

Prevalence Of Root Dilaceration in Permanent Incisors Among Chennai Population- A Retrospective Disease

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Abstract

Introduction: A dental anomaly known as root dilaceration is defined as an abnormal curvature of the dental root which can cause complications in orthodontic, as well as problems during eruption. The main objective of this study is to determine the root dilaceration in permanent incisors among the Chennai population. **Materials and methods:** A total of 4960 teeth, which included 620 patients were examined. Each tooth was examined for root dilaceration, including the form (mild, moderate, or severe), root third, and root direction. A software (angle meter) was used to calculate the angle created by the root deviation in relation to the long tooth axis. **Results:** SPSS program v13.0 was used to perform an exploratory data analysis on the findings. The study sample had percent 2.12% (105 cases) of root dilaceration, with 53.84% female and 46.19% male patients, and the superior lateral incisor being the most affected tooth (80%). The mildest form of root dilaceration was the most common with 80% in the apical third and 84% towards the distal direction. **Conclusion:** Dilaceration is a relatively uncommon dental anomaly that affects all teeth. Recognizing the problem will make endodontic, orthodontic, and surgical care easier.

Keywords: dilaceration, Chennai population, prevalence, permanent incisors.

The term dilaceration was first coined in 1848 by Tomes, who defined the phenomenon as the forcible separation of the developed dentin's cap from the pulp while the dentin's development is still ongoing (1). Root dilaceration, with the exception of trauma, is a dental anomaly in which the tooth root has a varying angle of curvature caused by the crown's displacement from the rest of the root during its early development (1). For Chehayeb (2)(3) (2)(3) root deviation is said to be root dilaceration when there is an angulation equal to or greater than 20 degree formed between root and the long axis of the tooth.

The cause of root dilaceration is debatable, but it is assumed to have a clear association to trauma in the primary dentition, such as intrusive luxation or avulsion of the deciduous corresponding tooth (4). Dilaceration can be caused by one of two factors. Mechanical trauma to the primary predecessor tooth is the

most widely accepted cause, which results in dilaceration of the permanent tooth in the process of forming. Idiopathic developmental disturbances have been proposed as a possible cause in cases where there is no clear evidence of another possible cause a traumatic event. (5,6)(7) Scar formation, primary tooth germ developmental anomaly, facial clefting (9)(8), advanced root canal infections (25), ectopic tooth germ development and lack of space (9)(11)(12)(13)(10,11), and the effect of anatomic structures (for example, the cortical bone of the maxillary), the presence of an adjacent cyst, tumor, or odontogenic hamartoma (for example, odontoma and supernumerary tooth ((12) (11)(13)(14) (15) (16) (Margaskis 14) have all been reported as possible contributing factors.

Brin et al and Laskaris both explained their possible theories for why there is a correlation between dental trauma. Because of the close

proximity of the deciduous root apex and the permanent germ during odontogenesis, injuries may cause displacement of the calcified portion of the rest of the tooth, which continues to develop in this new position, resulting in an unusual angle.(4)(15).

Apical root dilaceration can affect 1 to 4.9 percent of all permanent teeth, with a higher incidence in female patients(16). It can also affect deciduous teeth as a result of prior trauma from neonatal laryngoscopy or endotracheal intubation. Hamasha et al examined 4,655 teeth on periapical radiographs and found that 176 (3.78%) presented. According to Silva Filho et al, of all permanent incisors, the upper centrals are the most affected (70.6%) followed by the laterals (20.6%) and lower incisors (8.8%)(17). While Malcic et al (16) reported that dilaceration is observed in the apical third of the roots of incisor, canines and premolars, while the middle third is more often affected in molars and finally, the cervical third in third molars. These authors also reported that premolars and maxillary anterior teeth present a higher total prevalence (4.6%) as compared with the rate affecting the corresponding region of the mandible (1.3%)

The most common way to diagnose root dilaceration is by a radiographic analysis. Clinically, the failure of permanent incisors to erupt, especially the upper ones, leads professionals to assume that there is an anomaly(3) The direction of root dilaceration should be considered in two planes and they can be categorized as mesial, distal, labial/buccal or palatal/lingual. If the roots bend mesially or distally, the dilaceration is clearly apparent on a periapical radiograph. The application of CBCT in the diagnosis and treatment of impacted dilacerated teeth has become increasingly indispensable.(18)(19). Recognizing root dilaceration is important during root canal treatment, it was proposed that failure to diagnose root dilaceration contributes to a higher rate of endodontic treatment failures.(3)(2).

The studies on prevalence of root dilaceration include, mostly, all permanent teeth, not being observed studies regarding only central and lateral permanent incisors.

Due to the difficulties of preventing this abnormality and the need to improve dentists'

understanding and diagnostic abilities on the subject, the aim of this study was to determine the prevalence of root dilaceration in permanent central and lateral incisors in both the maxilla and mandible.

Material and methods:

From a total of 1000 dental records, a random sample of 620 opgs was chosen from the patients who visited Saveetha dental college and hospital radiology department, Chennai evaluated within a period of January to march 2020 with an inclusion criteria of opgs of patients above 10 years. Exclusion criteria included patients who were less than 7 years old and patients with permanent incisors root with less than 2/3rd of the root formed, records with poor quality radiographs. The final sample included 620 records. All the teeth in each record were examined to give a total of 4960 teeth. From the evaluated radiograph, 334 opgs belonging to female individuals and 286 opgs belonging to males.

Dilaceration was described as deviations greater than 20° produced by the roots in relation to the long axis of the tooth. According to Schneider, and Erlich, Pereira and Panella(20) dilaceration was classified in accordance with degree of curvature of root as mild(20-40°), moderate(41-60°), and extreme curvature degree(above 60°), root third in which it was present (cervical, central, or apical), and root position (mesial, distal, buccal or lingual). The root dilaceration was measured with a similar method by Schneider, measuring the angle formed by the midline of the tooth long axis and the dedicated segment. The angles were measured by making a drawing on the radiograph by using angle meter software.(figure1)

The data was noted in an excel sheet, if the patient does not have dilaceration only identification data was entered (gender, examined teeth, and age). In SPSS version 13.0 (Statistical Package for Social Sciences), the data were categorized, and an exploratory data analysis was carried out, which included the development of single frequency and double entry tables, as well as statistical result graphs.

Results:

Six hundred and twenty radiographs of upper and lower central and lateral incisors, aged from 10 to 70 years of age were evaluated (figure 2). Panoramic radiograph belonging to 334 (53.84%) female patients and 286 male patients (46.19%). The prevalence of root dilaceration in the sample was 2.12%, prevalence amongst the incisors is presented in the table 1, affecting the maxilla (67.61%), more than the mandible (33.33%). The maxillary lateral incisors were the most affected (60.95%), followed by the mandibular lateral incisors (19.04%), mandibular central incisors (13%) followed by the maxillary central incisors (7%). (figure 3)

The permanent incisors with root dilaceration presented a mild curvature in (84 - 80%) of the sample, followed by moderate type (16-15.2%) followed by the severe type (5-4.47%). The dilacerated presented facing towards distal with (85- 80.95%) followed by (20-19.7%) towards the mesial. (figure 4) The location of the dilaceration in the root third were more frequently in the apical third with (84-80%), followed by the middle third with (20-19.21%) and cervical third with about (1-1.8%).

On chi square study, a statistically significant relationship was observed between gender and dilaceration in the maxillary lateral incisors and mandibular central incisors ($p=0.02$ and $p=0.03$, respectively). There is no significant correlation between gender and dilaceration associated with maxillary central and mandibular lateral ($p=0.74$ and $p=0.12$, respectively, $p>0.05$). (table 2)

Discussion:

Root dilaceration is a dental anomaly of shape characterized by a change in the root or crown angulation of the formed tooth. While its etiology is most often linked to trauma in the deciduous dentition (5)(6) However, one research expressed concern on the etiology of dilacerations, believing that trauma was not the primary cause (Anderson et al. 1971)(21). There was no history of trauma in 29 cases in another report (Stewart 1978) of 41 dilacerated teeth. No history of trauma to the lower labial segment was found in two other case reports of mandibular dilaceration (Feldman 1984, Chadwick & Millett 1995(22)). Other factors such as irregular root development due to cysts or adjacent

tumors(10)(23)(14)(24), the development of the ectopic tooth germ,(21,22,25)(26) and genetic factors (27) may also be involved.

Root dilaceration is a relatively rare condition, which occurs in both primary and permanent dentition but incidence in permanent is higher than primary, with a prevalence of 1 to 4.9 percent among all dental classes, according to the literature. (16), (28,29)(30,31) However, no research on root dilaceration confined to the incisor region, the focus of this study, were found, despite a prevalence of 2.15 percent. 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 Chennai population dental patients have shown an overall prevalence of 2.15% for individuals teeth examined. Hamasha et al (3) found a prevalence of 1.2% for all teeth in Jordanian patients, whilst the results of Ezoddini et al (32) and Thongudomporn and Freer (33) 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 (35) found out the prevalence of root dilacerations was 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.

The standards for understanding root dilaceration in the literature differ. Malcic et al (16) observed a prevalence of 1.01% of root dilaceration in incisors while examining all teeth. Chehayeb(2) had very stringent requirements for identifying root dilaceration of upper lateral incisors, which meant that only straight teeth (deviation $<20^\circ$) were not considered dilacerated. They found that dilaceration occurs 97.9% of the time in the upper lateral incisors. It's irrelevant if 97.9% of teeth are graded as having a deviation. Besides which, the distal position of the root of the upper lateral incisor is considered natural tooth anatomy. The data reported by Chohayed are

consistent with our results, where the prevalence for the upper lateral incisors is 88.5%.

From the root dilaceration observed, the group most frequently affected was the upper lateral incisors (60.95%), followed by lower lateral (19.04%), lower central (13%) and upper central (7%) agreeing with Silva et al by claiming that from all incisors, the upper lateral were the most affected by dilaceration (22.1%). However, the results of Silva Filho et al contradict those in this study, since the central incisors were the most affected (70.6%), followed by the lateral (20.6%) and lower incisors (8.8%). This is likely due to their close topographic relationship with primary teeth, which are often injured.

According to gender ($p = 0.981$), which is similar to a recent report of Ezoddini et al (32). However, other studies reported that dilaceration occurred equally between males and females (33)(3). In the present study, there is a significant difference in incidence of dilaceration associated with gender with p value = 0.2, 0.3 in maxillary lateral and mandibular central incisors respectively.

Although root dilacerations showed similar distributions in both jaws in our sample, it is stated that the prevalence is higher in the maxilla 67.61% than in mandible 33.39%. One other study noted that two thirds of the dilacerations in their study were in the mandible. These results are consistent with Malčić's et al (16) or Hamasha's et al. (3) results which expressed higher distribution in maxilla than mandible but not consistent with Milogu's et al. (34) findings which showed no significant difference. This finding may be the product of a trauma factor that affects the maxillary region of children in the deciduous dentition phase, especially the upper incisors, due to its position. The most prevalent type of dilaceration in this sample was the mild one (80%), followed by moderate (15.2%) and severe (4.47%) confirming the findings of Silva et al who observed, respectively, that 73.1% were dilacerations the mild type, 17% moderate and 9.7% severe. (17)

As for the root third where they were located, 80.2% of dilacerations were in the apical third, which agrees with the results of Malčić et al. In the middle and cervical third, the

prevalence was 19.2% and 1.1% confirming the findings of Malčić et al (16) of 13% and 2.3% respectively. This is due to the impact force on primary incisor which is vertically directed is transferred in the direction of the longitudinal axis and it may be carried along the apex to the noncalcified or partially calcified tooth germ of the permanent successor.

The roots were distally oriented in 80.95% of the incisors, which is consistent with the findings of Silva et al 16, who found that 95.1% percent of the roots were centered to the distal. This is due to which the calcified portion of the permanent tooth germ is displaced in such a way that the remainder of the noncalcified part of the permanent tooth germ forms an angle to it distally.

As several studies have been conducted to investigate the prevalence of root dilaceration, their methodologies have varied. Periapical radiographs were used by others, while panoramic and periapical radiographs were combined by others. Furthermore, some previous studies (35) used extracted teeth to detect root dilaceration, which may have resulted in an underestimation of their occurrence because teeth with curved roots are easily broken during extraction. The current research was focused on the examination of panoramic radiographs. Muhammed et al (35) found no statistically significant difference between panoramic and intraoral radiographs in detecting periapical pathology. According to current research, when atypical anatomy is suspected, in addition to the conventional radiograph, for a more accurate diagnosis, modern radiographic methods such as helical or spiral computed tomography are used. Cone beam computed tomography may be a reliable, noninvasive, and realistic way to compare the results of studies on gender and bilateral incidence of root dilacerations in different ethnic groups. Cone beam computed tomography images will show the true nature of tooth structures in three dimensions, allowing for accurate angulations and distance estimates (36). As a result, it is a valuable endodontic method for clinicians who are treating or retreating dilacerate teeth.

The purpose of diagnosing root dilaceration before starting endodontic care is to use

endodontic instruments to control the curves in the root canals. Failure to maintain root canal curvature is a common endodontic procedure defect, which can lead to ledging, apical cavitation (transport and zipping), perforation, and instrument breakage. The versatility of instruments in terms of scale must be addressed when using finger instrumentation techniques. Therefore, the diagnosis of root dilacerations before endodontic treatment is essential in either preventing complications throughout treatment or ensuring a positive treatment outcome.

During surgical tooth extraction, a dilacerated root can easily fracture ((22,38),34). Furthermore, it has been reported that the availability of dilacerations in the orthodontic treatment of teeth may complicate the procedure.

According to the methods used and the results obtained in this study, root dilaceration of incisors is a significant anomaly affecting the anterior teeth, despite its rarity. With a prevalence of 2.5%.

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Conflict of Interest:

We certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript

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Legends:

Fig1:indicates the mild,moderate and severe dilaceration measured using angle meter software

Fig2: represents the distribution of age in the collected sample of radiograph

Fig 3: Distribution of percentage of dilaceration in root of permanent incisors with about highest prevalence in max LI (60.95%)(64), mand LI (19.05%)(80), mand CI (13.33%)(14), max CI (6.67%)(7)

Fig 4: Indicates the distribution of root direction in the dilacerated root in permanent incisors. max LI (67.86%)(53), max CI(5.95%)(5), mand LI (15.46%)(16), mand CI (10.71%)(9)