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RESEARCH ARTICLE

RESPECT THE BENDS- FOR CLINICAL SUCCESS

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Abstract

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Introduction:-

A straight root with a straight canal is rather an exception than a common finding. The dilaceration or curvature in the root is considered to be a developmental anomaly in which there is an abrupt change in axial inclination between the root and the crown.[1] Identification, negotiation and management of such curvatures can be challenging for practitioners.

Accurate diagnosis and planning is a must for any successful treatment outcomes. However periapical radiographs have been an essential tool for diagnosis in Endodontics. But there are certain limitations too. However these can be used to assess the root curvature but may lead to misinterpretation since the radiographs produce a two-dimensional image of a three-dimensional object [2] and thus, curvatures that are present bucco-lingually may not be visible. The majority of the canals do have some curvature on the different planes and thus, it is not possible to demonstrate them solely on the basis of radiographs.[3]

However 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.[4] 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.

Case Reports:-

Case 1:-

A 42-year-old male reported to department of conservative dentistry and Endodontics with pain in relation to lower right back tooth region of the jaw since 15 days. Clinically, the tooth was carious and tender on vertical percussion. Radiograph revealed the carious pulp exposure with widening of the periodontal ligament space. It also revealed unusual root morphology of the mesio-buccal and distobuccal roots which showed a sharp curvature at middle third (figure 1.1). Prior to the formulation of endodontic therapy the degree of curvature was determined by using Schneider method and it showed severely curved canals in relation to both the teeth. With informed consent, local anesthesia was administered using 2% lignocaine and 1:100000 Adrenaline and Endodontic therapy was initiated under rubber dam isolation. Access cavity was prepared. The pulp chamber was irrigated by following standardized irrigation regimen using 5.25% of sodium hypochlorite (NaOCl), 17% ethylene diaminetetraacetic acid (EDTA) and physiological saline. For verifying the patency of the root canals, No.8 and 10 stainless steel K-files (Mani, Inc, Japan) were used. No.15 K file glide path was ascertained up to the radiographic working length (figure 1.2). Gate-Glidden (GG) drills were used for orifice enlargement up to size No 3. 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. The apical portions of the canals were prepared using short amplitude filing. Special emphasis was placed on 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 25.06% 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 with 25 size 6% gutta percha in both the teeth (figure 1.3) .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 1.4). The patient was given postoperative instructions and recalled for further follow up. At 6 months review, the patient was absolutely asymptomatic and there was no radiographic sign of any periapical disease (figure 1.5).



Figure 1.1

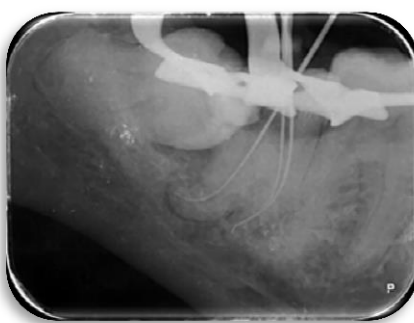


Figure 1.2



Figure 1.3



Figure 1.4



Figure 1.5

Case 2:-

A 19-year-old female reported to the Department of Conservative Dentistry and Endodontics, with pain in relation to upper right back tooth region of the jaw. Clinical examination revealed maxillary right second premolar which was carious. Tooth was tender on percussion. Medical history was non-contributory. Radiographic examination revealed that the caries was extending into the pulp chamber of the involved tooth. The roots of 15 were doubly curved (Bayonet or 'S' shaped) (figure 2.1). From the clinical and radiographic findings, a diagnosis of previously initiated therapy associated with symptomatic apical periodontitis was made in relation to 15. Prior to the formulation of endodontic therapy the degree of curvature was determined by using Schneider method and it showed severely curved canals in relation to 15 .With informed consent, local anesthesia was administered using 2% lignocaine and 1:100000 Adrenaline and Endodontic therapy was initiated under rubber dam isolation. The access cavity in 15 was prepared. The pulp chamber was irrigated by following standardized irrigation regimen using 5.25% of sodium hypochlorite (NaOCl), 17% ethylene diaminetetraacetic acid (EDTA) and physiological saline. For verifying the patency of the root canals, No.8 and 10 stainless steel K-files (Mani, Inc, Japan) were used. No.15 K file glide path was ascertained up to the radiographic working length (figure 2.2). 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. 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. The apical portions of the canals were prepared using short amplitude

filing. Special emphasis was placed on 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 6% 25 size of the instrument. Calcium hydroxide was used as an intracanal medicament and closed dressing was given for 6 days. In the next visit, the canals were flushed with saline and dried with paper points. A master cone radiograph was taken with 25 size 6% gutta percha in both the teeth (figure 2.3). 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. The patient was given postoperative instructions and recalled for further follow up. At 6 months review, the patient was absolutely asymptomatic and there was no radiographic sign of any periapical disease (figure 2.4).



(figure 2.1)



(figure 2.2)



(figure 2.3)



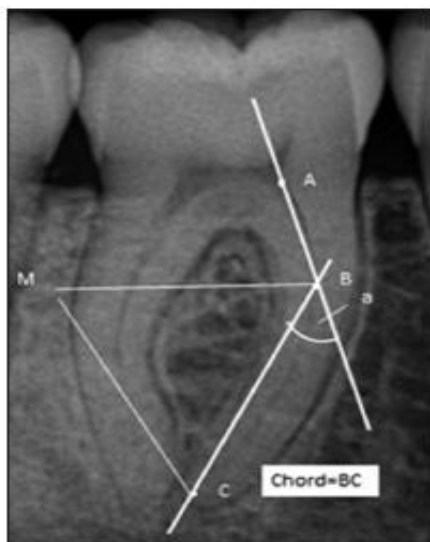
(figure 2.4)

Discussion:-

Successful endodontic treatment is a thorough knowledge, respect, and appreciation for root canal anatomy together with careful, thoughtful, and meticulously performed cleaning and shaping procedures. A variety of factors, including crown and root dilacerations, might complicate this treatment [5]. 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 when angulated x-rays are taken [4] which are advised during treatment planning.

Failure of root canal treatment in curved canals is mainly due to procedural errors such as ledges, fractured instruments, and canal blockage, zip and elbow creation. 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. Schneider proposed a method to calculate the curvature based on the angle that is obtained by two straight lines. Schneider's method involves firstly drawing a line parallel to the long axis of canal in the coronal third of root canal. A second line is drawn from the apical foramina to intersect the first line.



The Schneider's angle is measured with the intersection of these lines on a hard copy of the diagnostic radiographic print-out. Accordingly, the degree of root canal curvature is categorized as:

Straight: 5° or less

Moderate: $10-20^{\circ}$ and

Severe: $25-70^{\circ}$. [6]

After determining the degree of curvature, we have followed various techniques for the management of curved 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. [7] since 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 and
2. Decreasing the length of the file which is aggressively cutting at a given span.

Decreasing the force can be done by the following-

1. Precurving the file: A precurved file traverses the curve better than a straight file. Precurving is done in two ways:
 - i. Placing a gradual curve for the entire length of the file
 - ii. Placing a sharp curve of nearly 45° near the apical end of the instrument
2. 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.
3. 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.
4. 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:

1. Anti-curvature filing
2. Modifying the cutting edges of the instrument by dulling the flutes on outer surface of apical third and inner portion of middle third, which can be done by a diamond file
3. 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. 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.[8]

Conclusion:-

Severe root curvature may pose substantial difficulty in cleaning and shaping as well as obturation of the root canal. A thorough knowledge about internal 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 enhance the quality of the treatment along with 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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