

# ENDODONTIC RETREATMENT OF C-SHAPED AND RADIX ENTOMOLARIS ANATOMIC VARIATIONS IN MANDIBULAR MOLARS: TWO CASE REPORTS

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## ABSTRACT

Endodontic success depends on multiple factors. The tooth position, morphology, anatomic variations, clinical skills, and expertise along with equipment and materials used, all contribute to clinical success. This article describes in detail non-surgical retreatment of two anatomic variations in mandibular molars that were failing because of persistent periapical disease, due to previous misdiagnosis and inadequate endodontics.

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## INTRODUCTION

Root canal disinfection, thorough debridement and three-dimensional filling is the goal of root canal treatment (RCT).<sup>1</sup> Failure to perform any of these steps could result in post-treatment endodontic diseases. Lack of healing is primarily attributed to persistent inter-radicular infection residing in previously un-instrumented canals, isthmi, or other complex irregularities of the root canal system.<sup>2</sup>

Anatomical and morphological variation in the root canal system often put the clinicians in a difficult scenario where identification of root canal orifices, cleaning, shaping, and debridement become a challenging task. Hence, good knowledge of internal anatomy and morphological variation is prerequisite for proper diagnosis and treatment planning. Mandibular molars are known to show variations in root canal morphology. Among many such variations, Radix entomolaris (RE) & C-shaped canal configuration have clinical implications.<sup>3</sup>

Previously treated teeth with persistent periapical lesion(s) might be preserved with nonsurgical retreatment or endodontic surgery, assuming the tooth is restorable, periodontally sound, and the patient desires to retain the tooth. This paper discusses non-surgical retreatment of a two mandibular

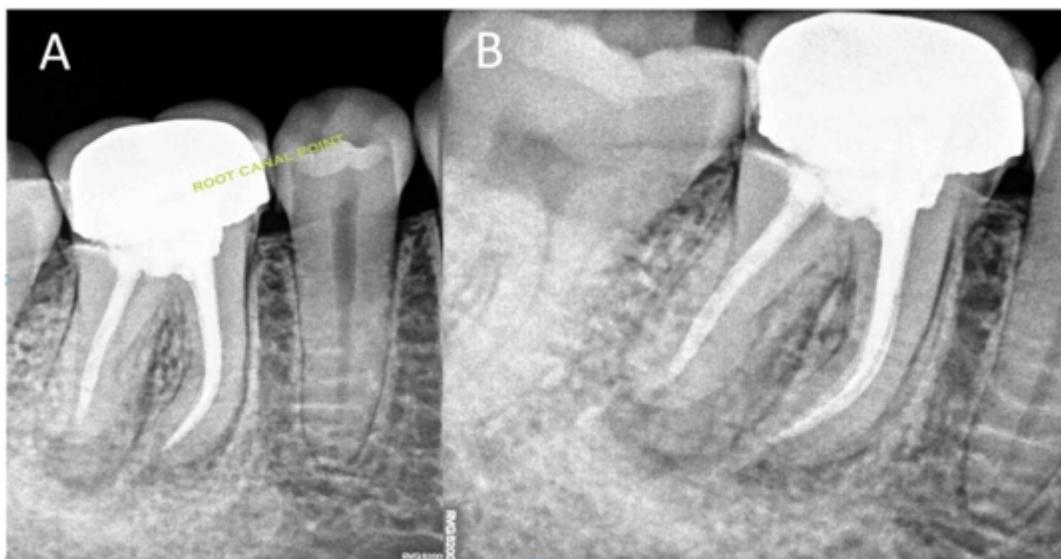
molar; one with RE & another having C-shaped canal system.

## CASE REPORTS:

These are the retreatment case reports of two patients referred to “Root Canal Point”, Kochi, India for specialized endodontic treatment. A thorough history was recorded from the referring dentist & patient, and the cases were examined both clinically and radiographically. The medical history of both patients was non-contributory. Local anesthesia was obtained and the entire procedure in each case was carried under a surgical operating microscope. Fixed prosthesis on the teeth were sectioned and removed using high speed hand piece. Split-dam technique was used to remove old fillings/secondary decay, and restorability of tooth was assessed. After adequate soft tissue management, a permanent pre-endodontic composite build-up was done under rubber-dam isolation for optimal irrigant dynamics. Later, required access modifications were done for initiation of retreatment.

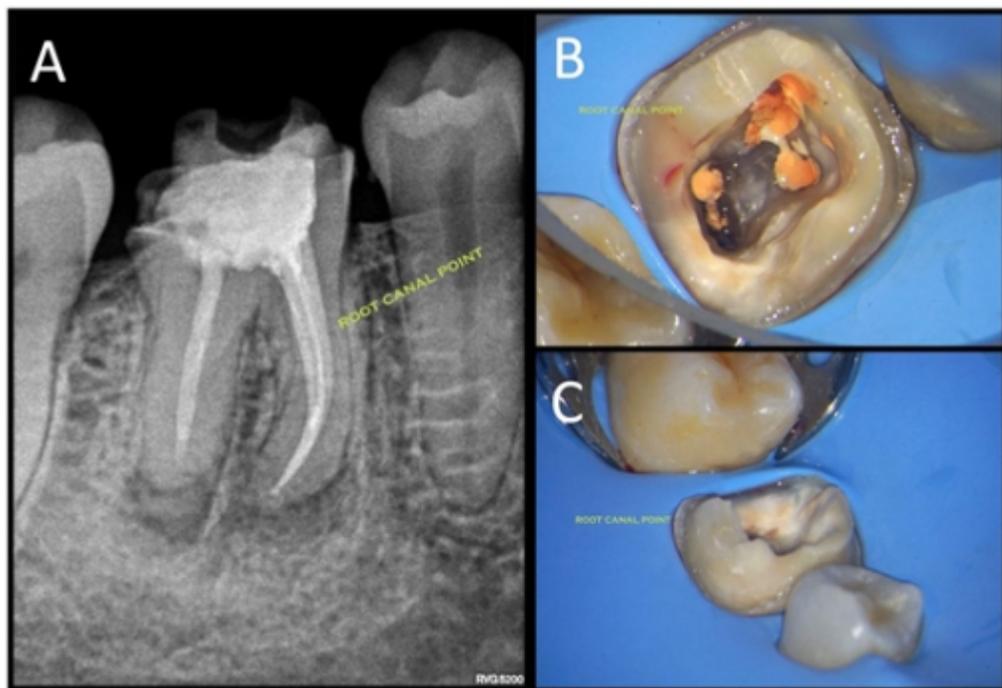
### CASE 1

27-year-old, female patient presented with a chief complaint of intermittent swelling on right lower back region since 3 months. The swelling was diffused and recurring in nature.

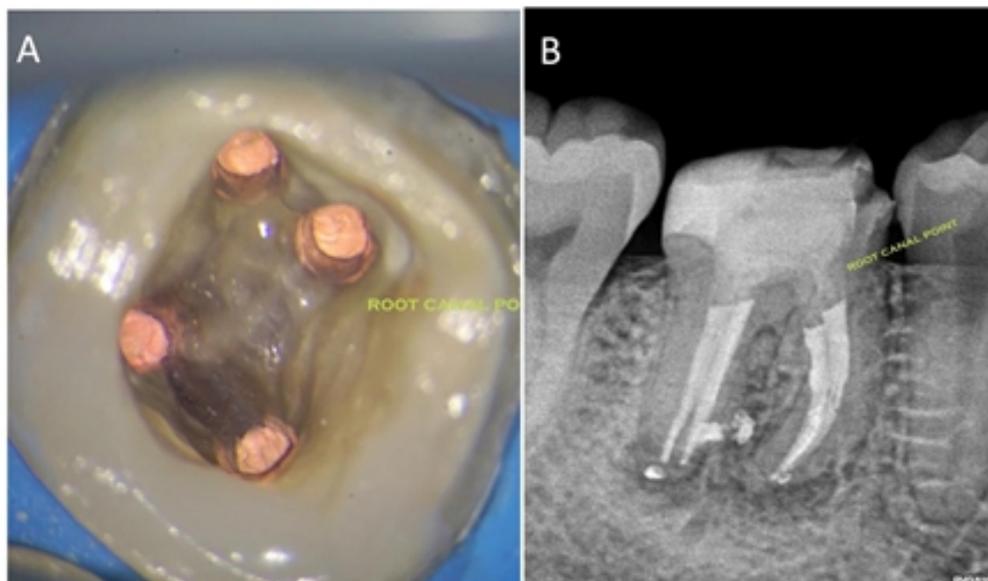


**Fig 1. (A)**  
Pre-operative radiograph

**(B)** mesial shift radiograph.



**Fig 2.** (A) IOPAR after crown removal (Note the secondary decay towards the distal aspect). (B) Initial access on re-entry after old restoration caries removal (Note the discoloration and percolation of the distal canal suggestive of an infection). (C) Restorative assessment showing good ferrule.



**Fig 3.** (A) Post-operative microscopic image (Note the clean pulpal floor to facilitate adhesion). (B) Immediate post-operative IOPAR after adhesive composite restoration (Note the accessory canal & 3D filled root canal system).

**Fig 4.** 5-months follow-up showing good periapical healing



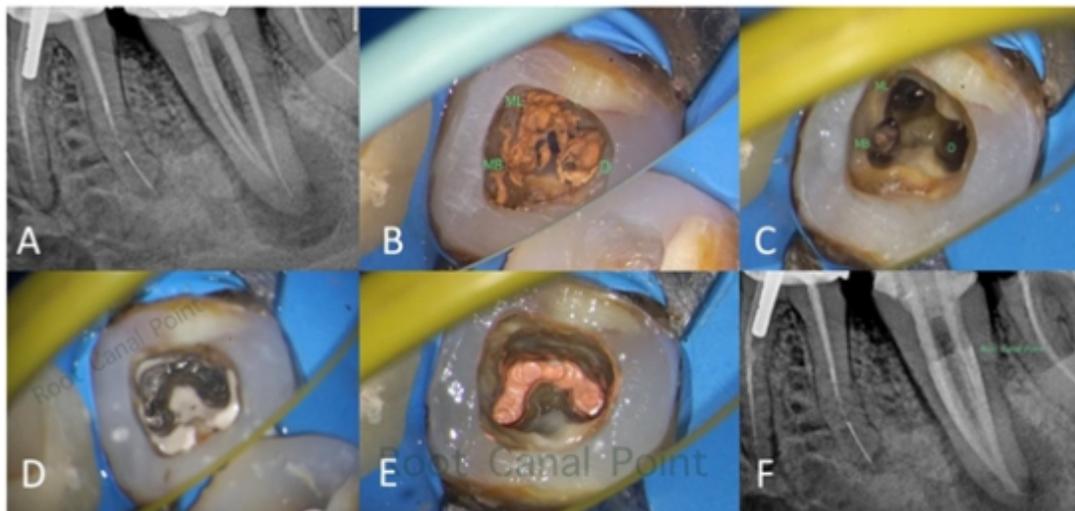
On clinical examination, patient had a fixed prosthesis on tooth #46, associated with a sinus opening in relation to the buccal aspect. Tooth was tender on percussion. Patient reported that the primary root canal treatment was done 8 years ago and a periapical surgery was performed on the same tooth 4 years back. Intra Oral Periapical Radiograph (IOPAR) revealed endodontic treatment with a diffuse periapical pathology in relation to mesial and distal roots (Fig.1 A). Mesial shift IOPAR revealed the presence of disto-lingual root which was not negotiated & filled (Fig.1 B), which could be the possible cause for the failure of previous non-surgical & surgical endodontic treatment. Based on clinical and radiographic examination, it was diagnosed as a case of incomplete RCT with symptomatic apical abscess.

On proper rubber dam isolation access was gained and 3 obturated canals were identified and gutta percha (GP) was removed using retreatment files, ultrasonic tips, and down pack pluggers under magnification. After complete elimination of GP, additional canal was identified on the disto-lingual aspect following the Developmental Root Fusion Line (DRFL). Patency was achieved in all the four

canals and working length was determined with apex locator. Root canals were instrumented using ProTaper Universal rotary file system. Irrigation was performed by using normal saline, 5.25% sodium hypochlorite solution, and 17% EDTA coupled with ultrasonic agitation. A three-dimensional obturation was done using continuous wave compaction (System B, Sybron Endo) and AH plus sealer. The tooth was then restored with a posterior composite resin core (Fig 3B). The patient was referred to her general dentist for crown. 5-months follow-up showed satisfactory periapical healing (Fig4).

## CASE 2

A 45-year-old female patient reported with a chief complaint of pain associated with intermittent swelling in lower left back tooth region for the past 3 months. She also complained of lip paresthesia on the same side. Patient reported a history of RCT in relation to tooth #37 five years back. Clinical examination revealed a fixed prosthesis on #37 and the tooth was tender on percussion. Radiographically, the tooth was conical in shape with fused mesial and distal root with a thin radiolucent



**Fig 5.** (A) Pre-operative IOPAR showing tooth #37 with a periapical abscess involving inferior alveolar nerve canal, (B) Clinical image showing GP filling the pulp chamber space, (C) Single cone obturation GP removal, (D) C-shaped canal after cleaning and shaping, (E) 3D obturation, (F) Post-operative IOPAR.

line between them, with a suspected C-shaped canal obturated with single cone technique. There was large periapical radiolucency partially involving the mandibular canal (Fig 5A). Based on the clinical & radiographic finding a diagnosis of incomplete RCT with symptomatic periapical abscess was made.

On removal of old filling, GP was found to filling up all over the pulp chamber space which was removed to reveal single cone obturation in 3 canals (Fig 5B). Complete removal of the GP was done using the combination of ultrasonic (US) tips, retreatment rotary files (Protaper-Dentsply Tulsa, USA) and micro-debrider. A careful evaluation of the pulp chamber floor revealed isthmus connecting the 3 artificially created canals (Fig 5C).

US tips coupled with hand files were used to open-up the isthmus connecting the 3 canals to enhance irrigant dynamics (Fig 5D). Ultrasonic activation with 17% EDTA was done to remove the sealer/GP remnants from the root canal system. Patency was achieved and working length was determined. Cleaning & shaping was performed with 4% rotary files followed by circumferential filing with hand K-files. Copious amount of 5.25% sodium hypochlorite was used for irrigation which was activated



**Fig 6.** Three-year follow-up showing complete healing

using the Endo activator system. Obturation was performed using System S technique (Fig 5E) (B & L, USA). Tooth was then restored with composite resin (Fig 5F). 3-years follow-up radiograph revealed a sufficiently good periapical healing (Fig 6). The patient also reported relief from lip paresthesia for the past 2 years.

## DISCUSSION

When primary root canal treatment fails, clinicians have three possible options. The first and most desirable option is non-surgical endodontic retreatment. When coronal access to post-treatment disease is not desirable/blocked, the second option, ie surgical endodontics followed by retrograde sealing of the root canal can be performed. While the last option, which is not desirable, is dental extraction.

The most important step in retreatment is to identify the cause of post-treatment disease. Hence, a good clinical and radiographic examination is important. If needed, a 3D Cone Beam Computed Tomography (CBCT) examination can be done. Later, a decision must be made to whether to initiate retreatment or call on a specialist endodontist. Knowing when to treat an endodontic case and when to refer is an invaluable clinical skill for a clinician. Making clinical decisions about which teeth we can treat, and which should be referred, ultimately pivots on the following fundamental question: Do I have the skills, time, equipment & experience to perform this procedure? If the answer is “yes”, the treatment should be started and if “no”, the patient should be referred.

Retreatment cases with long standing fixed prosthesis should be initiated with the removal of existing prostheses as it will help us to identify secondary decay, understand the original angulation of the tooth and better assessment of restorability. In both cases, the removal of the crown revealed the presence of secondary decay. Additionally, it helped the authors to plan a better post endodontic restoration which plays a key role in overall survivability of endodontically treated teeth.

An additional third root, first mentioned in the literature by Carabelli, is called the RE.<sup>4</sup> This supernumerary root is located disto-lingually in mandibular molars, mainly first molars. Unpublished in-vivo clinical study data from the authors reported an incidence of 6% in the South-Indian population. This additional root is generally short, acutely curved, and narrow.<sup>5</sup> Hence, relocation and enlargement of the orifice of the RE, initial root canal exploration with small files (size 10 or less) together with radiographic root canal length and curvature determination, and the creation of a super loose glide path before preparation are invaluable in avoiding procedural errors.

Case 1 failed because the previous clinician failed to identify and fill an additional root / canal. Patient had undergone a periapical surgery on the distal root 3-years back. However, the second clinician also failed to identify this variation and only the distobuccal root had been resected. Kottoor et al had reported the relationship of DRFL and additional roots in mandibular molars.<sup>6</sup> This is a good clinical tip that can lead to identification of additional roots clinically.

Presence of accessory canals which was revealed following the obturation could also be a contributing factor for post-treatment disease in case 1 (Fig 3B). These lateral canals, when sufficiently large, can harbor large amounts of micro-organisms which then act as a nidus of infection and lead to peri-radicular disease. However, filling of these lateral canals are prudent only when there is a chance of bacterial penetration from the necrotic canal to peri-radicular tissue.<sup>7</sup> Accessory canal cannot be accessed through routine bio-mechanical preparation hence, thorough irrigation plays the key role.

A C-shaped root canal is defined as a root canal that in the transverse section is shaped like the letter "C". In a recent in-vivo CBCT study, it has an incidence of 13% in the South-Indian population.<sup>8</sup> C-shaped canal poses diagnostic difficulty radiographically, because of the two-dimensional view of the radiograph. However, Fan et al. (2007) came up with a radiographic classification of C-shaped canals, which can help the clinician identify this anomaly pre-

operatively. Dentine thickness around the isthmus towards the center of C-shaped canals are very thin especially towards the lingual wall. Hence, preparation should be restricted with lesser taper hand / rotary files and anti-curvature filing is recommended to avoid strip perforations.

It is difficult to ensure complete removal of diseased pulp or necrotic tissues from the isthmi. Hence, use of dynamic irrigation with chemical solutions such as NaOCl is of particular importance.<sup>9</sup> In addition, warm gutta-percha condensation techniques can be expected to result in favorable canal filling in C-shaped root canals.<sup>10</sup>

It can be noticed in case 2, radiographically all the 3 GP cones (white lines) had reached .5mm short of apex (Fig 5A). Despite a radiographically good looking obturation it failed primarily because of improper 3-dimensional filling. Hence, particular attention should be paid to the 'isthmus' of C-shaped canal configuration. This is a highly challenging task for a clinician because rotary files, conventional syringe irrigation and single cone obturation with dedicated cones will fail to shape, clean, and fill the isthmus.

A successful clinical outcome of endodontically treated teeth depends on adequate root canal treatment as well as on adequate restorative treatment. Hence, before jumping into Re-RCT clinician should plan for the restorative assessment (Fig 2A & B). In addition, a clean pulpal floor is important for proper bonding of any adhesive restoration (Fig 3A, 5E). Hence, a planned restoration on a clean bondable surface will improve the long-term survivability of an endodontically treated tooth.

## CONCLUSIONS

Every dental practitioner and specialist endodontists should possess deep knowledge of all existing anatomical variants and their radiographic characteristics to avoid treatment failures. Appropriate pre-clinical analysis by the

general dentist for assessment of the tooth, anatomy, position, pathology, skill, and equipment, are important parameters to consider for case referral to a specialist endodontist.

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