large populations and when time and economic constraints are present.

REFERENCES

1. Rajendran R. Developmental disturbances of oral and para oral structures. In: Rajendran R, Sivapathasundharam B (Eds). Shafer's textbook of oral pathology (6th ed). New Delhi, Elsevier 2009;40.
2. Ghom AG, Karamore T. Teeth anomalies. In: Ghom AG (Ed). Textbook of oral Radiology (1st ed). New Delhi, Elsevier 2008;447.
3. White SC, Pharoah MJ. Dental anomalies. In: White SC, Pharoah MJ (Eds). Oral radiology principles and interpretation (5th ed). Missouri, Mosby 2004;340.
4. Hamasha AA, AL-Khateeb T, Darwazeh A. Prevalence of dilaceration in Jordanian adults. *Int Endod J* 2002;35:910-12.
5. Davies PH, Lewis DH. Dilaceration—a surgical/orthodontic solution. *Br Dent J* 1984;156:16-18.
6. 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; 102:104-09.
7. 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;15:441-44.
8. Kearns HP. Dilacerated incisors and congenitally displaced incisors: Three case reports. *Dent Update* 1998;25:339-42.
9. Chadwick SM, Millett D. Dilaceration of a permanent mandibular incisor. A case report. *Br J Orthod* 1995;22:279-81.
10. Stewart DJ. Dilacerated unerupted maxillary central incisors. *Br Dent J* 1978;145:229-33.
11. Estrela C, Bueno MR, Sousa-Neto MD, Pécora JD. Method for determination of root curvature radius using cone-beam computed tomography images. *Braz Dent J* 2008;19:114-18.
12. Maragakis MG. Crown dilaceration of permanent incisors following trauma to their primary predecessors. *J Clin Pediatr Dent* 1995;20:49-52.
13. Andreasen JO, Sundstrom B, Ravn JJ. The effect of traumatic injuries to primary teeth on their permanent successors. A clinical and histologic study of 177 injured permanent teeth. *Scand J Dent Res* 1971;79:219-83.
14. Celik E, Aydinlik E. Effect of a dilacerated root on stress distribution to the tooth and supporting tissues. *J Prosthet Dent* 1991;65:771-77.

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