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INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/14665
DOI URL: http://dx.doi.org/10.21474/IJAR01/14665

RESEARCH ARTICLE

NEGOTIATING THE CURVES WITH AF-F ONE FANTA ROTARY FILE: A CASE REPORT

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Manuscript Info

Manuscript History
Received: 28 February 2022
Final Accepted: 31 March 2022
Published: April 2022

Key words: -
Curved Root Canals, Fanta AF-F One Rotary File, Root Canal Preparation, Schneider Method

Abstract

The Posterior teeth often present with curved and dilacerated roots, a significant challenge for the clinicians during the endodontic treatments. The efficient biomechanical preparation is also affected by improper instrumentation in the curved or constricted canals. The use of conventional instruments and techniques in the dilacerated roots may develop ledges, fractured instruments, and canal blockages which further complicate the endodontic treatments. The introduction of Fanta AF-F One rotary file instruments has significantly impacted the biomechanical preparation of root canals systems. The Fanta AF-F One rotary file has noted advantages such as increased flexibility, higher strength, and wear resistance over the conventional rotary endodontic systems. The present case series discusses the endodontic treatment of two severely curved root canal systems successfully treated with Fanta AF-F One rotary file endodontic system.

Introduction:-

The endodontic therapy involves the removal of diseased dental pulpal tissue, preparing the root canals with proper irrigation, and then sealing the prepared canals with an inert filling material.[1] The biomechanical preparation of the root canal system is considered as one of the most important stages in endodontic treatment. It includes the removal of vital and necrotic pulp tissues from the root canal system, along with removal of infected root dentine and the removal of metallic and nonmetallic obstacles in retreatment conditions.[2]

The ideal root canal treatment is one in which the original root canal morphology is maintained during biomechanical preparation, flaring from the coronal to the apex and preserving the apical foramen.[1,3] However, due to the complexity of the ideal root canal anatomy,rootcanalpreparation may vary.[3] The biomechanical preparation of various root canal curvatures within the root canal poses a major challenge to clinicians in routine endodontic procedures. These curved root canals limit the ideal mechanical preparation of the root canaland can lead to some procedural errors.[4]

A tooth with a straight root and a straight root canal is an exception rather than being normal because most teeth show some curvature of the canal. In addition, most canals have multiple planes of curvature throughout their length. [5]

Tomes, in 1848, called such curvatures as “dilacerations.” It refers to an angulation or a sharp bend or a curve in the root or crown of formed tooth or a deviation or bend in the linear relationship of a crown of a tooth to its root.[6]

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Tooth is considered to have a dilaceration toward the mesial or distal direction if there is a 90° angle or greater along the axis of the tooth or root. Dilaceration can also be defined as deviation of the apical part of the root by 20 degree or more.[5]

The curved and dilacerated roots of the posterior teeth are often the biggest challenge for dentists during endodontic treatment.[7]Dilaceration is the result of a developmental disorder in which the axial tilt between the crown and root changes rapidly.[7]Dilaceration is seen in both the permanent and primary dentitions. A common cause of endodontic treatment failure in such root canal variations is due to procedural errors such as ledge formation, fractured instruments, canal blockage, zipping, or elbow formation. The most accurate method for diagnosing the presence of dilacerated root is Periapical radiographs.[7]

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. Curved canals can be[8]:

1. Gradual curvature of the mesial canals in the apical third;
2. Acute curvature in the apical third;
3. Curvature throughout the canal;
4. Dilacerated root canal and
5. S-shaped root canal.

To challenge the complex root canal anatomy, recent advances in the field of dentistry have led to the use of nickel-titanium (NiTi) rotary instruments in endodontic practice. The NiTi instruments have high stiffness that improves with increasing instrument sizes and aid in delivering high lateral forces in curved canals.[9] The NiTi rotary files have become popular instruments to shape root canals because of their elasticity, efficiency, and cutting capacity.[10]NiTi rotary instruments such as Fanta AF F-one file system (Fanta Dental, Changzhou, China) made up of heat treated have a modified S-shaped flat-sided cross-section constitutes the main distinguishing feature of this file instead of the U-shape common to many other rotary instruments.[11] The unique feature of the Fanta AF F-one system (Fanta Dental, Changzhou, China) is efficient in terms of instrumentation, preserves the original shape of canals and is highly resistant to cyclic fatigue. It is made of the AF-R Wire. It has a flat design that reduces the instrument's cutting surface area. The manufacturer claims that the vertical blades can sweep the debris from flutes to the relieved area.[12]

The current case report presenta case of curved root canal treated successfully with the AF F-one rotary file system.

Case Report:

A 28-year-old male patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of severe and continuous pain in the mandibular right back tooth region in the past three months. The patient gave a history of severe pain that aggravates while sleeping, and the pain was relieved only for a few hours after taking the medications. No significant medical history was observed. The intraoral examination revealed deep disto-occlusal caries concerning #46. Tenderness on percussion was observed for tooth #46. Chronic irreversible pulpitis was the provisional diagnosis

The intraoral periapical radiograph revealed an ill-defined area of radiolucency involving enamel, dentin, and pulp with no signs of periapical pathosis [Fig.-1]. The provisional diagnosis was confirmed with the investigations, a final diagnosis of chronic irreversible pulpitis was confirmed, and root canal treatment was advised.

With informed consent, local anesthesia was administered using 2% lignocaine and 1: 200,000 Adrenaline using the inferior alveolar nerve block technique, and the endodontic procedure was initiated under rubber dam isolation.

The access cavity preparation was performed with size 2 round burs [Mani Inc., Japan]. The standardized irrigation protocol used in the present case was the usage of 5.25% of sodium hypochlorite [Prime Dental Products Private Limited, India], 17% EDTA (Prime Dental Products Private Limited, India), and physiological saline. The patency of the root canal was determined using no. 8 and no. 10 stainless steel K- files (Mani, Inc., Japan).

A 10 # K file was pre-curved following gradual curvature seen in the radiograph with mesial and distal roots in the apical third. This no. 10 K file was used for the creation of the glide path till the radiographic working length. Estimated length till the curvature was marked on the engine-driven instrument

A sharp bend of around 90° was observed in the apical portion of the distal and mesial canal of tooth #46. Considering the severe dilacerated distal and mesial canal in the #46, the working length files no. 10 and no. 15 were safely withdrawn. The coronal flaring was done using gates glidden drill no. 2 and 3 [Mani, Inc., Japan].

The working length was determined through an electronic apex locator in all canals (Root ZX, J. Morrita, Japan) and was confirmed using the intraoral periapical radiograph [Fig-2].

The suggested sequential method of filing with AF-F One Fanta (Fanta Dental, Changzhou, China) rotary file was used for preparation for all the canals, where all of them were negotiated initially with the hand files up to number #20 file freely in the canal. All the hand files were pre-curved before placing within the canal to retain the original shape of the canal and prevent the transportation to the apical side of the apical foramen.

The #13/03% tapered AF-F One Fanta file was used initially for achieving the glide path and immediate removal of interferences within the canal, followed by the #20/04% tapered AF-F One Fanta File using the feather touch brushing motions, and preparations were completed till the apex of the canals.

Special attention was given to frequent irrigation of the root canal and recapitulation to avoid blockage by dentinal debris and remove the pulp tissue's necrotic remnants.

Calcium hydroxide [RC Cal, Prime Dental Products, Private Ltd., India] was used as an intracanal medicament, and a closed dressing was given for two weeks. On the second visit, the canals were irrigated with saline and dried with paper points.

All the canals were flushed thoroughly with saline and dried with absorbent paper points on the next visit. A master cone radiograph was taken with 4% gutta-percha points [Fig.-3]. The single cone obturation was performed using AH Plus sealer [Dentsply, Maillefer, Switzerland] [Fig.- 4].

The post-endodontic restoration was done with Tetric N – Ceram Bulk Fill with a self-etch bond (Ivoclar) to maintain a good coronal seal. The postoperative instructions were given to the patient and recalled after three months for evaluation. After three months' postoperative review, the patient was asymptomatic, and there were no radiographic signs of periapical disease. The patient was referred for the fabrication of a full-coverage restoration. The patient gave her informed consent for the publication of this case.

Discussion:-

The broad term of root canal curvatures is specified as dilaceration by Tomes, where it implies to any kind of angulation or any sharp bend or any curve in the root or crown of the formed tooth or a deviation or bend in the linear relationship of a crown of a tooth to its root.[5]

The tooth is considered to be dilacerated if the direction of the curved root is 90° or more to the long axis of the tooth and if the apical portion of the root is curved about 20° or more to the long axis of the tooth.[5]

The traumatic injuries during the time of tooth development stands the main etiologic factor for the dilacerated roots.[13]

One of the most important aspects of endodontic treatment is the cleaning and shaping of the root canals. The most desirable shape of the prepared canal is a progressive taper with the largest diameter at the coronal end and is narrowest at the apical constriction.[14]

A progressive taper allows a greater degree of instrument and irrigant contact with the surfaces of the canal walls, thereby enhancing the effectiveness of cleaning.[15]

However, the preparation of curved canals presents one of the greatest challenges in endodontics and is fraught with difficulties.

Only the curvatures in mesio-distal plane can be seen on radiograph, though curvatures in the bucco-lingual plane are also evident in many teeth.[8]

The curvatures in the root canals varies depending on the location or severity, the curvatures may be apical or gradual or S shaped.[16]

The curved root canals also exhibit immense difficulty in proper disinfection of the entire root canal system. Indeed, the instrumentation in the curved root canals mainly depend on the flexibility of the instruments, techniques of biomechanical preparation, location of the apical foramen, and the calcification in the root canal anatomy.[17,18]

The endodontic complications such as the ledge formations, canal blockages, root canals perforations, and apical transportations are usually observed with the improper handling of the instruments or improper techniques of instrumentations.[12] Thus, evaluating the degree of root canals curvatures in the diagnostic radiograph or at the working length determination aids in the successful endodontic treatment.

Schneider in 1971 has proposed a method to determine the root canal curvatures based on the preoperative radiographs. In Schneider's method, first a line parallel to the long axis of canal in the coronal third of root canal is drawn, a second line is drawn from the apical foramina to intersect the first line. Then, Schneider's angle was determined at the intersection of these lines on a hard copy of the diagnostic radiograph.[3,19]

Accordingly, the root canal curvatures are differentiated based on the angle of the curvatures such as straight (5° or less), moderate (10°–20°), and severe (25°–70°).[3]

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[20]:

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.

Decreasing the force can be done by the following-

a. Precurving the file: A precurved file traverses the curve better than a straight file.
    1. Precurving is done in two ways:
    2. Placing a gradual curve for the entire length of the file
b. 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.

c. 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.
d. 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.[20]

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The technological advancements have led to the development of more efficient and time-saving instruments in the field of dentistry.

The AF F One, a NiTi Rotary file manufactured to be used in continued rotation has two active cutting tips and a flat side-cut, providing it with better cutting efficiency, as debris are easily cleared up from the flutes to the safe-sided relief area through vertical blades, then out of the canal.[21] Furthermore, the flat side-cut lowers the contact area with canal walls, providing more room for irrigants during preparation and minimizing stresses acting on the file, thus lessening the chances of file disengagement.[22]

The S-shaped, cross-sectional design is characterized by a smaller cross-sectional metal mass compared to other designs; in the present study, the mass was reduced even more by the flat-sided curvature results in a higher flexural

stress. Several studies have shown that the more flexible the design. The more complex the canals are, the more relevant the influence of the mass—a more severe file is, the more resistant it is to cyclic fatigue.[23] Reduced mass was also shown to be a relevant factor in increasing the flexibility of the instruments.[24,25]

In clinical practice, a flat design could also be beneficial in reducing torsional stresses, because the contact surface is smaller and less friction is produced when progressing into the canal. A reduced blade engagement and friction can also influence the cyclic fatigue study, because the instrument is less engaged in the artificial canal while rotating.[26] Several studies have shown that, if the instruments blade engagement and friction can also influence the cyclic fatigue study, because the instrument is being able to move more freely or straighten during the cyclic fatigue test, the resistance can be slightly improved .[27-29]

Since, AF-F One Fanta rotary file system is made up of AF-R wire,with an extended cyclic fatigue life beyond the conventional NiTi alloy, which may allow preserving the original shape of the canal; without increasing the risk of failure because of cyclic fatigue.[22] Thus AF-F One rotary file is indicated for safe and efficient biomechanical preparations in curved and constricted root canal systems.

List of Figures:

Fig.-1: -Pre-Operative Radiograph.

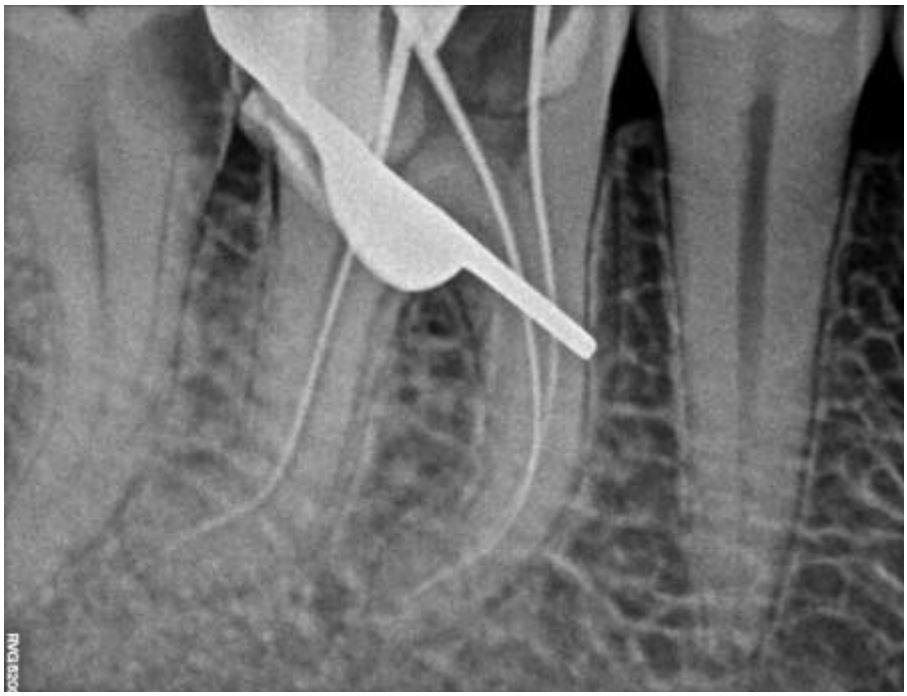

Fig. 2:- Working length determination radiograph.

Fig. 3:- Master cone selection Radiograph.

Fig. 4:- Post ObturationRadiograph.

Conclusion:-

The severe root canal curvatures in the posterior teeth have to be determined through pre-operative radiographs to reduce the iatrogenic errors and increase the successful endodontic treatment outcome. The appropriate instrumentation technique for the root canal variations needs to be selected based on the root canal anatomy and calcifications before initiating the endodontic procedure. The Fanta AF-F One rotary instrumentation has shown an effective cutting efficiency and time-saving biomechanical preparation while maintaining the original shape of the root canal curvature.

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