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Negotiating the double curvature

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Abstract

Root anatomy is highly complex and unpredictable. The knowledge of the normal and its frequent variations can greatly enhance the success rate of endodontic practice. Variations in the number and the configuration of the root canals is common. Routine periapical radiographs help us to assess the number, length, curvature and aberration of the canal system of the tooth.

Keywords: Dilacerations, Double curvature canal

Introduction

Dilacerations is a developmental anomaly which results in a sharp angulation or bend between the root and the crown of the tooth. The term Dilaceration was first coined in 1848 by Tomes, who defined the phenomenon as the forcible separation of the cap of the developed dentin from the pulp in which the development of the dentin is still progressing.(1) It can occur anywhere along the length of the root.(2) The most common etiology is mechanical trauma to the deciduous tooth which results in damage to the permanent tooth germ in such a way that the remaining portion of the tooth germ is formed at an anglulation.(3)

Other contributory factors are ectopic development of tooth germ, presence of scar/ infection/ cyst/tumor, developmental anomaly of tooth germ and genetic factors.(4)

The criteria for recognizing root dilaceration vary in the literature. According to some authors,(5,6) a tooth is considered to have a dilaceration toward the mesial or distal direction if there is a 90-degree angle or greater along the axis of the tooth or root, whereas others defined dilaceration as a deviation from the normal axis of the tooth of 20 degrees or more in the apical part of the root(7) Root canal curvatures can be –(9,19)

1. Apical curve,
2. Gradual curve,
3. Sickle-shape curve,
4. Severe-moderate-straight curve,
5. Bayonet curve,
6. Dilacerated curve

Several studies have suggested methods to determine root canal curvature using periapical radiographs. Schneider proposed a method to determine curvature based on the angle that is obtained by two straight lines. The first is parallel to the long axis of the root canal, and the second passes through the apical foramen until intersecting with the first line at the point where the curvature starts. The formed angle (α) was named according to the degree of root canal curvature:(10)

1. Straight: 5°
2. Moderate: 10-20° and
3. Severe: 25-70°

Dilacerations can occur in either mesial/distal direction or in buccal/palatal direction. If the roots are dilacerated in labial direction, it is called as a scorpion tooth. If the root has double curvatures it is called as bayonet dilaceration. When the roots are dilacerated in buccal/ lingual direction, it gives a bull's eye appearance on a periapical radiograph.(11)

Prevalence of dilacerations in maxillary first premolar is 3.32% and maxillary second premolar is 4.1% on panoramic radiograph.(12)

The prevalence of dilacerations ranges from 0.32% to 7% but only 0.45% in mandibular first molar, mandibular third molars are affected most often, while the maxillary arch is affected more than the mandibular arch. Furthermore, permanent teeth are affected more frequently than primary teeth and posterior teeth more than anterior teeth with no gender predilection.(13,14,15,16)

Dilacerations are more commonly found in maxillary posterior teeth.

Extreme curvatures in the root canal requires the use of NiTi instruments which can effectively clean the canals without breakage.

Table 1: Classification of root canal curvatures

According to anatomic location[17]	Schneider's classification (1971)[18]	Ingle and Taintor's classification (1985)[19]	Zidell's classification (1985)[20]	Nagy classification[20]
Apical third Middle third Cervical third	Severe 25–70° Moderate 10–20° Gradual curve Straight up to 5°	Apical curve Dilacerated Dilaceration Bayonet Sickle-shaped curve	Severe curve Bayonet curve Apical bifurcations Apical curve Accessory root canals	I shape (straight) curve J shape (apical curve) C shape (entirely curved) S shape (multi curve)

Case Report

A male patient reported to the `Department of oral and maxillofacial surgery, Saraswati Dental College, Lucknow with a chief complain of pain and swelling in the upper region of jaw and was referred to the department of conservative dentistry and endodontics for RCT in relation to 14,15.

Clinical examination revealed an oval, well defined swelling on the palatal mucosa of size 5x2.5 cm. On palpation it was non- tender and non-mobile.

On radiographic examination, it was found that there was an impacted canine with relation to the roots of 14 and 15. The treatment option planned was surgical removal of the impacted canine 13 following the endodontic treatment of 14 and 15. The roots of 15 were observed to be S shaped and 14 to be dilacerated.

The right maxillary premolar 14 was anesthetized using 2% lignocaine with epinephrine 1:100 000and access cavity preparation was done using Endo access bur (Dentsply Maillefer, Ballaigues, Switzerland) under rubber dam isolation. Initially 6,8,10 and 12 no. K files (C^+ VDW) were used to determine the patency of the canal. The working length was established using an apex locator Ipex(NSK) and reconfirmed using 15no. K file (Dentsply) on a digital radiovisiograph. Sequential filing was done with NiTi file no. 15, 20 and 25. Copious irrigation was done with saline and Chloro Quick (stabilized NaOCl, 1-Hydroxyethane 1,1 Diphosphonic Acid) in order to prevent blockage of the canal. Further preparation was done with Hyflex CM rotary files till 4% 25 size of the instrument. Obturation was done using size 25 4% guttapercha. Post-operative restoration was done using composite.

After completion of the root canal treatment patient was referred to the department of oral surgery for the removal of cyst and impacted canine.

Fig. 1: Working length determination irt 14

Fig. 2: Master Cone Selection i.r.t 14

Fig. 3: Master Cone Selection i.r.t. 15.Obturation i.r.t. 14

Fig. 4: Obturationdone i.r.t. 14,15

Discussion

Dilaceration can be seen in both the permanent and deciduous dentitions. Two possible causes of dilaceration are trauma and developmental disturbances, and it has also been proposed that it might be associated with some developmental syndromes. The success of root canal treatment depends largely on complete biomechanical debridement of the canals and the elimination of microorganisms from the root canal system. In dilacerated teeth, it is often difficult to explore and negotiate the root canals, especially if the state of the pulp has caused apposition and/or resorption of the canal wall. Therefore, when an endodontic file is introduced into the root canal during treatment, it might be blocked by such irregularities.[21] Another problem in endodontic treatment of these cases is the inability to continuously follow the root canal curvature, and this might result in blocking of the canal, ledging, apical cavitation such as transportation and/or zipping, perforation, and instrument breakage.[22]

The diagnosis and management of double curvatures, or S-shaped canals, present an endodontic challenge. Careful examination of preoperative radiographs is clinically helpful.[23,24] The important treatment strategy requires that careful attention is paid to anatomical complexities and that anatomical variations can be found in any portion of a human tooth root.[25,26]

Strategies for management of mid root curvatures begin in the preoperative evaluation. Excellent access and management of the coronal third are the first two steps toward managing the severe curvatures. Achieving an excellent shape in the coronal third has significant application in creating a platform for ideal treatment of mid root curvature. An ideal coronal third preparation will allow greater volumes of irrigant to reach more deeply into the canal space more quickly, and allow the insertion of hand files into the middle and apical third without the obstructive and restrictive dentin that would otherwise be present at this level of the canal. Removal of restrictive dentin is consistent with better tactile sense and a greater flexibility in use of the file, in that the file can be used with the greatest possible effectiveness at its tip because it is not being restricted along its length.[27]

The deformation of canal instruments and instrument breakage in root canals are serious problems that are encountered in endodontics. An increase in canal curvature can result in preparation errors.[30,31,32] Bending during use in curved canals causes endodontic instruments to exert a force on the wall of the curved zone. Consequently, an equivalent force acts on the canal instrument in the dentine. The stress acting on a canal instrument is highest in the curvature zone. The contact between the file and the surface of the canal may cause enough stress to break the file. Despite their superelasticity, recently developed Ni-Ti canal instruments can suffer from cyclic fatigue effects in curved canals, as determined by Pruett et al.[33] who reported that a sharp canal curvature increases the stress on canal instruments. Sattapan et al.[34] demonstrated that torque delivered to the endodontic instrument was dependent on tip size, taper, and canal size. Clinically the fatigue of an instrument may be related to the degree of flexure when placed in a curved canal. Zelada et al.[8] concluded that both the speed of rotation and the curvature of the root canals contribute to an increased risk of breakage of endodontic rotary instrument. The curvature, however, would seem to be by far the most important factor.

The 'S' shaped canal has two curves, with the apical curve being very difficult to negotiate. The chances of strip perforation are very high in these root canals. (Depending on the degree of the apical curvature, in a few cases it is impossible to instrument this area.) Guttman suggested preflaring the coronal 1/3rd of the canal (at the expense of the tooth structure) to reduce the angle of curvature. Once this is done, it is easy to negotiate the remainder of the root canal.[28]

The incidence of procedure reduced by[29]

- Decreasing the restoring force by means of which straight file has to bend against the curved dentine surface and

- Decreasing the length of the file which is aggressively cutting at a given span.

Decreasing the force can be done following

- Precurving the file: A precurved file traverses the curve better than a straight file. Precurving is done in two ways:
- Placing a gradual curve for the entire length of the file
- Placing a sharp curve of nearly 45° near the apical end of instrument.

Conclusion

Understanding complex root canal morphology and choosing a proper canal preparation technique suited for such morphology, will contribute to successful endodontic treatment and negotiation of curvature.

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