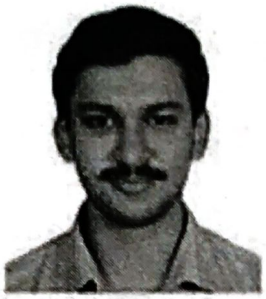

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MANAGING ANOMALOUS APICAL ROOT CANAL ANATOMY WITH ARTIFICIAL APICAL BARRIER

Abstract:

Dental trauma is always a psychological and physical assault. Above this trauma to the young permanent tooth affects its complete normal development. it results in either open apex or developmental anomalies like short root, inadequate apical barrier formation, dilacerations etc. Incomplete root formation challenges the treatment alternatives. Proper clinical and radiographic examination helps in identifying this bizarre anatomy and aids in treatment planning. Intraoral periapical radiographs does not always provides the exact image of clinical picture as it has its own pitfalls being two dimensional. In modern endodontics, cone beam computed tomography surely provides the accurate three dimensional image. The recent trend in the management of open apex is regenerative endodontic procedures; regeneration is not always possible in every case particularly when there is lateral exit of the canal. In such cases single step apexification using either MTA or biodentine can be a better alternative. This clinical case report presents a case of bizarre apical root anatomy diagnosed using cone

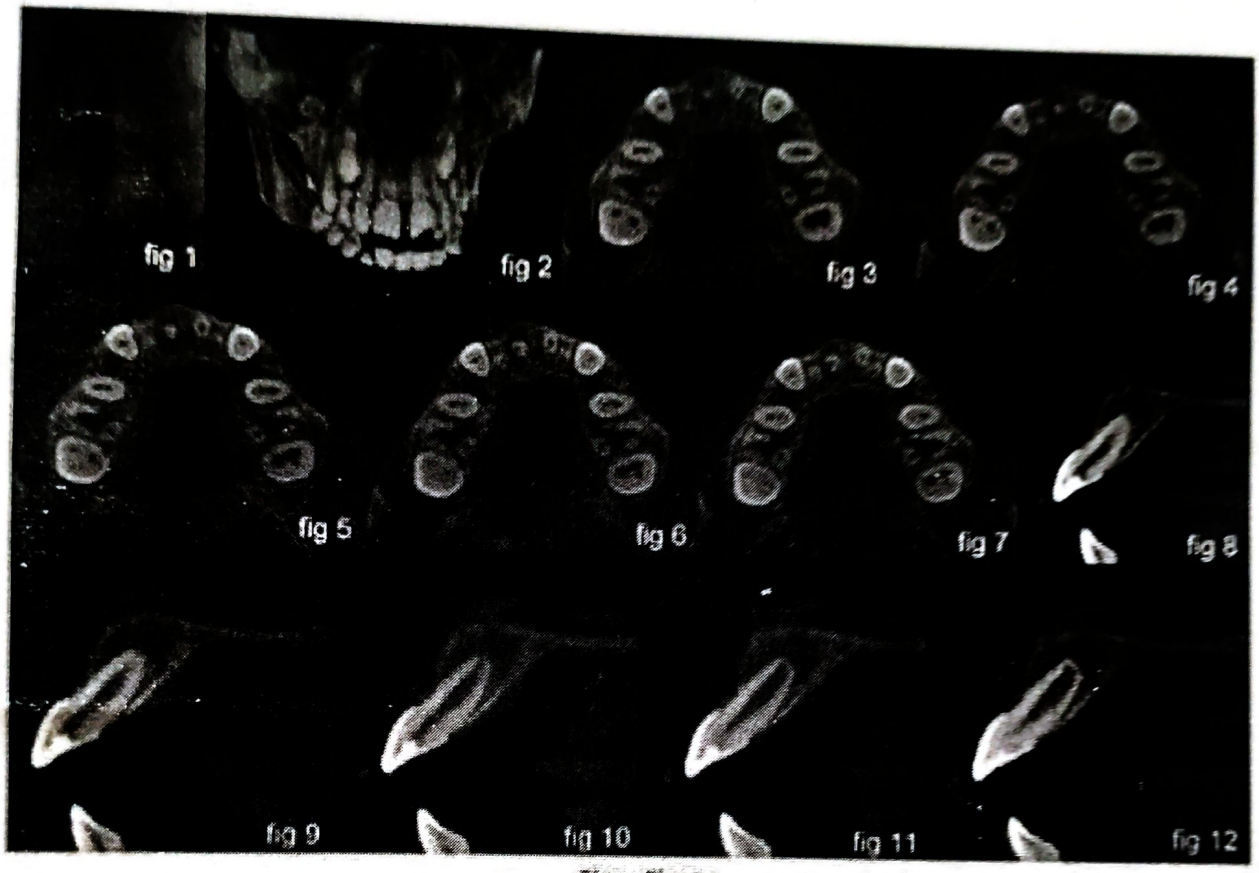

Fig 1 - Fig 12

beam computed tomography and managed by single step apexification using biodentine.

KEY WORDS

Biodentine, CBCT, lateral exit, Open apex.

INTRODUCTION

It is imperative for the clinician engaged in endodontic therapy to be well known with apical root canal anatomy and its variations pertaining to each tooth for successful endodontic therapy1. The tooth in question is approached with a view that an anomalous root or root canal is a certainty rather than a rarity. Apical delta, accessory canals, lateral exits, open apex, apical bifurcations are the common findings in apical area of root canal. Developmental anomalies or deviation from normal pattern due to trauma are expected contribution to these variable patterns observed2. Dental trauma is most common in the age group of 8-10 years and affecting anterior tooth most likely3. There can be two configurations of open apices blunderbuss4 (The walls of the canal are divergent and flaring, more especially in the buccolingual direction - The apex is funnel shaped and typically wider than the coronal aspect of the canal) and non-blunderbuss (the walls of the canal may be parallel to slightly convergent as the canal exits the root -the apex, therefore can be broad (cylinder shaped) or tapered (convergent).

Knowledge of average values, use of intraoral periapical radiographs, clinical examinations helps in determining the root canal anatomy. But all these methods have their own limitations. Periapical radiographs lack accuracy due to anatomic noise, geometric distortion, and two dimensional images5.

Recent development of cone beam computed tomography in endodontics shows promising results in this aspect. 3 D imaging is possible without any superimposition from adjacent structures, reduced radiographic exposure, image can be observed in all the three planes at a time6.

The anatomic variations of root canal are difficult to manage at times. Herein we present a case of such anatomic variation in apical end closure resulting in barrier formation as observed in cone beam computed tomography which was managed by creating apical stop using biodentine.

CASE REPORT

An 11 year old female patient reported to the department of conservative dentistry & endodontics with the chief complaint of sinus opening and pus discharge since 3-4 months. Patient was unaware of any history of trauma and the medical history was non contributory. On clinical examination both upper central incisors had Ellis class # 1 fracture and draining sinus tract was observed in relation to 11. Intraoral periapical examination revealed the presence of periapical lesion in relation to 11 with an open apex and an anomalous apical closure. Revascularisation was planned for the patient.

A conventional endodontic access opening was established with an Endo Access bur and an Endo Z bur (Dentsply Tulsa, Tulsa, OK) under rubber dam isolation for tooth #11. Coronal enlargement was performed with a nickel-titanium ProTaper SX rotary file (Dentsply Maillefer, Ballaigues, Switzerland) to improve the straight-line access. Working length was determined by using radiographic method. On exploration of apical third of canal we observed that apex had a hard barrier ; which was wedge shaped dentine structure placed horizontally on the apex of the root ,the base of the wedge was on the mesial part which was thinned out at the distal region and with a lateral exit. To confirm the uncertainty of apical closure we decided to take cone beam computed tomography (CBCT). Informed consent was obtained from the patient and a CBCT scan was performed with a CBCT scanner (Kodak 9500 Cone Beam 3D system, Carestream Health Inc., Rochester, NY, USA) at a tube voltage of 60 kVp, tube current of 5 mA, 0.076 mm voxel resolution and the field of view of diameter 50 (limited CBCT). All protective measures were taken to protect the patient from radiation according to As Low As Reasonably Achievable guidelines6. Axial images were transmitted to a commercially available dental program (Kodak Dental Imaging Software 3D module v 2.4) to reformat panoramic and cross-sectional images in all three planes. Axial slices of the maxilla of 200-mm thickness were obtained at different levels to determine the root canal morphology. A 3D reconstructed image was also obtained.(Figure 2)The axial section at the root tip showed absence of an apical opening but a coronal section showed a lateral exit which becomes more centralised.(Figures 3-7)Sagittal section revealed an apical opening only in one region.(figures 8-12)Treatment plan was changed to single step apexification with biodentine in order to strengthen the apical portion of root and avoiding the possibility of extrusion of gutta-percha filling through thin apical barrier.

Major emphasis was given to chemical disinfection so as to maintain the thickness of dentin. 5.25% sodium hypochlorite (Novo Dental Product Pvt Ltd, Mumbai, India), blunt end syringe was used for irrigation. After through irrigation and perfect drying of canal Ca (OH)2 mixed with saline was placed.

After two weeks patient was evaluated for resolution of sinus and pus drainage. Ca (OH)2 was removed from the canal by irrigation with normal saline. Biodentine (Septodont Healthcare India Pvt Ltd, Taloja, Maharashtra, India.) was mixed with liquid and placed into the apical portion of canal using endodontic pluggers (Dentsply maillefer India Pvt Ltd). Remaining canal was obturated with gutta-percha (Diadent Group International Canada) using lateral condensation technique. The access cavity was sealed with glass ionomer cement (GC Corporation

Fig 7

Tokyo, Japan]. The patient was asymptomatic during the follow up visit and intraoral periapical radiograph revealed resolution of periapical pathology.(figure13)

DISCUSSION

During root development the apical part of the pulp is described as being blunderbuss appearance. As tooth matures the funnel shaped foramen closes and constricts to a small apical foramen7. Presence of normal healthy pulp tissue aids in this development.
Trauma to immature permanent tooth may lead to loss of pulp vitality, pulpal necrosis which prevents the root formation. The treatment of pulpal necrosis in an immature tooth with an open apex presents a unique challenge to the dentist8. The absence of an apical constriction makes root canal treatment difficult because of the inability to obtain a seal with conventional obturation techniques.
In the present case on radiograph evaluation the apex seemed to be an open apex, while clinical examination was showing some bizarre anatomy. The pulp space volume is always much greater than the normal clinical radiograph would suggest7. So we opted for more conclusive cone beam computed tomographic examination.

CBCT produce three-dimensional scans of the maxillo-facial skeleton at a considerably lower radiation dose than conventional computed tomography (CT) 6. With CBCT, a three-dimensional volume of data is acquired in the course of a single sweep of the scanner, using a simple, direct relationship between sensor and source, which rotate synchronously through 180_–360_ around the patient's head. The X-ray beam is cone-shaped and captures a cylindrical or spherical volume of data.

Sophisticated software compatible with personal computers is then used to reformat the huge volume of data allowing it to be processed into a format that closely resembles images produced by conventional computed tomography scanners.The exposure time with CBCT scanners is typically less than 20 s and reconstruction of the image takes less than 2 min . CBCT makes possible to view an image in all the three dimensions at a time without anatomic noise, image distortion when compared to radiographs.

The presence of thin apical barrier may increase the chances of extrusion of gutta-percha during conventional obturation technique, which necessitates the creation of apical barrier. Laterally placed opening of apical foramen contraindicates the revascularisation procedures. Biodentine was selected as material of choice because of its strength, faster setting time and better handling properties. Research suggests that the high pH and released calcium ions are required for a material to stimulate mineralization in the process of hard tissue healing. Sulthan carried out a study to evaluate the pH and calcium ion release of MTA and Biodentine TM when used as root end fillings. He concluded that Biodentine TM presented alkaline pH and ability to release calcium ions similar to that

of MTA9. In another study by Han and Okiji that compared the uptake of calcium and silicon released from MTA and Biodentine TM used as endodontic materials into root canal dentine concluded that the elemental uptake into dentine was more prominent for Biodentine TM than for MTA10. This will add regenerative value to biodentine.

Revascularisation is the state of the art treatment for open apex but in the present case it was not done because of wedge shaped barrier could be reinforced by biodentine and the chances of periapical extrusion was minimal due to the lateral apical exit.

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FIGURE LEGENDS

Fig 1.Intra oral periapical pre operative radiograph showed wedge shaped dentine structure placed horizontally on the apex of the root ,the base of the wedge was on the mesial part which was thinned out at the distal region and with a lateral exit.
Fig 2. 3D reconstructed preoperative CBCT image
Fig 3-7.Axial view The axial section at the root tip showed absence of an apical opening but a coronal section showed a lateral exit which becomes more centralised
Fig 8-12. Sagittal section revealed an apical opening only in one region
Fig: 13 2 year follow up radiograph shows resolution of periapical lesion.

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