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Endodontic Management of Maxillary First Premolar with S-Shaped Canals.

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Abstract: *- Root canal systems often have complex anatomy and pose various challenges to every clinician. Research into the morphology of the pulp has revealed that the dental pulp takes many intricate shapes and configurations before reaching the tooth apex like gradual curve, sickle-shaped curve, severe-moderate-straight curve, apical curve, bayonet / S-shaped curve and dilacerated curve, canals emerging as separate but meeting at single apex etc. Among these the 'S' shaped or bayonet shaped root canal are most difficult to treat. The unique morphology of dilacerated and S-shaped root canals often pose utmost challenges in negotiation, biomechanical preparation and even obturation of root canal. Common causes of failures in such cases are primarily related to procedural errors such as ledges, zip and elbow creations, root perforations, fractured instruments and canal blockages with dentinal debris. As clinician, one should have a thorough knowledge and insight of the morphology of root canal related to its shape, form and configuration and effective management strategies before commencing treatment of such cases to render the finest possible treatment. This case report discusses successful endodontic treatment of a maxillary left first premolar (24) with an S-shaped root canal with six months follow up.*

Keywords*- S-shaped canals, Bayonet shaped canals, Ni-ti files, Maxillary First Premolar*

1. 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]
According to Vertucci,[2] maxillary premolars are the teeth with the maximum anatomic variations, the most common being S-shaped or Bayonet-shaped root canal.
Routine periapical radiographs help us to assess the number, length, curvature, and aberration of the canal system of the tooth. 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.

2. Case report-

A 32-year-old female patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of severe, continuous, non-radiating pain in relation to upper left posterior teeth, since 5 days. The pain increased with intake of hot or cold fluid. Medical and past dental histories were non-contributory.
Intraoral examination revealed a deep disto-proximal carious lesion involving pulp with respect to maxillary left first premolar. The tooth was tender on 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 revealed the presence of a coronal radiolucency on the disto-proximal aspect, involving pulp space, suggestive of caries involving the pulp chamber. Further careful reading of preoperative radiograph revealed double-curved roots or S-shaped canals.
From the clinical and radiographic findings, a diagnosis of symptomatic irreversible pulpitis was

made in relation to tooth no.24. Hence, endodontic treatment was advised in tooth 24.

After obtaining informed consent in prescribed format, local anesthesia was administered using 2% lignocaine and 1:80000 Adrenaline and Endodontic therapy was initiated under rubber dam isolation. Initial access was achieved by using a 1016HL bur (Dentsply Maillefer, Ballaigues, Switzerland) and refinement of the access cavity with coronal flaring was achieved using the Endo Z bur (Dentsply Maillefer, Ballaigues, Switzerland) to obtain straight line access to the root canals. Initial negotiation and scouting of the S-curved canals were achieved with a size-10 stainless steel K file (Dentsply Maillefer, Ballaigues, Switzerland). Working length was determined and confirmed by radiograph. Hand-filing was achieved by slowly inserting the Nickel-titanium hand files to the working length followed by passive gentle, withdrawal strokes upto file size -20. This allowed an unobstructed glide path to be developed along the S-shaped curvature with minimal transportation. The pulp chamber was irrigated using 5.25% of sodium hypochlorite (NaOCl), 17% ethylene diamine tetra-acetic acid (EDTA) alternatively to remove the smear layer, and lastly with physiological saline. After hand-filing, canals were prepared using Hyflex CM file system and enlarged upto 0.04/30 file size (4% taper). Corresponding size Gutta percha master cones were fit to the radiographic terminus with firm tug back for each canal and radiograph is taken to confirm its position. The root canals were coated with AH Plus sealer (Dentsply DeTrey, Konstanz, Germany) and the gutta percha master cones were also coated with sealer and fit to working length with the aid of a size 25 finger spreader (Dentsply Maillefer, Ballaigues, Switzerland). The tooth was temporarily restored with Cavit (ESPE, Seefeld Oberb, Germany). After 1 week the post-endodontic restoration was done with light cure composite resin to maintain a good coronal seal. Tooth reduction for full cast crown was done. Finally Porcelain fused to metal crown was cemented onto the reduced tooth with type I Glass Ionomer Cement.

The patient was given postoperative instructions and recalled for further follow-up after 1 week, 1month, 3months and 6 months

3. 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.[3] The variability of the root canal system of multirooted teeth represents a challenge to both endodontic diagnosis and treatment. The preoperative awareness of potential anatomic variations is essential for the success of the endodontic treatment. The only way to detect root canal morphology and anatomy is the use of a preoperative radiograph and an additional radiographic view from a 20-degree mesial or distal projection. In this respect, it becomes clear that extreme variations in root fusion are difficult to ascertain with radiographs. 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.

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 suggested that preflaring the coronal 1/3rd of the canal (at the expense of the tooth structure) to reduce the angle of curvature.[5] Once this procedure is completed, it is easy to negotiate the remainder of the root canal.

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.[6] 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.

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

Decreasing the force can be done by precurving the file as it traverses the curve better than a straight file and 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 allows smoother transition of the instrument sizes to cause smoother cutting in curved canals. Use of flexible files (NiTi files, Flex R files) help in maintaining shape of the curve and avoid procedural errors like ledge, elbow or zipping of the canal.

Decreasing the depth of actively cutting files is achieved by 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; by changing the canal preparation techniques, i.e. use of coronal preflaring and crown down technique.

In this case Hyflex CM file system was used for the biomechanical preparation because this system, files

are more flexible and has less aggressive cutting efficiency which effectively reduce the commonly occuring errors during biomechanical preparation like ledging, zipping etc.

4. Conclusion-

The clinical experiences show different approaches that can be successfully employed to treat challenging teeth having roots with multiple curves. With improvement in technology of file systems, challenges like bayonet canals can be dealt more effectively. To address challenging mid root curvatures, understanding of the complex root canal morphology and choosing a canal preparation technique is of paramount importance, followed by thorough irrigation, debridement and disinfection which will ensure successful endodontic treatment in complex situations.

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figure 1: preoperative intraoral periapical radiograph


figure 2: rubber dam isolation


figure 3: Access cavity preparation


figure 4: working length determination


figure 5: Master cone periapical radiograph


figure 6: Post -obturation periapical radiograph

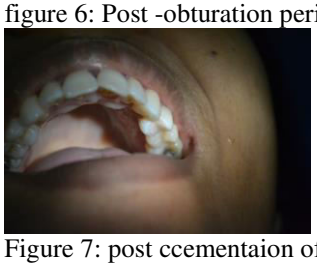
Figure 7: post ccementaion of prosthetic crown