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Case Series

Endodontic management of curved canals in mandibular molars- A case series

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ABSTRACT

A tooth with a straight root canal and a single foramen is the exception rather than the rule. Most of the canals have multiple curvatures along their length, which poses difficulty in root canal instrumentation. Because of the presence of curved canals in mandibular molars, Endodontic treatment is very challenging. Curved canals have been found to be relatively higher in mandibular molars, ranging from 3.3 to 30.92% when compared to maxillary molars. Constricted canals and curvatures introduce factors that can increase the risk of procedural errors during root canal preparation. A thorough assessment of the preoperative radiographs, careful and a meticulous approach can yield into a safe and a successful endodontic treatment of such teeth. The current case series presents two such interesting cases of endodontic management of curved canals in mandibular molars.

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1. Introduction

Every clinician aims to achieve the best treatment outcomes of endodontically treated teeth. To attain the best results, one must diagnose the condition very well. Therefore, complete knowledge of root canal morphology with comprehensive understanding of the root canal system complexity is particularly important in clinical practice to reach the desired treatment.

Most of the human root canals have mutiplanar curvatures and to the multiple degrees; suggesting that a tooth with a straight root canal and a single foramen is the exception rather than the rule.

Cleaning & Shaping of the root canal system has been recognized as one of the most important step that can impact the subsequent stages of root canal treatment.

But this step can become extremely difficult in severely curved canals. Curvature present in the canals introduce

factors that can increase the risk of procedural errors during root canal preparation. These errors include transportation, ledges, perforations, instrument separation, asymmetrical dentine removal, and alterations of the internal anatomy

A thorough assessment of the preoperative radiographs, careful and a meticulous approach can yield into a safe and a successful endodontic treatment of such teeth. The current case series presents two such interesting cases of endodontic management of curved canals in mandibular molars.

2. Case Report 1

A 34-old male patient was referred to the Dental Outpatient Department of Subdivisional Hospital, Kalka from a Local Dentist with the chief complaint of pain in relation to lower right back tooth region. Clinical examination revealed mandibular right second molar having deep carious lesion. The tooth was tender on percussion. Medical history was noncontributory. Tooth was vital when pulp sensibility tests were conducted. The radiographic examination revealed the

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radiolucency involving mesial pulp horn with widening of periodontal ligament. There was loss of lamina dura apically in relation to both mesial and distal roots. Apart from these findings, a sharp curvature in the mid-third region of the tooth was observed on the radiograph (Figure 1 a). A diagnosis of Symptomatic Apical Periodontitis was established. Endodontic treatment was planned followed by full coverage restoration of the tooth.

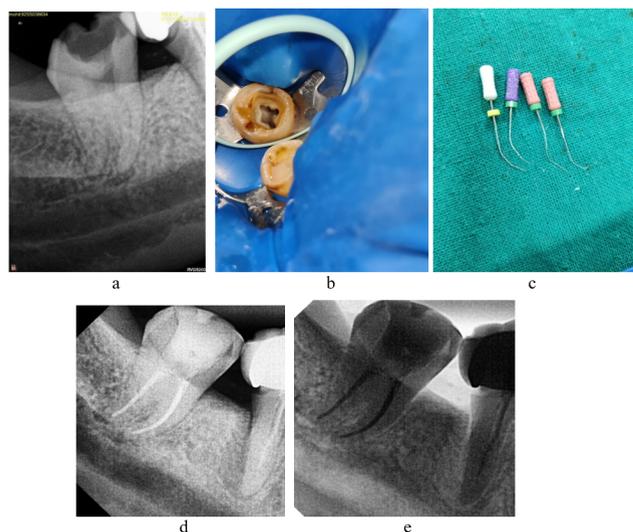


Fig. 1: a); Preoperative radiograph; b): Access cavity preparation under rubber dam isolation; c): Precurved hand files; d & e): Postoperative Radiographs

With informed consent, local anesthesia was administered using 2% lignocaine and 1: 200,000 Adrenaline and Endodontic treatment was initiated under rubber dam isolation. The carious lesion was removed and the endodontic access cavity was prepared using round end tapered diamond bur(Mani) (Figure 1 b).

Initial negotiation of the canals was done with K-file no. 8 followed by K file number 10(Mani), one by one so as to establish the patency of all the canals present. When K file no.10 was used for establishing the patency of the canal, it was found that that file was reaching a hard end point 3mm short of apex. A working length IOPA was taken to know the reason of blockage which revealed the presence of sharp curvature in the middle third of the canal.

Length of the canal was determined till the point of resistance. After that the taper of the canal was increased by 4% 1mm short of this point. In the next step, No.10 K file was precurved and inserted into the canal through this curvature. Precurving of the hand files was done according to degree of curvature (Figure 1 c). File no. 10 was modified by cutting 1mm from the tip to have file no.12. and precurved in the same direction and to the same extent as that of scouting file. Recapitulation was done with file no. 12 to check the patency and to remove the dentinal debris

thus formed. All the handfiles were used in reciprocating handpiece(K-400) using watch winding motion.

Gate-glidden drills(Mani) were used 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.

Working length was determined by electronic apex locator and confirmed by radiograph using no.15 K File.

In the next step, Glide path files (NTmagic Files) of intermediate sizes no.12, no.15, no.19 in 3% taper were used in order to have a reproducible glide path till the working length.

Final cleaning and shaping was carried out using NT Rainbow-S (NineTen) up to 4% 30 size of the instrument. Throughout the procedure, thorough debridement of the canals was done using 5.25% hypochlorite irrigant.

The canals were then flushed with saline. Final flush was done done with 17% EDTA 1ml canal. All the irrigants were activated using Sonic Activator. A master cone radiograph was taken with 30 size 4% Gutta percha. The cold lateral condensation method of obturation was performed using calcium hydroxide based sealer. Post obturation was done with composite resin (3M) to maintain a good coronal seal (Figure 1 d,e). The patient was given postoperative instructions and recalled for further follow up.

3. Case Report 2

A 29-old female patient reported to the Dental Outpatient Department of Subdivisional Hospital, Kalka, with the chief complaint of severe pain in relation to lower right back tooth region. Patient also reported that pain increased while lying down on bed and while sleeping and relieved only for few hours after taking analgesics. Clinical examination revealed deep caries in relation to disto-occlusal aspect of mandibular first molar. The tooth was mildly tender on percussion. Medical history was noncontributory. Tooth was vital when pulp sensibility tests were conducted. The radiographic examination revealed deep caries in close approximation to pulp with no signs of periapical pathosis. Apart from these findings, the tooth showed gradual curvature with respect to mesial canals (Figure 2 a). A diagnosis of Symptomatic Irreversible Pulpitis was established. Endodontic treatment was planned followed by full coverage restoration of the tooth.

With informed consent, local anesthesia was administered using 2% lignocaine and 1: 200,000 Adrenaline and Endodontic therapy was initiated under rubber dam isolation. The carious lesion was removed and the endodontic access cavity was prepared using round end tapered diamond bur.

Initial scouting of all the canals was done by size 10 K file. In this case, File was not reaching upto the complete length in the distal canal

At the level of blockage, a working radiograph was taken to reveal the exact level and possibly the reason for blockage. Further movement of the size 10 K-file was hindered because the canal curvature began at this level. The length and radius of curvature were determined and replicated to the scouting K-file.

Taper of the canal was increased upto 4% 1mm short above the point of resistance. Size 10k file was precurved and the canal was negotiated till working length. For the smooth glide path formation, size 10k file, size 12k file & size 15 k file were used using K 400 reciprocating handpiece. Once size 15 k file became loose in the canal, then the rotary instrumentation was initiated. Rest of the steps are same as discussed in the first case. Special attention was given on thorough debridement of the root canal and the frequent recapitulation. Final cleaning and shaping were carried out using NT Rainbow-S (Nineten) up to 4% 30 of the instrument. The postendodontic restoration was done with composite resin.(Figure 2 b)

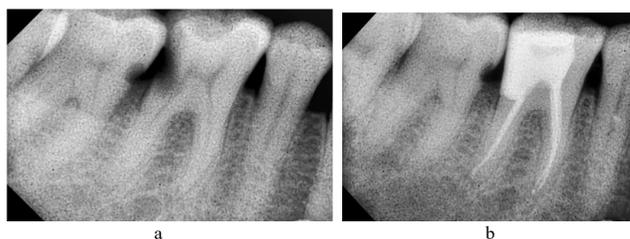


Fig. 2: a): Preoperative radiograph; **b):** Postoperative radiograph

Endodontic treatment of both the cases were completed under 3.2X magnification.

4. Discussion

A major biologic aim of the root canal therapy is to address the problem of apical periodontitis by cleaning and shaping and the subsequent sealing of the root canal system. A well-shaped canal is defined more specifically by the absence of procedural errors, achievement of complete disinfection & the retention of as much tooth structure as possible. Most of the root canals present in the teeth have multiplanar curvatures along their length, which pose difficulty in their thorough debridement and hence increases the incidences of procedural errors.¹

Endodontic treatment of 2nd and 3rd molars is generally challenging as there is presence of curved canals, fused roots and C-shaped canals. The prevalence of curved canals has been found to be relatively higher in mandibular molars, ranging from 3.3 to 30.92% when compared to maxillary molars that range from 1.33 to 8.46%.

The first step is the careful review of pre-operative radiographs recognizing the presence of severe curvatures radiographically and identifying other important considerations in treatment. These considerations include

the length, degree and the direction of curvatures, the number of curvatures, position of the tooth in the arch and the position of crown in relation to root.

Many attempts have been made to measure the extent of curvatures. The most accepted one is given by Schneider. Accordingly, the degree of root canal curvature is categorized as straight: 5° or less, moderate: 10–20° and severe: 25–70.²

Root canal curvatures may be apical, sickle shaped, straight curve which can be moderate/severe, gradual, bayonet/S-shaped curve, and dilacerated curve.³ Curved root canals present a challenging situation for cleaning, shaping and disinfection of the root canal system.⁴ These curves must always be assessed and maintained strictly

Multiple angled radiographs provide a good sense of the anatomy in three dimensions particularly if you donot have CBCT technology available. A shifted radiograph can give the clinician important information about the presence of subtle curvatures in the buccolingual plane.

The specific equipment required for the management of curved canals includes long-shafted miniaturized burs, thin endodontic explorers like DG 16 or JW17, highly reflective mirrors, ultrasonic tips, diagnostic dye and most importantly Magnification.

Magnification using either Loupes or Dental Operating microscope enhances treatment outcome in the management of curved canals as it enhances the visual information thereby reducing the incidences of procedural errors which are commonly seen while operating with an unaided eye

The present case series included endodontic management of a curved root canals of mandibular molars. Knowledge of internal root anatomy guides a successful endodontic therapy.⁵ In the present case series, proper attention was directed in preoperative radiographic assessment which helped in negotiating root curvature and canal configuration.

One of the major challenge in the management of curved canals is the force required for rotating a file in comparison to the force necessary to progress the file through the curvature.⁶ A moderate curvature in the mid-root or the cervical portion of the canal is more threatening than a severe curvature in the apical third of the canal.

In most instrumentation techniques, determining the glide path upto the working length and coronal pre enlargement has been suggested.⁷ A pre-established glide maintains a continuous and clear path from the canal orifice to the apical foramen which reduces torsional tresses on the shaping instruments therefore reducing the risk of fracture of the instrument and other procedural errors in the canal.

Coronal preflaring removes coronal third debris before shaping instruments negotiates the apical third which further reduces the potential of apical extrusion of the debris.⁸

A glide path can be established either with the hand files or with the rotary files. The benefits of using K-files include better tactile sensation and better understanding of

the anatomy as when removed from curved canals, they often retain an impression of the canal anatomy alerting the operator to the topography of the most significant curves.

The drawbacks of using hand files are that they are time consuming, causes higher operator fatigue, highly technique sensitive especially for an inexperienced operator, alters the root canal anatomy and causes more extrusion of the apical debris.⁹

Rotary glide pathfiles reduces instrumentation time, helps in preventing the procedural errors, preserves root canal anatomy, reduces operator fatigue, and minimizes the apical debris extrusion. The disadvantages include the increased risk of torsional stresses and hence the torsional failure when engaged inside the anatomy, the reduced tactile sensation, the additional cost and the limitation of their use only after preparing initial glide path with the hand files.¹⁰

In the present case series, small handfiles were first precurved and then placed inside the canal using reciprocating handpiece. Precurving of handfiles and use of smaller number files facilitates easy negotiation of canal curvature¹¹ and preserve root canal anatomy without any procedural mishap. Using K files in reciprocating handpiece in curved canals reduces preparation time, operator and hand fatigue and also reduces risk of instrument separation.

Usage of rotary files in crown down technique helps in early flaring of coronal third and has advantages such as reduced coronal binding of the instruments, less apical extrusion of debris, and effective irrigation of apical third of the root canal.¹²

The root canal curvature reduces apical penetration of the irrigant which affect the irrigation efficacy. Finer and more flexible needles (30 Gauge) were used to ensure delivery of irrigant in apical third. All the irrigants used were activated using sonic activator as activation of irrigants improves cleaning ability and disinfection efficacy.

5. Conclusion

Management of curved canals can be time-consuming, challenging and frustrating. A sound knowledge about internal anatomy of the tooth, thorough assessment of preoperative radiographs is crucial prerequisite in managing curved canals. To address challenging mid root curvatures, it is essential to remain patient, first negotiate the canals by hand files and then consider using rotary files with copious irrigation in between each file. A consistent strategy should be followed for the successful management of curved

canals.

6. Source of Funding

None.

7. Conflict of Interest

None.

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