Managing curved canals

Irama Ansari, Rahul Maria

Abstract

Dilaceration is the result of a developmental anomaly in which there has been an abrupt change in the axial inclination between the crown and the root of a tooth. Dilaceration can be seen in both the permanent and deciduous dentitions, and is more commonly found in posterior teeth and in maxilla. Periapical radiographs are the most appropriate way to diagnose the presence of root dilacerations. The controlled regularly tapered preparation of the curved canals is the ultimate challenge in endodontics. Careful and meticulous technique will yield a safe and sufficient enlargement of the curved canals. This article gives a review of the literature and three interesting case reports of root dilacerations.

Keywords: Balance forced technique, dilacerations, precurved files, protaper

Introduction

A tooth with a straight root and a straight root canal is an exception rather than being normal because most teeth show some curvature of the canal. In addition, most canals have multiple planes of curvature throughout their length. Tomes, in 1848, called such curvatures as “dilacerations.” It refers to an angulation or a sharp bend or a curve in the root or crown of formed tooth or a deviation or bend in the linear relationship of a crown of a tooth to its root [2] [Figure 1].

Tooth is considered to have a dilaceration toward the mesial or distal direction if there is a 90° angle or greater along the axis of the tooth or root. Dilaceration can also be defined as deviation of the apical part of the root by 20 degree or more. [1]

Cause

The condition is thought to be due to trauma during the period in which tooth is forming. The result is that the position of the calcified portion of the tooth is changed and the remainder of the tooth is formed at an angle. [1]

Presence of curvature may pose difficulty in root canal instrumentation. The final result of instrumentation of curved canals may be influenced by several factors such as flexibility and diameter of the endodontic instruments, instrumentation techniques, location of the foraminal opening and the hardness of dentin. [3]

Ledge formation, blockages, perforations and apical transportation are undesirable accidents that have been observed to occur after preparation of curved canals. [3]

Management of such curved canals is an endodontic challenge; so, for a successful therapy, a thorough knowledge of root and root canal morphology is required. Curved canals can be

• Gradual curvature of the mesial canals in the apical third;
• Acute curvature in the apical third;
• Curvature throughout the canal;
• Dilacerated root canal and
• S-shaped root canal.

How to determine the curvature

Before initiation of treatment, an estimate should be made as to the degree of curvature of canals by seeing the radiograph.
The interior angle is formed by intersection of the straight line from the orifice through coronal portion of the root and another straight line from apex through apical portion of canal.\[4\]

**Various techniques used for management**

Traditionally, canal shaping has been achieved using ISO-normed, 0.02-tapered stainless steel instruments. Sizes above #15 or #20 become inflexible and have a tendency to straighten. When carried out in curved canals, such procedure often results in iatrogenic damage to the natural shape of the canal, particularly in its apical third, resulting in errors like ledge, elbow or zipping of the canal.\[5\] To avoid occurrence of such errors, even contact of the file to canal dentine should be there. But the file has the tendency to straighten up, and hence it is difficult to control removal of dentine along the entire length of file in push pull motion.

The above errors can be reduced by\[6\]
- decreasing the restoring force by means of which straight file apt 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 by the 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 the instrument

**Extravagant use of smaller number files as they can follow canal curvature**

Because of their flexibility, they should be used until larger files are able to negotiate the canal without force.

**Use of intermediate size of files**

It allows smoother transition of the instrument sizes to cause smoother cutting in curved canals, e.g. cutting 1 mm of No. 15 file makes it No. 17 file as there is an increase of 0.02 mm of diameter per millimeter of length.

**Use of flexible files**

As they help in maintaining shape of the curve and avoid errors like ledge, elbow or zipping of the canal.

Decrease in length of actively cutting files is achieved by the following:
- Anti-curvature filing.
- Modifying cutting edges of the instrument by dulling the flute on outer surface of apical third and inner portion of middle third, which can be done by diamond file.
- Changing canal preparation techniques, i.e. use of crown-down technique. Tendency to create narrow canal shapes minimizing access of irrigants and creating potential to allow debris to be pushed apically. Attempts at overcoming the deficiencies of these instruments resulted in a number of preparation techniques that aimed to reduce iatrogenic defects and produce canals with a more flared shape.\[9\]

A significant advancement in root canal preparation with hand instruments was made with the introduction of balanced force movements of files. The balanced force movements of the file are:\[9\]

- A – clockwise 60°, so that it binds against the wall and advances apically.
- B – anticlockwise 120° with apical pressure, so as to crush and break off the engaged dentinal wall.
- C – clockwise 60° without apical advancement, allows flutes to be loaded with debris and removed from the canal.

**Advantage**
- Efficient and less prone to cause iatrogenic damage and maintains the instruments centrally within the root canal.
- Extrusion of debris apically is also reduced, resulting in less postoperative pain.

**Motion of file in a root canal**

Enlargement of a straight canal does not pose particular problems. It could be done by a succession of inward and outward motions accompanied or not by rotary motions. However, curved canals are different where departure from the balanced force technique can result in damage of the canal wall. As it is impossible to ascertain on the basis of radiograph whether there is a curvature in a buccolingual plane or not, it is expedient to apply the balanced force technique as a general rule for the preparation of all root canals.\[7\]

Introduction of very flexible instruments made from nickel titanium alloy having a taper 2-6 times greater than the ISO standardized 0.02 files have revolutionarised the management of curved canal. They have the ability to pass around curves more readily. They are available as GT instruments and Protaper instruments (Dentsply). Both instruments appear to offer many advantages over traditional 0.02 taper hand instruments. Both instruments can be used in conjunction with or complementary to rotary instruments. Hand NiTi instruments can also be selected instead of rotary instruments in teeth with difficult canal anatomy like severe curvature in apical third and problematic handpiece access.\[9\]

The crown-down sequence of instrumentation has largely superseded the outdated step-back method. The advantages of this root canal preparation from crown to apex with early coronal flaring include:
- reduced coronal binding of instruments;
- less likelihood for a change in the working length measurement during preparation;
- less risk of inoculation of endodontic pathogens into the
periradicular tissues;
• enhanced penetration of irrigant into the root canal system and
• less risk of extrusion of irrigant and debris.

Sequence of instrumentation done with various types of curvatures

- Endodontic therapy was initiated under local anesthesia and straight-line access was gained in all the three canals.
- Pulp chamber was irrigated with sodium hypochlorite (NaOCl).
- Initial scouting of all the root canals was done with K-file no. 10, one by one, and the patency of root canals was established. This negotiating file reproduced the same curvature as that of the curved root canal.
- File no. 10 was clipped by 1 mm and precurved in the same direction and to the same extent as the scouting file – this gave us file no. 12.
- File no. 12 so obtained was placed in the canal till the apical third.
- Special emphasis was placed on frequent irrigation of the root canal to avoid blockage by dentinal debris and to remove the necrotic tissue. NaOCl and saline were used for irrigation.
- Simultaneously, reverse flaring was initiated in the coronal third with K-file no. 40. It was placed in the orifice position for a slight reaming of the coronal portion.
- Recapitulation was done with file no. 12 and coronal flaring was done in crown-down fashion with K-files no. 35 and 30.
- Gate-glidden (GG) drills were placed sequentially in a step-back fashion (i.e. no. 1, 2 and 3) to allow easy placement of instruments and to improve the tactile sensation of the instrument placed in the canal. Coronal flaring till (GG) no. 3 was sufficient to provide unrestricted placement of the instrument.
- Recapitulation with file no. 12 was done to check patency and to remove the dentinal debris thus created.
- File no. 12 was placed and the pulp chamber was flooded with ethylenediaminetetraacetic acid (EDTA) that provided the necessary lubricating action.
- A working-length radiograph was taken at this point with file no. 10 placed in the root canal to avoid over-instrumentation.
- Sequential filing of the curved canal was done with K-files no. 15, 17, 20, 22 and 25 until full working length was achieved. Files were selected to take advantage of the flexibility of the files up to no. 25.
- K-File no. 30 was placed 1 mm short of the working length.
- To confirm the deep shape and completeness of uniform preparation, files no. 30, 35, 40 and 45, etc. were used passively in step-back fashion until 3–4 mm short of the orifice.
- During the whole preparation, root canals were repeatedly irrigated with irrigant and frequent recapitulation was done.
- A final working-length radiograph was taken.
- Canals were flushed with saline and dried with paper points.
- All the straight canals were conventionally prepared by using the step-back preparation technique.
- The lateral condensation method of obturation was preferred.

Case Reports

Case 1
Dilacerated root canal

• A 22-year-old male reported in our department with pain in relation to right maxillary first molar.
• Clinically, the tooth was carious on the occlusal surface and tender on percussion.
• Radiograph revealed the carious pulp exposure with widening of the periodontal ligament space [Figure 2].

It also revealed unusual root morphology of the mesiobuccal and distobuccal roots which showed a sharp curvature at middle third. After anaesthesia and rubber dam isolation a modified rhomboidal shaped cavity was prepared. A 10 # K file was precurved in accordance with the degree of curvature seen in radiograph with mesiobuccal and distobuccal roots. This 10 # K file glide path was ascertained till radiographic working length. Estimated length till the curvature was marked on the engine-driven instrument and then the coronal flaring was done. Working length was then confirmed using apex locator in all canals. Where there was decrease in working length in mesiobuccal and distobuccal roots than the radiographic working length estimated, due to coronal flaring and straightening of the canal, 10 # K file was reintroduced till radiographic working length followed by 15 # and 20 # K file. Always precurve the instruments before placing to retain the original shape of the canal and prevent transportation to the apical side of the apical foramen. Now, with rotary Protaper, cleaning and shaping was achieved in all canals. S1 was used in brushing motion till the working length. Shaping of the canal was then done by S1 and S2 till the working length. In both mesiobuccal and distobuccal roots, canals were finished till F1. In palatal root, cleaning and shaping was done till F3. After finishing, master cone was selected and obturation was done [Figure 3].

Case 2
Gradual curvature of the mesial root in the apical third [Figures 4, 5]

Case 3
Curvature throughout the canal [Figures 6, 7]
Discussion

One of the most important aspects of endodontic treatment is the cleaning and shaping of the root canals. The most desirable shape of the prepared canal is a progressive taper with the largest diameter at the coronal end and is narrowest at the apical constriction. A progressive taper allows a greater degree of instrument and irrigant contact with the surfaces of the canal walls, thereby enhancing the effectiveness of cleaning.

However, the preparation of curved canals presents one of...
the greatest challenges in endodontics and is fraught with difficulties. Only the curvatures in mesio-distal plane can be seen on radiograph, though curvatures in the bucco-lingual plane are also evident in many teeth. Failure of root canal treatment in curved canals is mainly due to procedural errors like ledges, fractured instruments, canal blockage, zip and elbow creation.\[3\]

The cases presented above were treated with hand instrumentation with K files and NiTi rotary instruments. It is important that a tooth with complex root canal morphology be treated properly the very first time, since endodontic treatment in such teeth is likely to fail if not treated carefully.

Conclusion

Proper care and attention should be directed in radiographic assessment, access cavity preparation and exploration to negotiate extra and curved canals. Current NiTi preparations that use files with greater taper or variable taper are a substantial improvement over instrumentation with 0.02 tapered stainless steel files, particularly when used in curved root canals. These newer instruments produce better shape, using fewer instruments and in a shorter time.\[5\] The Protaper sequence is always the same regardless of the tooth or anatomical configuration of the canal being treated.

References

1. Jafarzadeh H, Abbott PV. Dilaceration: review of an endodontic challenge. J Endod 2007;33:1025-30.
2. Hamasha AA, Al-Khateeb T, Darwazeh A. Prevalence of dilaceration in Jordanian adults. Int Endod J 2002;35:910-2.
3. Jain N, Tushar S. Curved canals: ancestral files revisited. Indian J Dent Res 2008;19:267-71.
4. Wiene FS. Endodontic therapy. 6th ed, St Louis, 2004, Mosby
5. Saunders EM. Hand Instrumentation in root canal preparation. Endodontic Topics 2005;10:163-7.
6. Stock CR, Gulabivala WK. Endodontics. 3rd ed, St Louis, 2004, Mosby.
7. Charles TJ, Charles JE. The ‘balanced force’ concept for instrumentation of curved canals revisited. Int Endod J 1998;31:166-72.
8. Schilder H. Cleaning and Shaping of the root canals. Dent Clin N Amer 1974;18:269-96.

How to cite this article: Ansari I, Maria R. Managing curved canals. Contemp Clin Dent 2012;3:237-41.

Source of Support: Nil. Conflict of Interest: None declared.