S-shaped Canals

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ABSTRACT

Root canal systems often have complex anatomy and pose challenges to an endodontist. Research into the morphology of the pulp has revealed that the dental pulp takes many intricate shapes and configurations before reaching the tooth apex. Curves in multiple spatial orientations like S-shaped canals provide examples of such variations. Management of S-shaped or Bayonet-shaped canals can be troublesome as they involve at least two curves, with the apical curve being the most vulnerable to deviations in anatomy and loss of working length. The prospect of the treatment in such cases depends on accurate diagnosis followed by careful and meticulous cleaning and shaping and finally three-dimensional hermetically sealed obturation of the root canal system. As clinician one should have a thorough knowledge of such variations from the norm and effective management strategies to render the finest possible treatment. This case report discusses successful endodontic treatment of a maxillary right second premolar with an S-shaped root canal.

Keywords: Bayonet-shaped canal, Maxillary first premolar, S-shaped canal.

INTRODUCTION

According to Vertucci, maxillary premolars are the teeth with the maximum anatomic variations, the most common being S-shaped or Bayonet-shaped root canal.

S-shaped root canals have also been reported in maxillary laterals, maxillary canines, and mandibular molars.

Routine periapical radiographs help us to assess the number, length, curvature, and aberration of the canal system of the tooth. Root canal curvatures can be classified as in Table 1.

S-shaped or Bayonet-shaped canals can be troublesome and challenging since they involve at least two curves, with the apical curve being the most vulnerable to deviations in anatomy and loss of working length.

This paper reports successful endodontic management of an S-shaped canal in a maxillary premolar.

CASE REPORT

A 35-year-old female patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of severe, continuous, nonradiating pain in relation to upper right posterior teeth, since 5 days. It got relieved on taking medication but reoccurred thereafter. Medical and past dental histories were noncontributory.

Intraoral examination revealed a deep distoproximal carious lesion in maxillary right second premolar. The tooth was tender on vertical percussion, suggestive of symptomatic apical periodontitis. On pulp status evaluation, the tooth showed exaggerated response to heat, cold, and electric pulp tests.

Radiographic examination of the tooth (Fig. 1) revealed the presence of a coronal radiolucency on the distoproximal aspect, in close proximity to the pulp space, suggestive of caries obliterating the pulp chamber. Widening of periodontal ligament space was evident on both mesial and distal aspects of the root and an ill-defined radiolucency was seen in the periapical region.

Based on these findings, a diagnosis of chronic periapical abscess was made. After further careful reading of preoperative radiograph, a double-curved root was observed (Bayonet or S-shaped). The degree of root canal curvature was measured using Cunningham and Senia’s method.

Treatment plan was then formulated. Root canal therapy was advised for maxillary right second premolar.

Endodontic access opening was made using a no. 2 round bur, Endo-Z FG burs (Cavity Access Z Set, Dentsply Maillefer, Ballaigues, Switzerland). Mesial and distal canals were located. The access cavity was flared in the coronal-third using Gates Glidden drill no. 3, to reduce the angle of curvature. Canal patency was then established using # 8 stainless steel K files (Dentsply, M access). The pulp chamber was irrigated 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. Mor Japan) and confirmed using a radiograph (Fig. 2). G files (Micromega, no. 10, 17) were
used to establish a glide path. Sequential filing of the curved canals was done using nickel–titanium (NiTi) hand files no. 15 and 20 (Dentsply, M access) to the working length. Final cleaning and shaping was carried out using V-taper rotary files up to size 25. Calcium hydroxide was used as an intracanal medicament and closed dressing was given for 3 days.

In the next visit, the canals were flushed with saline and dried with paper points. A master cone radiograph was taken (Fig. 3). Single-cone obturation was performed using AH Plus sealer (Fig. 4). The postobturation restoration was done with composite resin to maintain a good coronal seal. The patient was given postoperative instructions and recalled for further follow-up.

DISCUSSION
The complex morphology of the root canal system of multirooted teeth is challenging in terms of both endodontic diagnosis and treatment. In this view, preoperative awareness of potential anatomic variations becomes essential for the success of the treatment. 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. Ledge formation, blockages, perforations, and apical transportation are undesirable occurrences that have been observed after the preparation of curved root canals. Therefore, determining the degree of curvature of root canal before starting the endodontic treatment is mandatory. Several methods have been advocated to determine root canal curvature using periapical radiographs. A method of describing changes in the direction of S-shaped canal configurations was published by Cunningham and Senia. In the case presented the angle of both the coronal and the apical portion of the canal had to be determined (Fig. 5). According to this method, Point A is at the center of the canal orifice area, Point B is located at that point where a deviation from the straight position of the canal is registered. A line is drawn through Points A and B. A second line is drawn from Point B to the point at which the canal starts to deviate again from the long axis of the tooth (Point C). The angle formed by the intersection of the two lines is measured as the canal curvature. A further line is drawn from Point C to the apical foramen (Point D). The angle at which the lines through Points B and C and D intersect yields angle Y for the change in direction of the canal in the apical section.

This technique has the following advantages over the Schneider method: (1) multiple curved canals can also be described in their S-shaped configuration; and (2) the canal deviation is determined in relation to the actual configuration of the canal. This thus permits determination of multiple changes in the direction of the long axis of the canal, but not of curvature characteristics. Like those detailed above, this method is based on random specification of reference points on the long axis of the canal and lines connecting them.7

In this case; the buccal canal had a less severe curvature; hence this canal could be prepared in a crown-down technique using V-Taper rotary instrument. The palatal canal was doubly curved, thus a double flare technique was used to enlarge this canal. The access cavity was flared in the coronal-third using Gates Glidden drill no. 3, in order to reduce the angle of curvature; reducing the angle of curvature by flaring the access will make the approach to the second curve much easier. Gutman8 suggested preflaring the coronal one-third of the canal (at the expense of the tooth structure) to reduce the angle of curvature so that preflaring of the canal was done using Gates Glidden drill no. 3 before commencing the biomechanical preparation.

A frequent error that may occur during endodontic procedure in an S-shaped canal is the failure to maintain root canal curvature, resulting in ledge formation, apical transportation, zipping, instrument breakage, and the most common being strip perforation.9 To avoid these mishaps, the basic principles of endodontic therapy must be followed, i.e., good preoperative radiograph, straight line access to apical foramen, precurving the endodontic hand instrument, file recapitulation, thorough irrigation, and use of flexible NiTi instruments.10-11 Dilacerated teeth are uncommon but the presence of severe root dilacera-
tions increases the risk of mishaps during the endodontic procedure. Hence, thorough examination and sound treatment planning are strongly advocated.

REFERENCES


Fig. 5: Cunningham and Senia’s method of determining root canal curvature