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Case Report

Dentistry Section

Permanent Maxillary Central Incisor with Dilacerated Crown and Root and C-Shaped Root Canal

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ABSTRACT

Dilaceration is a rare disturbance in traumatised permanent teeth, which constitutes about 3% of the injuries to developing teeth. It usually occurs as a result of trauma to the deciduous predecessors and results in non axial displacement of the already formed hard tissue portion of the developing crown. Endodontic treatment of such teeth presents a challenge to clinicians, and careful management is required to successfully address the root canal anatomy and other possible variations.

The C-shaped canal configuration is most frequently seen in mandibular second molars, but this variation may also occur in mandibular first molars, mandibular third molars, maxillary molars, mandibular first premolars, and even in maxillary lateral incisors, with rare reports of such variations occurring in the maxillary central incisors. Diagnosis, endodontic access cavity preparation, root canal preparation and filling might be complicated by the presence of dilacerations and C-shaped canals.

This paper is an attempt to provide details of an unusual case of crown and root dilacerations and a C-shaped canal in the maxillary central incisor, successfully managed by using Self-Adjusting File (SAF) system.

Keywords: Dilaceration, Self-adjusting file, Trauma

CASE REPORT

A 16-year-old boy reported to the Department of Conservative Dentistry and Endodontics with the chief complaint of pain and discolouration in the upper left front tooth. The patient's medical history was non contributory. From detailed dental history given by the parents accompanying him, it emerged that the patient, at 2-3 years of age, suffered a trauma to the anterior maxilla due to a fall from stairs, following which he lost his left primary central incisor. No dental treatment was undertaken. His parents reported that permanent successor tooth had erupted with alterations in colour and shape, though the parents were dissatisfied with the aesthetics, they had never visited a dentist earlier.

On examination, the maxillary left central incisor appeared abnormal, exhibiting a short clinical crown with alterations in the incisal and middle thirds of the crown. The affected part of the crown was distinctly hypoplastic, with palatal displacement and yellowish-brown discolouration. The tooth also exhibited enamel hypoplasia and discolouration with the presence of gingival inflammation labially and also a gingival overgrowth on the palatal cervical margin of the tooth.

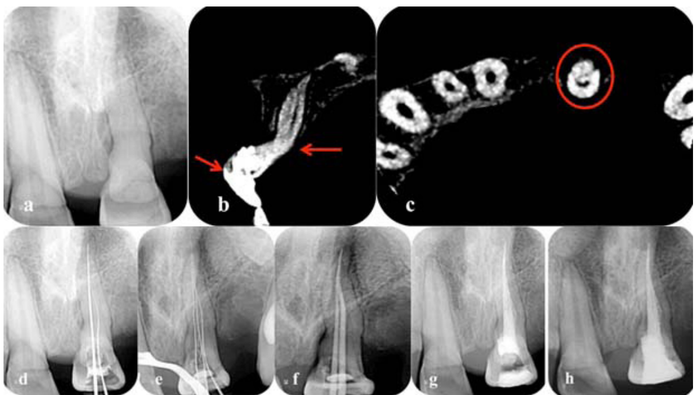
Maxillary left central incisor tooth did not respond to electrical and thermal pulp sensitivity tests. Percussion test was positive with maxillary left central incisor. Evaluation of the state of occlusion revealed traumatic occlusion related to the maxillary left central incisor and mandibular left central and lateral incisor. An intraoral periapical radiograph revealed periodontal ligament widening in the apical third of the root. Radio-opacity seen in the middle portion of the crown was assumed to be dens in dentin. The pulp chamber and root canal was indistinct [Table/Fig-1a].

To ascertain the variations in tooth anatomy and the root canal system of the left central incisor, dental imaging with Cone Beam Computed Tomography (CBCT) (Planmecaromexis with slice of 0.1mm FOV 60x4 for 60 seconds) was carried out. Sagittal-sectional CBCT image revealed crown dilaceration along with root dilaceration at the middle third of the root and absence of dens in dente [Table/Fig-1b] Cross-sectional CBCT images confirmed the presence of a C-shaped canal (semicolon) [Table/Fig-1c]. On the basis of history, clinical and radiological findings, a diagnosis of pulp necrosis with symptomatic apical periodontitis with "C-shape" canal and crown root dilaceration was arrived at.

An extensive search of literature revealed no case reported earlier of a maxillary central incisor having a dilacerated crown with dilacerated root and C-shaped canal. The purpose of this paper was to present and describe the endodontic management, with the help of a SAF, of a maxillary central incisor having crown and root dilaceration as well as a C-shaped canal configuration, diagnosed using radiographic and CBCT examination.

On the basis of diagnosis treatment plan was formulated, scaling and polishing of all the teeth was done. After administering local anaesthesia, the tooth was isolated, using a rubber dam by split dam technique.

Since the crown was bent palatally, labial approach for the access cavity was made. The pulpal floor revealed a C-shaped canal separated by a thin layer of dentin. Patency of canals was established by #06, #08 and #10 k-files, working length was determined using electronic apex locator accompanied by radiograph [Table/Fig-1d].



[Table/Fig-1]: a) Preoperative intraoral periapical radiograph; b) Sagittal-sectional CBCT image shows crown dilaceration along with root dilaceration; c) Cross-sectional CBCT images confirmed the presence of a C-shaped canal; d) Working length determination; e) The placement of the SAF (1.5 mm) till working length; f) Master cones selection; g) Post obturation radiovisiograph image; h) After one year follow up radiovisiograph image was taken to assess the healing.

The canal was scouted by a #15 k-file, followed by using PathFile instruments (013, 016, 019; Dentsply-Maillefer, Ballaigues, Switzerland) to the working length followed by a #20 K-file to establish a free glide path to the working length, as recently described by Solomonov M et al., to accommodate a SAF of 1.5 mm diameter [1]. The placement of the SAF (1.5 mm) till working length was confirmed by a radiograph [Table/Fig-1e]. The file was operated with a transline in-and-out motion in each of the canals for four minutes at 5,000 vibrations/min and 0.4 mm amplitude using EndoStation (RedentNova). Continuous irrigation was done using 3% Sodium Hypochlorite (NaOCl) at a flow rate of 4 ml/min, employing in-built peristaltic pump. The shaping procedure resulted in removal of the thin layer of dentin between the two canals and both of were joined to form a continuous (C1; according to Fan B et al.,) C-shaped canal [2].

The canal was dried using sterile paper points. Master cones were selected and confirmed using Radiovisiograph (RVG) image [Table/Fig-1f]. Obturation was carried out by the warm lateral condensation method, applying AH-Plus (De Trey-Dentsply, Konstanz, Germany) as sealer. Post-obturation RVG was taken to confirm the quality of obturation [Table/Fig-1g]. After one year follow up RVG was taken to assess the healing [Table/Fig-1h]. Further restoration of teeth was done with composite resin.

DISCUSSION

Traumatic injuries to primary dentition are quite common. An intrusive injury affecting the primary incisors varies from 4.4 to 22%, while 12 to 74% of developmental disturbances of the permanent incisors can be attributed to the injuries of their primary predecessors. Traumatic injury to primary dentition might affect the tooth germ of the permanent successors, either in the coronal or root region or the entire tooth germ. The sequelae of injury to the coronal region may include structural alterations, discolouration, enamel hypoplasia or crown dilaceration [3].

According to the American Association of Endodontists glossary of endodontic terms, dilaceration is defined as a deformity characterised by displacement of the root of a tooth from its normal alignment with the crown which may be a consequence of injury during tooth development [4].

In the current case the patient suffered intrusive luxation of the primary predecessor teeth around the age of 2 years. Crown dilaceration has a greater occurrence following intrusion or avulsion of primary teeth, and the most affected age group at the time of injury is seen to be between 1.5 and 3.5 years. At the age of 2-3 years, the tooth germs of the permanent maxillary incisors are usually located superior and palatal in relation to their primary predecessors. It is noted that trauma to the maxillary incisor crown may cause the root to move palatally and cause injury to the overlying tooth germ [5].

“The pathology of crown dilacerations can be described by the theory of displacement of the enamel epithelium and mineralised portion of the tooth in connection with dental papilla and cervical loop. Facially, the stretched inner enamel epithelium can lead to differentiation of new odontoblast; hence dentin formation is unaffected, but enamel formation is usually affected” [6]. Therefore, a horizontal band of dentin without enamel on the facial aspect is evident. The bent portion in these teeth with defective enamel and open dentinal tubules may act as a portal for entry of bacteria into the pulp space [3]. In the present case, traumatic force resulting to the avulsion injury at 2-3 years seems to have most affected the left central and lateral incisors, with lighter impact on the right central and lateral incisors. Also, the left central incisor erupted in slight labioversion. Endodontic success was achieved despite the difficult internal anatomy of the canal system. While locating and negotiating the canals, care was taken to avoid perforating the root. This emphasizes the need, before the onset of treatment, for correct diagnosis and determination of morphological variations.

Intraoral periapical radiographs are essential diagnostic tools in endodontics to determine both the normal and abnormal morphology of a tooth externally and internally. Being a 2-dimensional view of a 3-dimensional structure, however, an inherent limitation of the radiograph is its inability to clearly view complex tooth morphology, especially in the buccolingual plane. This limitation can be overcome using CBCT. Nowadays, CBCT is being commonly used in Endodontics to gain added information about the tooth anatomy, morphological variations and pathology. It not only aids in better preoperative diagnosis and treatment planning but also postoperative assessment [7].

Some authors state that all canals with the general outline of a C are C-shaped canals, regardless of whether a separate canal or orifice is observed. In studying C-shaped canals, Fan B et al., classified them as: C1 is a continuous C-shaped canal running from the pulp chamber to the apex following a C-shaped outline without any separation; C2 is a semicolon-shaped orifice in which dentine separates the main C-shaped canal from one mesial distinct canal; and C3 refers to those with two or more discrete and separate canals [2].

The irregular areas in a C-shaped root canal system may house soft tissue remnants or infected debris and/or bacterial biofilm, which may lead to inadequate cleaning and root filling procedures [1]. In the present case, the left central incisor exhibited a C2 type variant root canal, which was confirmed using CBCT.

C-shaped root canal systems are occasionally found in mandibular molars but rarely in maxillary molars. Boveda C et al., have reported an unusual case of a C-shaped root canal system in a maxillary left lateral incisor [8]. C-shaped canals present a challenge for endodontic instrumentation which may be better addressed by the use of SAF system. Solomonov M et al., compared the use of SAF and ProTaper system in C-shaped canals. They concluded that the SAF was more effective in shaping the walls of C-shaped root canals [1]. With the use of rotary files there is active packing of dentin chips and debris into the recesses/isthmuses present in root canals [9]. The novel lattice structure of SAF imparts better flexibility and enables better irrigation in complex C-shaped root canals [10].

CONCLUSION

Thorough understanding of the internal anatomy of the tooth along with its variation is mandatory for successful endodontic therapy. The maxillary central incisor, being a single rooted tooth with minimal canal variation, is considered to be the most simple for endodontic treatment to intervene. However, canal variation like a C-shaped canal is extremely rare and, when dilacerated, it is most challenging to intervene with the limitations of intracanal instruments that are available till recent past. CBCT has increased the scope of endodontics by serving as an important tool for the complex anatomy of a tooth. It is possible to achieve endodontic success in such teeth by establishing a correct diagnosis and adhering to the basic principles of endodontic treatment. The SAF system by adopting itself three dimensionally according to shape of canal creates a route to successfully apply these principles in C-shaped canals but further studies and clinical experience with the SAF for managing C-shaped canals are required.

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