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**Case Report**

# Management of a maxillary second premolar with an S-shaped root canal - An endodontic challenge

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## Abstract

Knowledge of dental anatomy and its variations is essential for the success of endodontic treatment. Complex and unusual root canal morphology is an often occurring phenomenon. One such variant root canal morphology is the 'S' shaped or bayonet shaped root canal. The unique morphology of S-shaped root canals often pose utmost challenges in their endodontic management routine periapical radiographs aids in assessing these morphological variations in the root canal system This case report discusses endodontic treatment of a maxillary second premolar with an 'S' shaped root canal.

## Key words

Bayonet shaped canal, S-shaped canal, Double flare technique.

## Introduction

It is uncommon to observe a tooth with a straight root and a straight root canal because most teeth exhibit some curvature of the root canal. In addition, most canals have multiple planes of curvature throughout their length [1].


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Endodontic therapy will be successful only when a thorough disinfection of the entire root canal systems achieved.

Understanding these unusual root canal morphology will contribute to success in endodontics. According to Vertucci [2, 3, 4], maxillary premolars are the teeth with the maximum anatomic variations. One such variation that occurs often in the maxillary premolars is the 'S' shaped or bayonet shaped root canal being very difficult to negotiate [5]. This report discusses the endodontic management of an 'S' shaped root canal.

## Case report

A 43-year-old female patient was referred to the Department of Conservative Dentistry and Endodontics, for the management of a right maxillary second premolar. On clinical examination, tooth 15 had a large carious lesion on the mesio-proximal aspect (**Figure - 1**). The patient gave a history of severe pain for the past three days. Radiographic examination of the tooth revealed radiolucency in the disto-proximal aspect, very close to the pulp space. The root was doubly curved (Bayonet or 'S' shaped). From the clinical and radiographic findings, a diagnosis of irreversible pulpitis was made in relation to 15. Hence, endodontic treatment was initiated in 15.

**Figure - 1:** Preoperative radiograph.

With informed consent, local anesthesia was administered using 2% lignocaine and 1:100000 Adrenaline and Endodontic therapy was initiated under rubber dam isolation. Access was opened with a No: 2 round bur. For verifying the patency of the root canals, No.8 and 10 stainless steel K-files (Mani, Inc, Japan) were used. There was a single canal which was negotiated to the apex. The estimated length till the curvature was marked on the engine-driven instrument and coronal flaring was done. Gate-Glidden (GG) drills were used for orifice enlargement up to size No 3. The pulp chamber was irrigated by following standardized irrigation regimen using 5.25% of sodium hypochlorite (NaOCl), 17% ethylene diamine tetraacetic acid (EDTA) and physiological saline.

The working length was established using an apex locator (Root ZX, J. Morita, Mfg. Corp, Japan) and confirmed using a radiograph (**Figure – 2**). Sequential filing of the curved canals was done using nickel titanium (NiTi) hand files No. 15, 20, and 25 (Mani, Inc, Japan) to the working length. The apical portions of the canals were prepared using short amplitude filing. Frequent irrigation of the root canal and recapitulation was done to avoid blockage by dentinal debris and to remove the necrotic remnants of the pulp tissue. Final cleaning and shaping was carried out using Hyflex CM rotary files up to 4% 40 size of the instrument. Calcium hydroxide was used as an intracanal medicament and closed dressing was given for six days. In the next visit, the canals were flushed with saline and dried with paper points. A master cone radiograph was taken (**Figure – 3**).

The lateral condensation method of obturation was performed using AH Plus sealer. The post-obturation restoration was done with composite resin to maintain a good coronal seal (**Figure – 4**). The patient was given postoperative instructions and recalled for further follow up.


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At three months review, the patient was absolutely asymptomatic and there was no radiographic sign of any periapical disease.

**Figure - 2:** Working length radiograph showing S-shaped root canal.

**Figure - 3:** Master cone radiograph.

**Figure - 4:** Post obturation radiograph.

## Discussion

Endodontic therapy will be successful only when a thorough disinfection of the entire root canal system is achieved. However, the presence of curvatures may pose difficulty in root canal instrumentation and cleaning [5]. Root canal curvatures may be apical, gradual, sickle-shaped, severe-moderate-straight curve, bayonet / S-shaped curve and dilacerated curve [6]. Curved root canals exhibit great difficulty in cleaning, shaping and obturation of the root canal system [7]. The final results of the instrumentation of curved root canals may be influenced by several factors such as the flexibility and diameter of the endodontic instruments, instrumentation techniques followed during the management, location of the foramina opening, and the hardness of dentin [8, 9]. Ledge formation, blockages, perforations and apical transportation are undesirable occurrences that have been observed after the preparation of curved root canals [10].

The 'S' shaped canal has two curves, with the apical curve being very difficult to negotiate. The chances of strip perforation are very high in these root canals. Guttman [11] suggested preflaring the coronal 1/3$^{rd}$ of the canal (at the expense of the tooth structure) to reduce the angle of curvature. Once this procedure is completed, it is easy to negotiate the remainder of the root canal. Endodontic file has the tendency to straighten up in the canal, and hence it is difficult to control removal of dentine along the entire length of file in push pull motion.

The incidence of procedural errors can be reduced by:

- Decreasing the restoring force by means of which straight file has to bend against the curved dentine surface and


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- Decreasing the length of the file which is aggressively cutting at a given span.

Decreasing the force can be done by the following

- Precurving the file: A precurved file traverses the curve better than a straight file. Precurving is done in two ways:
  - Placing a gradual curve for the entire length of the file
  - Placing a sharp curve of nearly 45° near the apical end of the instrument
- Extravagant use of smaller number files as they can follow canal curvature, because of their flexibility. The smaller size files should be made super loose in the canal before using larger files to negotiate the canal without force.
- Use of intermediate size of files: It allows smoother transition of the instrument sizes to cause smoother cutting in curved canals, e.g. cutting 1 mm of No. 15 file makes it No. 17 file as there is an increase of 0.02 mm of diameter per mm of length.
- Use of flexible files (NiTi files, Flex R files): As these files help in maintaining shape of the curve and avoid procedural errors like ledge, elbow or zipping of the canal.

Decreasing the length of actively cutting files is achieved by the following:

- Anti-curvature filing.
- Modifying the cutting edges of the instrument by dulling the flute on outer surface of apical third and inner portion of middle third, which can be done by a diamond file.
- Changing the canal preparation techniques, i.e. use of coronal pre-flaring and crown down technique.

Tendency to create narrow canal shapes minimizing access of irrigants and creating potential to allow debris to be pushed apically. Attempts at overcoming the deficiencies of these instruments resulted in a number of preparation techniques that aimed to reduce iatrogenic defects and produce canals with a more flared shape.

As canal was doubly curved, a double flare technique was used to enlarge this canal. The access cavity was flared in the coronal-third, in order to reduce the angle of curvature to the first curve. Reducing the angle of curvature by flaring the access (at the expense of the tooth structure) will make the approach to the second curve much easier. Preflaring, in this case, was done with gate-glidden drills. Once this was done, the palatal canal was negotiable, up to the apex. NiTi hand files, with 0.02 taper, were used to prepare the apical portion of the root canal. Short amplitude filing was done to enlarge the apical portion and also to merge it with coronal-third of the root canal. The apical enlargement was limited to size 25 only. Any over enlargement can easily result in perforation in these canals [5].

## Conclusion

Understanding the complex root canal anatomy of the tooth, appropriate instrumentation techniques and customized treatment planning depending upon the degree of curvature will help manage curved canals, prevent complications and will contribute to successful endodontic treatment.

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