

Management of c-shape root canal configuration: Case Report

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ABSTRACT

Unusual root canal anatomies present significant diagnostic and treatment challenges. A comprehensive understanding of root canal variations, combined with accurate diagnosis, meticulous treatment planning, and clinical expertise, is essential for successful management. The C-shaped root canal configuration is a notable anatomical variation, commonly observed in mandibular second molars. This configuration often remains undetected and, due to its complex morphology, poses difficulties in canal negotiation, debridement, and obturation, which can contribute to endodontic treatment failure.

Case Reports: This article describes the management of distinct C-shaped root canal configurations utilizing cold lateral condensation

Conclusion: A thorough understanding of the anatomical variations associated with C-shaped canals is essential for their effective clinical management. The use of advanced irrigation and obturation techniques facilitates successful treatment of these complex canal anatomie

INTRODUCTION

C-shaped canal anatomy was first documented by Cooke and Cox in the mandibular second molar in 1979, although Weine et al. noted that several clinicians had previously suggested its presence in lectures. This canal configuration exhibits a high prevalence in mandibular second molars, ranging from 2.7% to 45.5%, and has also been reported in maxillary first molars (0.12%), maxillary third molars (4.7%), mandibular third molars (3.5%–4%), and mandibular second premolars (1%). Studies have shown no significant correlation between C-shaped canal occurrence and gender, age, or tooth position; however, ethnic variations exist, with the highest prevalence reported in East Asian populations, including Chinese (29.7%) and Koreans (31.3%–45.5%).

The C-shaped root canal system is defined by its horizontal cross-sectional morphology resembling the letter “C,” with canals that may be continuous or separated. This anatomical variation arises from the failure of Hertwig’s epithelial root sheath to develop or fuse properly in the furcation area during tooth development.

Fan et al. modified Melton’s classification of C-shaped canals into the following categories (Figure 1):

- **Category I (C1):** Continuous “C” without any separation.
- **Category II (C2):** Semicolon-shaped, resulting from discontinuation of the “C” outline, with either angle α or $\beta \geq 60^\circ$.
- **Category III (C3):** Two or three separate canals, both angles α and $\beta < 60^\circ$.
- **Category IV (C4):** Single round or oval canal in cross-section.
- **Category V (C5):** No observable canal lumen (usually near the apex).

C-shaped canals present diagnostic challenges radiographically due to the two-dimensional nature of conventional imaging. Thin fins, slits, and webs complicate canal shaping, debridement, and obturation. Irregular areas may retain soft tissue remnants or infected debris, potentially causing bleeding, pain, and treatment failure. Therefore, the selection of an appropriate obturation technique is critical for successful management. This report highlights the management of C-shaped mandibular molars using different obturation systems.

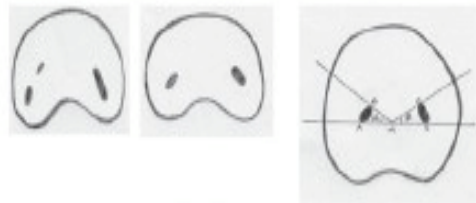
C1		The shape is an uninterrupted "C" with no separation or division
C2		The canal shape resembles a semicolon resulting from a discontinuation of the "C" outline, but either angle α or β should be no less than 60°
C3		Two or three separate canals and both angles, α or β are less than 60°
C4		Only one round or oval canal in that cross-section
C5		No canal lumen can be observed (which is usually seen near the apex only)

Fig. 1: Fan et al's anatomic classification of C-shaped canal configuration

CASE REPORT

A 24-year-old female patient presented to the department with a chief complaint of pain during mastication in the lower right posterior region. Her medical history was non-contributory. Intraoral examination revealed deep caries in tooth #47, which exhibited tenderness on percussion. Radiographic evaluation showed a large occluso-proximal radiolucency approaching the pulp chamber, along with a mild widening of the periodontal ligament space (Figure 1a). Notably, the tooth exhibited a conical morphology with fused mesial and distal roots. Pulp vitality tests, including cold spray and electric pulp testing, elicited no response. Based on clinical and radiographic findings, a diagnosis of necrotic pulp with acute apical periodontitis was established, and root canal treatment was planned and explained to the patient.

Following administration of local anesthesia and proper isolation with a rubber dam, an endodontic access cavity was prepared. Exploration of the pulp chamber revealed a C-shaped canal configuration corresponding to Fan et al.'s C2 type. Working length determination was performed, and the canal was shaped using ProTaper rotary files (Dentsply Maillefer, Switzerland) up to F3, followed by circumferential filing with hand K-files to ensure thorough canal preparation. Irrigation was performed using 5% sodium hypochlorite (Acrylates, India), which was activated with the EndoActivator system (Dentsply Maillefer, Switzerland) to enhance cleaning of the intricate canal anatomy (Figure 1b). Calcium hydroxide (RC Cal, Prime Dental Products, Thane, India) was placed as an intracanal medicament, and the patient was scheduled for a recall visit after one week.

At the subsequent visit, obturation of the C-shaped canal was achieved using thermoplasticized gutta-percha (Calamus, Dentsply Maillefer, Switzerland) to ensure complete filling of the complex canal system. Finally, a post-endodontic restoration was performed using composite resin to restore tooth function and aesthetics (Figure 1c, d). The patient reported no postoperative discomfort, and follow-up radiographs indicated satisfactory obturation and periapical healing (figure 1e)

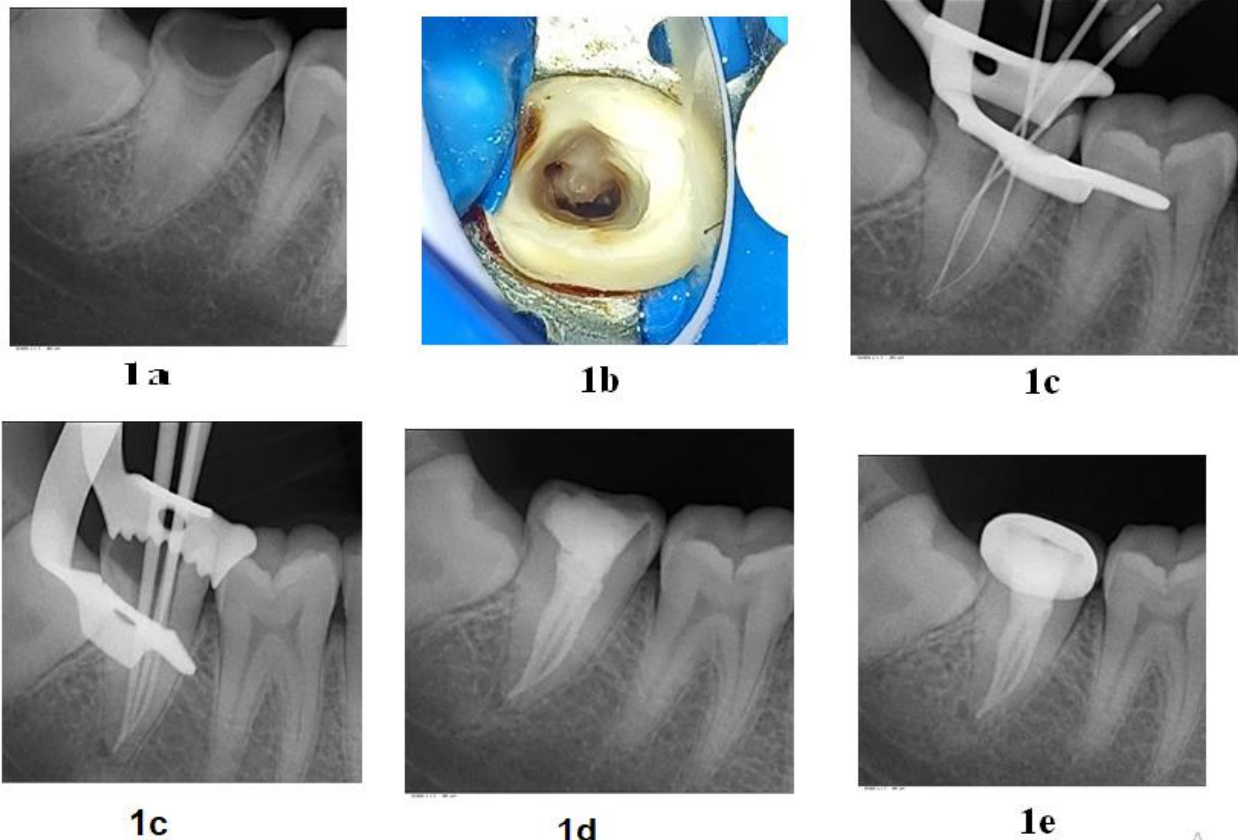


Figure 1b: 12 Months

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