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RESEARCH ARTICLE

RESHAPING THE CURVES FOR SUCCESSFUL ENDODONTIC TREATMENT: A CASE SERIES

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Abstract

Negotiating the dilacerated and S-shaped roots often present a challenging situation in their endodontic treatment. An insight of canal anatomy, coronal pre-flaring, pre-curving of all the hand instruments and use of smaller number files facilitates easy negotiation of canal curvature and maintenance of the shape without any procedural mishaps. This article aims at providing an insight to the clinical modifications required for the endodontic management of teeth with severe dilacerations and curved root canals.

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Introduction:-

The main purpose of endodontic therapy is to treat the diseased (vital or necrotic) dental pulp so that the function and appearance of the treated natural tooth can be maintained. The therapy involves the removal of diseased dental pulpal tissue, preparing the root canals along with proper irrigation solutions, and then sealing them subsequently using an inert filling material.[1]

The literature states that an ideal canal preparation is one in which the original canal morphology is maintained during the preparation procedure, along with the flare taper shape from the coronal to the apical region and thus, preserving the apical foramen.[2] This, however, may not be always possible due to the complexity of the root canal morphology. Common challenges that endodontists usually encounter during endodontic therapy are:

1. Accessing all the canals without encountering a procedural error
2. Maintaining the adequate working length and obturating the canal to its full working length
3. Preparing the canals by maintaining the adequate size and geometries of canals in all directions.

Presence of curvature may pose difficulty in root canal instrumentation. The final result of instrumentation of curved canals may be influenced by several factors such as flexibility and diameter of the endodontic instruments, instrumentation techniques, location of the foraminal opening and the hardness of dentin. Ledge formation, blockages, perforations and apical transportation are undesirable accidents that have been observed to occur after preparation of curved canals. Management of such curved canals is an endodontic challenge; so, for a successful therapy, a thorough knowledge of root and root canal morphology is required.[3]

The following table shows the various classifications given by different authors for curved root canal systems.

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Table 1:- Classification of root curvature[4].

According to anatomic location	Schneider's classification	Dobo-Nagy classification	Radius-based curvature	Shape-based curvature
Apical third curvature	Straight (if angle <5)	I shape (straight)	Severely curved (r<4 mm)	Apical gradual curve
Middle third curvature	Moderately curve (if angle is 10-20)	J shape (apical curve)	Moderately curved (r>4 mm; <8 mm)	Sickle-shaped curve
Coronal third curvature	Severely curved (if angle is >20)	C shape (entirely curve)	mild curvature (r>8 mm)[2]	Bayonet curve
		S shape (multicurve)		Dilacerated curve

The prevalence of curved canals has been found to be relatively higher in mandibular third molars, ranging from 3.3 to 30.92%, compared to maxillary molars that range from 1.33 to 8.46%. Curved root canals pose great difficulty in cleaning, shaping, and obturation of the root canal system with an exponential rise in difficulty with an increase in curvature. Predictability of treatment is ensured from a blend of profound knowledge and meticulous skill of the practitioner.[5]

This following article presents case reports on managing the curvatures in dilacerated tooth and in tooth having S-shaped root canal system.

Case Reports:-

Case 1 (Dilacerated root):

A 23 years old male patient was referred to the Department of conservative Dentistry and endodontics, with the chief complain of severe pain in the lower left mandibular teeth from a local dentist. No significant medical history was observed. The intraoral examination revealed decayed teeth in relation to #37 and #36. Tenderness on percussion was observed for tooth #37. Chronic irreversible pulpitis was the provisional diagnosis, and the intraoral periapical radiograph (IOPA) was advised to draw the final diagnosis and treatment plan. The IOPA revealed an ill defined radio-opacity extending into the coronal pulp, #36 and periodontal widening was observed in the apical portions of the mesial and distal roots of tooth #37. The final diagnosis of chronic irreversible pulpitis was confirmed and the root canal treatment was advised.

After administrating inferior alveolar nerve block, under the rubber dam isolation the access cavity preparation was performed. The pulp chamber was irrigated following the standardized irrigation regimen of 5.25% of sodium hypochlorite, and physiological saline. The patency of the root canals was determined using No. 8 and 10 stainless steel K-files. The working length was taken with the 10 and 15 number K files. Considering the severe dilacerated distal canal in the #37, the working length files were safely withdrawn. Working length was then confirmed with apex locator (Root ZX, J. Morita, Japan) and radiographs.

Figure 1:- Preoperative radiograph.

Figure 2:- Working length radiograph.

The suggested sequential method of filing for coltene hyflex was done in all the canals, where all of them were negotiated initially with the number 20 path files freely in the canal. The orifice enlager was introduced into the canals, and then with the feather touch brushing motions the preparations were completed till the apex of the canals. After copious irrigation, the preparation was completed till the root apex. Calcium hydroxide was used as an intracanal medicament and closed dressing was given for 3 days. In the next visit, the canals were flushed thoroughly with saline and dried with absorbent paper points.

A master cone radiograph was taken with 4% gutta-percha points. The single cone obturation was performed. The post endodontic restoration was done using the composite to maintain a good coronal seal. The postoperative instructions were given to the patient and recalled after 3 months for evaluation.

Figure 3:- Master cone radiograph.

Figure 4:- Postoperative radiograph.

Case 2 (S-shaped curved root canal):

A 40 year old female reported to the Department of Conservative Dentistry and Endodontics, with the chief complain of pain in relation to upper right posterior teeth. Clinical examination revealed proximal caries with respect to maxillary left second premolar. The tooth was tender on percussion. Medical history was non-contributory. Radiographic examination revealed radiolucency extending into the pulp chamber of the involved tooth. The roots of #25 were doubly curved (Bayonet or 'S' shaped). From the clinical and radiographic findings, a diagnosis chronic irreversible pulpitis with periapical abscess was made in relation to #25.

After administration of local anesthesia the access cavity was prepared for 25 under rubber dam isolation. The pulp chamber was irrigated following the standardized irrigation regimen using 5.25% of sodium hypochlorite (NaOCl), 17% ethylene diamine tetraacetic acid (EDTA) and physiological saline. For verifying the patency of the root canals, No.8 and 10 K-files were used. No.15 K file glide path was ascertained up to the radiographic working length.

Figure 5:- Preoperative radiograph.

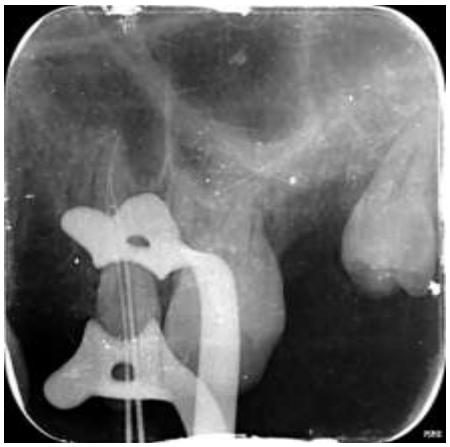

Figure 6:- Working length radiograph.

Working length was then confirmed using an apex locator (Root ZX, J. Morita, Japan). 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. Cleaning and shaping was carried out using Hyflex CM rotary files up to 4% No.30 size of the instrument.

In the next visit, the canals were flushed with saline and dried with paper points. A master cone radiograph was taken with 30 size 4% gutta percha cones. Obturation was performed. The post-obturation restoration was done with composite resin to maintain a good coronal seal. The patient was given postoperative instructions and recalled for further follow up.

Figure 7:- Master cone radiograph.

Figure 8:- Post operative radiograph.

Discussion:-

There is no doubt that the preparation of curved canals presents one of the greatest challenges in endodontics and is fraught with difficulties. Only the curvatures in the mesio-distal plane can be seen on a radiograph, yet it is well known that curvatures in the bucco-lingual plane are also evident in many teeth. Failure of root canal treatment in curved canals is mainly due to procedural errors such as ledges, fractured instruments, canal blockage, zip and elbow creation.[6]

Dilaceration was termed by Tomes and defined as a deviation in the linear relationship of a crown of a tooth to its root. The etiology of dilacerations are trauma to permanent tooth bud or idiopathic developmental disturbance.[7]

According to Vertucci[8] 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. 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[9] suggested preflaring the coronal 1/3rd 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. It is important to formulate a customized treatment plan for the management of curved canals.

The anticurvature filing method maintains the integrity of canal walls at their thin portion and reduces the possibility of root perforation or stripping. With this method, the dental practitioner maintains digital control over the endodontic instrument, and the preparation of the curved canal is eased.[10] Therefore, during biomechanical preparation of the canals anticurvature filing method was used during initial enlargement.

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:

1. Decreasing the restoring force by means of which straight file has to bend against the curved dentine surface
2. Decreasing the length of the file which is aggressively cutting at a given span.[11]

A significant advancement in root canal preparation with hand instruments was made with the introduction of balanced force movements of files. The balanced force movements of the file are:– clockwise 60°, so that it binds

against the wall and advances apically – anticlockwise 120° with apical pressure, so as to crush and break off the engaged dentinal wall. -clockwise 60° without apical advancement, allows flutes to be loaded with debris and removed from the canal. The balanced force technique is less prone to cause iatrogenic damage, decreases the extrusion of debris apically and maintains the instruments centrally within the root canal.[3]

Conclusion:-

To address challenging mid root curvatures, it is essential to remain patient, first negotiate canals by hand and consider using rotary files in a crown down manner with copious irrigation between each file.

Appropriate instrumentation techniques and customized treatment planning will help manage curved canals, prevent complications, and enhance the quality of the treatment.

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