C-SHAPED CANALS : A CHALLENGE IN ENDODONTICS

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In clinical practice we come across a large variety of canal shapes, sizes and curvatures. One of the variation is a 'C' shaped canal which derives its name from the cross-sectional morphology of the root and the root-canal. Weine in an epidemiological study demonstrated that 7.6% of the mandibular second molars showed the presence of a 'C' shaped canal. One can encounter several problems in managing such canals and specific techniques have to be employed in managing them.

Central to successful endodontics is knowledge, respect and careful appreciation of root-canal anatomy and thoughtfully and meticulously performed cleaning and shaping procedures.

The alliance between the pulp anatomy and endodontic cavity preparation is inflexible and inseparable. Unfortunately, the radiograph provides only a two-dimensional blue-print of the pulp anatomy. It is the third dimension that the clinician must visualize in order to clean and shape the canals properly and totally obturate the pulp space.

The anatomy of the pulp space definitely governs the treatment procedures to be opted for and followed. From the earlier studies of Hess and Zurcher, to the most recent studies on root-canal anatomy, it has long been established that a root with a graceful tapering canal and a single apical foramina is an exception rather than the rule.

In the clinical practice we come across a large variety of canal shapes, sizes and curvatures. One of the variation seen is a 'C' shaped canal.

The 'C' shaped canal

It was first recognized by Cooke and Cox,[2] and it derives its name from the cross-sectional morphology of the root and the root-canal. The pulp chamber of the 'C' shaped molar instead of having several discrete orifices has a ribbon shaped orifice with a 180 degree arc arising at the mesial end of the pulp chamber (mesiolingual or mesiobuccal) and sweeping buccally to end at the distal aspect.

Yang[8] in a study on Chinese population showed that 31.5% of studied population showed the presence of a 'C' shaped configuration. Weine[6] in a study on American population showed that 7.6% of mandibular second molars had a 'C' configuration. The teeth most commonly showing the 'C' configuration are the mandibular second molars and sometimes the maxillary first molar.

Classification

In 1991, Melton and Kraal[5] gave a classification of the 'C' shaped canals:

Type I : True 'C' shaped canal.

Type II : Semicolon shaped canal.

Type III : Discrete and separate canals.

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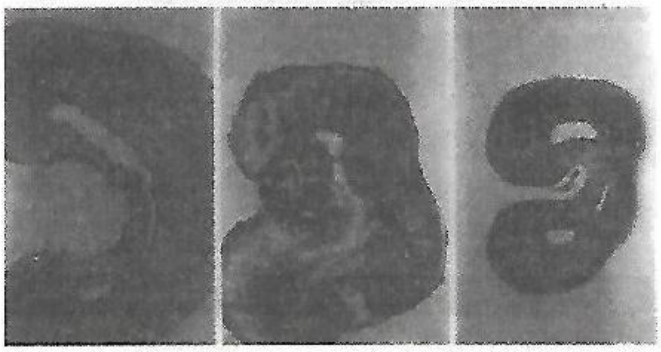

Fig. 1 : Classification of C-shaped canals (Melton and Kraal) (Type I, II and III C-shaped canals).

The canals vary further in shape and number along the length of the root Fig. 1.

Problems encountered in the management of C-shaped canals

The C shaped root-canal often poses a challenge to the clinician owing to its complex root-canal anatomy, during the various phases of treatment such as bio-mechanical preparation, obturation and final restoration.

A. *Problems encountered during biomechanical preparation :*

1. Difficulty in pulp extirpation due to the ribbon shape of the canal.
2. Excessive haemorrhage due to the large volume of the 'c' shaped pulp chamber.
3. Persistent discomfort during instrumentation.
4. The wide fins and small surface area preclude proper debridement using conventional hand instrumentation.

B. *Problems encountered during obturation :*

1. In the absence of a properly prepared apical stop or apical matrix, a 'C' shaped apical foramina can result into sealer extrusion.
2. Difficulty in lateral condensation due to the ribbon shape of the canal.
3. More chances of voids being present in the final obturation due to the presence of fins and uninstrumented canal walls.

C. *Problems encountered during final restoration of the tooth :*

1. The relatively small amount of dentin separating the internal canal system from external root surface jeopardizes the strength of the tooth to withstand masticatory forces. The use of a pre-fabricated or a cast post system poses a risk of strip perforation.

Management of the problems encountered during various treatment phases

The difficulties encountered during various treatment phases can be managed as follows:

A. *During biomechanical preparation :*

1. Intrapulpal anesthesia to avoid patient discomfort, pain and haemo-rrahge.
2. Pre-enlargement and coronal flaring with Gates-Glidden drills.
3. 'H' files for final cleaning and shaping the canal.
4. Copious irrigation with sodium hypochlorite along with circumferential filing to achieve thorough chemical debridement.
5. Ultrasonic debridement.

B. *During obturation :*

1. Use of thermoplasticized gutta-percha or vertically compacted gutta-percha for obturation.
2. Use of a double-plugger technique to achieve thorough compaction.

C. *During final restoration :*

1. Care has to be exercised to see that not too much dentin is removed during post space preparation.

CASE REPORTS

Case 1

A 20 year old female was referred to the Department of Endodontics, GDC and H, Aurangabad for a painful mandibular second molar. Patient gave a history a previous

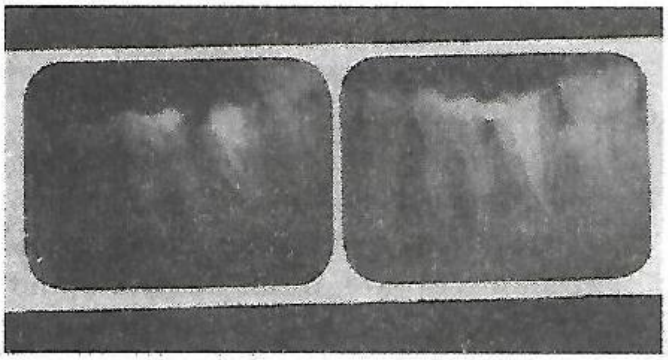

Fig. 2 : Case Report 1 (A. Pre-operative radiograph and B. Post-operative radiograph).

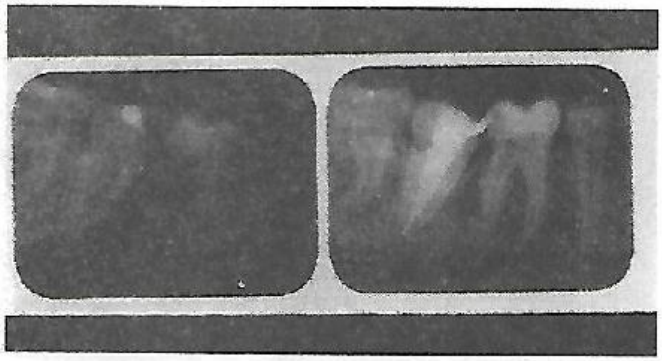

Fig. 3 : Case Report 2 (A. Pre-operative radiograph and B. Post-operative radiograph).

endodontic treatment with the tooth. IOPA revealed that the involved tooth had an inadequate obturation with periapical rarefaction. The tooth had a conical root and presence of radio-opaque tissue between the two separately obturated canals. On close observation, the adjacent tooth showed the presence of pulp stones.

This raised the doubt as to the presence of a 'C' shaped canal in the tooth and a misdiagnosis by the previous operator. It was decided to retreat the tooth.

The existing obturation was removed with eucalyptol as a gutta-percha solvent and H-files. A diagnostic radiograph was then taken to verify the length. The canal was then enlarged coronally using GG-drills. This facilitated the removal of a large pulp stone from the ribbon shaped area of the canal. The canal was then thoroughly debrided, using circumferential filing with K files, H files and copious sodium-hypochlorite irrigation. A master cone was then prepared using the roll-cone technique and a radiograph was then taken to confirm the apical fit. The master-cone was then compacted vertically to seal the apical third. The rest of the canal was then filled by back-filling with vertical compaction of gutta-percha.

Case 2

A 21 year old female patient reported to the Department of Conservative Dentistry and Endodontics, GDC and H, Aurangabad, with a painful mandibular right second molar. On clinical examination, deep occlusal caries were detected. Intra-oral periapical radiograph revealed a coronal radiolucency, involving the pulp chamber and peri-apical rarefaction. Access cavity preparation revealed the presence of a 'C' shaped orifice extending from the mesiolingual canal to the distal canal. Exploration of the orifice showed one common apical exit.

Cleaning and shaping was initiated with Gates-Glidden drills for pre-enlargement of the wider portion of the 'C' canal, followed by circumferential filing with a conventional hand instruments. Hedstroem files were especially useful to achieve a uniform canal preparation. Copious irrigation with 5% sodium hypochlorite was done during the entire procedure to facilitate the dissolution of pulp tissue in the smaller and inaccessible areas of the canal.

A master cone was prepared by the roll-cone technique and its length verified radiographically. The tooth was isolated and the canals dried using sterile paper points. Obturation was carried out with the custom master cone, accessory gutta-percha points and zinc-oxide root-canal sealer. The master cone was compacted vertically by using a 'double-plugger technique', so as to aid in proper distribution of hydraulic forces on the gutta-percha. The rest of the canal was obturated by vertical compaction with back-filling of gutta-percha. The tooth was then deoccluded and a postoperative radiograph taken Fig. 3.

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