

Coping with complexity: Navigating severe curve canals in endodontic root canal treatment: A clinical case series

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Abstract

Knowledge of tooth anatomy and its variations are essential for the success of endodontic treatment. Dilacerations represent developmental anomalies marked by sudden deviations in a tooth's longitudinal axis. Common causes of treatment failures in such cases are primarily related to procedural errors such as ledging, fractured instruments, canal blockages, zipping, and elbow creations. The current case series presents three such interesting cases of endodontic management of curved root canals in mandibular molars.

Keywords: Dilacerations; curved root canal management; endodontic treatment; root canal treatment; wisdom tooth

INTRODUCTION

Understanding root canal anatomy is like deciphering a complex puzzle in dentistry. In 1848, Tomes introduced the term "dilacerations," referring to angular or sharp bends in either the root or crown of a fully formed tooth or a deviation in the alignment between the crown and root.^[1] Ideal root canal preparation aims to maintain the original canal shape and widen gradually from the crown to the root tip. Effective endodontic treatment relies heavily on thorough shaping and cleaning of the root canal system, which can be challenging due to the intricate nature of root canal anatomy, especially with various anatomical curvatures.^[2] Root canal therapy for third molars is recommended strategically, involving indications such as serving as an abutment tooth for a fixed prosthesis, improving mastication when there are posterior teeth in the opposing arch, or serving as a location for a fixed partial denture when the second molar is missing.^[3] Curvatures

often lead to procedural errors, such as ledge formation, blockages, perforations, and apical transportation.^[4,5] However, managing cases with curved root canals remains challenging in endodontics, emphasizing the importance of understanding root and canal morphology for successful outcomes. This case series demonstrates the successful treatment of three cases with curved root canals.

CASE REPORTS

Case I

A 42-year-old male patient reported to the department of conservative dentistry and endodontics with diffuse pain in the mandibular right quadrant. The patient gave a history of pain for the last 10 days that aggravated while sleeping and relieved after taking the analgesics. The pain was spontaneous and aggravated, particularly at night. No relevant medical history was observed. Vitality testing (cold and electronic pulp testing) elicited sharp lingering pain after the removal of the stimulus. On radiographic examination, previously incomplete root canal treatment was seen. Based on the clinical and radiographic findings, a diagnosis of symptomatic irreversible pulpitis with symptomatic apical periodontitis with respect to #48 was

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made, informed consent was obtained, and endodontic treatment was initiated [Figure 1].

Case 2

A 27-year-old woman visited the department of conservative dentistry and endodontics complaining of pain in her lower right back tooth area for the past 2 months. She mentioned experiencing mild intermittent pain, which had worsened over the last 1 week, especially at night. She also reported sensitivity to hot and cold substances. Clinical examination revealed deep cavities on the occlusal surface of the lower right third molar and on the distal surface of the second molar (tooth numbers 47 and 48), which was tender to vertical tapping. The initial X-ray showed a caries lesion, indicating decay that had reached the pulp. Based on these findings, the diagnosis was symptomatic irreversible pulpitis with symptomatic apical periodontitis with respect to tooth numbers 47 and 48. After obtaining informed consent, endodontic treatment was started [Figure 2].

Case 3

A 48-year-old male patient reported to the department of conservative dentistry and endodontics with diffuse pain in the mandibular left quadrant. The patient gave a history of pain from the last month that aggravated while sleeping and was relieved after taking the analgesics. The pain was spontaneous and aggravated, particularly at night. No relevant medical history was observed. Vitality testing (cold and electronic pulp testing) elicited sharp lingering pain after the removal of the stimulus. Clinical examination revealed deep occlusal carious lesions were seen on the mandibular third molar. Based on the clinical and radiographic findings,

a diagnosis of symptomatic irreversible pulpitis with symptomatic apical periodontitis with respect to 38 was made, informed consent was obtained, and endodontic treatment was initiated [Figure 3].

Clinical management

After local anesthesia (Lignox 2%; Indoco Remedies Ltd., Mumbai) and rubber dam (Hygienic, Coltene) isolation, a modified rhomboidal-shaped cavity was prepared using round bur (Mani BR-31). A 10 K file (Mani Inc., Japan) was precurved by the degree of curvature seen radiographically with mesiobuccal and distobuccal roots, respectively. A size 10 K file (Mani Inc., Japan) was ascertained for the patency of the canals. The working length was determined using an apex locator (Root ZX mini; J Morita, Japan) and confirmed with a digital X-ray.

The estimated length till the curvature was marked using a rubber stopper on the engine-driven instrument, and then, the coronal flaring was done. A 10 K file (Mani Inc., Japan) was reintroduced into the canal until it reached the working length on the X-ray. This ensures that the canal is properly cleaned and shaped to the appropriate depth.

Subsequently, larger files, such as 15 and 20 K hand files (Mani Inc., Japan), were introduced to further shape and prepare the canal for treatment. 17/12 W0 (Endo plus woodpecker) was used for coronal flaring, followed by 18/0.05 (Endo plus woodpecker) for glide path preparation. Afterward, 20/0.04 (Endo plus woodpecker) was used till the working length, and final shaping was done using a size 20/0.06 (Endo plus woodpecker) rotary file. Copious irrigation was done between every instrumentation with 17% ethylenediaminetetraacetic acid (EDTA) (Neo EDTA

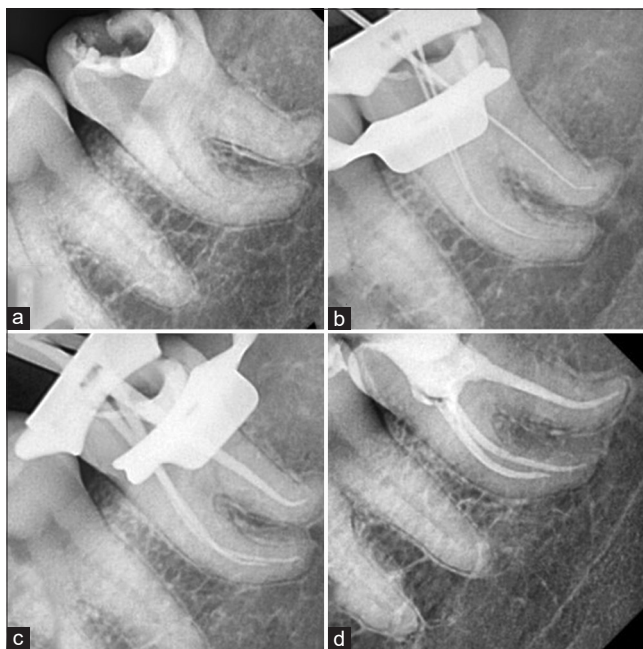


Figure 1: Case 1 - (a) Preoperative, (b) working length, (c) master cone, (d) postoperative

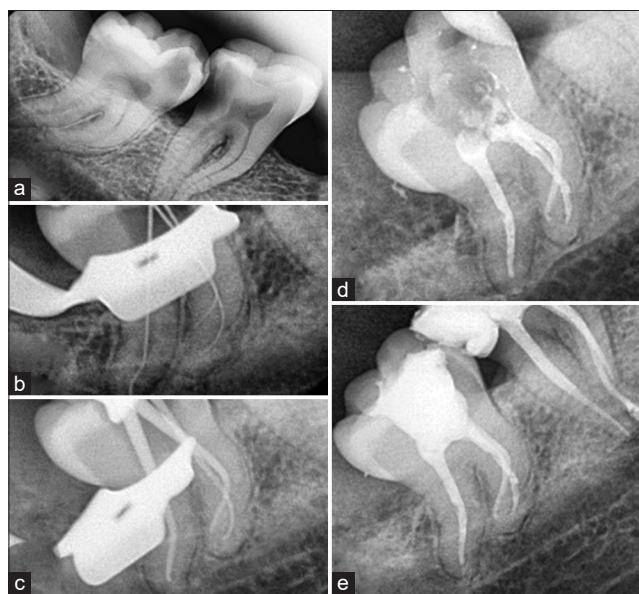


Figure 2: Case 2 - (a) Preoperative, (b) working length, (c) master cone, (d) obturation, (e) postoperative

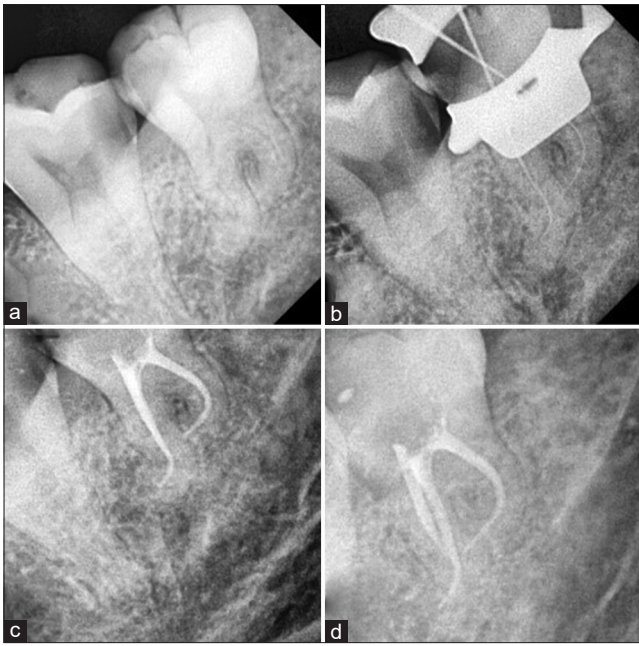


Figure 3: Case 3 - (a) Preoperative, (b) working length, (c) obturation (mesial angulation), (d) distal angulation

liquid) and 5.25% (Septodont Parcan) NaOCl 2 mL per canal. All the irrigants were activated using an ultrasonic activator (Eighteenth Medical Ultra-X-Ultrasonic Activator). The canals were then flushed with saline and dried using paper points. A master cone radiograph was taken with 20/6% (Dentsply) Gutta-percha. The single cone obturation method was performed with a calcium hydroxide-based sealer (Sealapex). Postoperative restoration was done with composite resin (3M Filtek) to maintain a good coronal seal. All the patients were given postoperative instructions and recalled for further follow-up.

DISCUSSION

Endodontic treatment of second and third molars poses significant challenges due to anatomical complexities such as curved canals, fused roots, and C-shaped canals. Mandibular molars, in particular, have a higher prevalence of curved canals (3.3%–30.92%) than maxillary molars (1.33% to 8.46%).^[3] Curvature more than 30° Schneider angle is considered high difficulty and risk for procedural accidents in most difficult assessment forms. According to Schneider, the degree of root canal curvature is classified as straight: 5° or less, moderate: 10°–20°, and severe: 25–70. Severe curvature (25–70) was seen in all four cases.^[4,6]

Using multiple angled radiographs offers a comprehensive view of the anatomy in three dimensions. A shifted radiograph can be particularly enlightening for clinicians, revealing subtle curvatures in the buccolingual plane. Curved canals with Schneider angle exceeding 30° pose high difficulty and risk for procedural accidents,

as observed in all three cases. Effective management requires specific equipment: long-shafted miniaturized burs, thin endodontic explorers (e.g. DG 16 or JW17), highly reflective mirrors, ultrasonic tips, diagnostic dye, and magnification (3.2x Admetec TTL). Magnification, whether using loupes or a dental operating microscope, enhances treatment outcomes by providing clearer visual information and reducing procedural errors commonly encountered without it.^[7] In this case series, endodontic management focused on curved root canals of mandibular molars with loop magnification up to $\times 3.2$. Emphasis was placed on thorough preoperative radiographic assessment, aiding in navigating root curvature and canal configuration.

In the majority of instrumentation techniques, establishing a glide path up to the working length and performing coronal preenlargement are recommended practices. This ensures a consistent and unobstructed pathway from the canal orifice to the apical foramen, thereby minimizing torsional stresses on the shaping instruments. By doing so, the risk of instrument fracture and other procedural errors within the canal was significantly reduced. In addition, coronal preflaring serves to remove debris from the coronal third of the canal before the shaping instruments reach the apical third. This proactive approach further mitigates the potential for apical extrusion of debris, contributing to a more controlled and successful endodontic procedure.^[8,9]

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 a 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.^[7]

In the present case series, hand files were first precurved and then placed inside the canal precurving of hand files and the use of a smaller number of files facilitates easy negotiation of canal curvature and preserves root canal anatomy without any procedural mishap.

The usage of rotary files in the crown down technique helps in the early flaring of the coronal third and has advantages such as reduced coronal binding of the instruments, less apical extrusion of debris, and effective irrigation of the apical third of the root canal.^[10] Successful completion of these cases largely depends on the use of magnification, multiple angulated radiographs, thorough precurving of hand files and coronal preflaring of the canal system, activation systems for comprehensive debridement, and sealing of all the canals.^[11]

CONCLUSION

Possessing a sound understanding of the internal anatomy of the tooth, coupled with a thorough assessment of

preoperative radiographs, is essential for success. When faced with challenging mid-root curvatures, patience is paramount. It is advisable to initially negotiate the canals using hand files before transitioning to rotary files, ensuring copious irrigation between each file. Consistently following this strategy is crucial for the successful management of curved canals, ultimately leading to improved treatment outcomes and patient satisfaction.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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