

Negotiating challenging root curvatures: Review & case reports

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Abstract

Knowledge of dental anatomy is an essential tool for the success of endodontic treatment. A clinician is required to have an insight of the morphology of tooth related to its shape, form and structure before commencing treatment. Routine periapical radiographs helps us to assess the number, length, curvature and aberration of the canal system of the tooth. Diagnosis, endodontic access cavity preparation, root canal preparation and filling, and other related treatment gets complicated by the presence of a dilaceration. This article reports review of literature and two interesting case reports of root dilacerations.

Keywords - Endodontic treatment, rotary protaper, root curvatures

Introduction –

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 not uncommon.¹ Routine periapical radiographs helps us to assess the number, length, curvature and aberration of the canal system of the tooth.

Dilaceration is a deviation or bend in the linear relationship of a crown of a tooth to its root, it is an angulation or sharp curve in the root or the crown of a developed tooth of 90° or more.² There are 2 possible cause of dilaceration. The most widely accepted cause is mechanical trauma to the primary predecessor tooth, which results in dilaceration of the developing permanent tooth.^{3,4,5} An idiopathic developmental disturbances is proposed as another possible cause in cases that have no clear evidence of traumatic injury.^{6,7}

The criteria for recognizing root dilaceration vary in the literature. According to some

authors,^{2,8} 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 root⁹

Root canal curvatures can be –^{10,11}

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

Curved root canals exhibit great difficulty in cleaning, shaping & obturation of the root canal system,¹ therefore determining the degree of curvature of root canal before starting the endodontic treatment is mandatory.

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

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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:¹²

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

Determining the curvature of the root will permit the maintenance of the curves associated with continuously tapered shapes and prevents structural deformations of the endodontic instruments. In this way, disastrous consequences to root canal preparation can be avoided, such as loss of working length, apical transportation, creation of ledges, elbows, zips and perforations, and fracture of instruments.¹² Thus, diagnosis of root dilacerations before endodontic treatment has a critical importance in either preventing complications during treatment or ensuring a good treatment result.¹³

Case report - 1

- A 32 year old male patient reported to the Department of Conservative Dentistry and Endodontics at Dr. D. Y. Patil dental college and hospital, Pune, with a chief complaint of pain in left lower posterior region of mouth.
- Clinical examination revealed –
 - Deep occlusal caries with left mandibular third molar (48).
 - The tooth was tender to vertical percussion.
 - No furcation involvement was seen clinically.
 - General oral hygiene was good.
- Radiographic examination revealed –
 1. Carious pulp exposure with widening of the periodontal ligament space

2. Unusual morphology of the mesial root which showed a sharp mid root curvature.

After clinical and radiographic examination, non surgical endodontic treatment of left mandibular third molar (48) was planned.

After adequate anesthesia, rubber dam was applied and access opening was done. The working length was determined (figure - 1) and cleaning and shaping was done using rotary protaper system –¹⁷



Figure 1: Working length determination

Using calcium hydroxide as an intracanal medicament, closed dressing was given for 6 days. The canals were obturated with 6% gutta percha points using resin based sealer (Figure - 2). Temporary restoration with IRM was given for 2 weeks. Then the post-obturation restoration was done with amalgam to maintain a good coronal seal. Four years follow-up radiograph showed healed periapical lesion (Figure - 3).

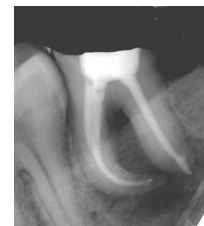


Figure 2: Immediate post-obturation IOPA



Figure 3: 4 years follow-up post-obturation IOPA showing healed periapical lesion

Case report – 2

- A 36 year old male patient reported to the Department of Conservative Dentistry and Endodontics at Dr. D. Y. Patil dental college and hospital, Pune, with a chief complaint of pain in left upper posterior region of mouth.
- Clinical examination revealed –
 1. Deep occlusal caries with left maxillary first molar (26).
 2. The tooth was tender to vertical percussion.
 3. No furcation involvement was seen clinically.
 4. General oral hygiene was good.
- Radiographic examination revealed –
 1. Carious pulp exposure with widening of the periodontal ligament space
 2. Unusual morphology of the palatal canal showing ‘S’ shaped curvature.

After clinical and radiographic examination, non surgical endodontic treatment of left maxillary first molar (26) was planned. The sequence followed for cleaning and shaping using rotary protaper system, was same as in case 1.

All three, Mesio-buccal, MB2 & disto-buccal canals, were enlarged till F1 and palatal canal was enlarged till F2. Using calcium hydroxide as an intracanal medicament, closed dressing was given for 4 days. The canals were obturated with 6% gutta percha points using resin based sealer (Figure – 4). Temporary restoration with IRM was given for 2 weeks. Then the post-obturation restoration was done with amalgam to maintain a good coronal seal.



Figure 4: Post-obturation IOPA

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.

Root dilacerations were similarly distributed between maxilla and mandible. The most frequently root dilacerated teeth were found to be mandibular third molars (12.8%), followed by maxillary third molars (7.4%), maxillary first molars (6.7%), mandibular second molars (5.5%), maxillary second molars (5.4%) and mandibular first molars (5.3%).¹³

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.¹⁴ 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.⁷

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.

Conclusion

Knowledge and recognition of canal configuration can facilitate more effective canal identification and unnecessary removal of healthy tooth structure. To address challenging mid root curvatures, it is essential to remain patent, irrigate copiously, first negotiate canals by hand, and consider using hand NiTi files in a crown down manner.

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