TITLE:A NOVEL APPROACH IN SURGICAL MANAGEMENT OF COMMINUTED CROWN-ROOT FRACTURE- A RARE CASE REPORT.

ABSTRACT

Comminuted root fractures have a questionable prognosis and present with very limited treatment options. In the following case, a comminuted crown root fracture in relation to maxillary left central incisor was managed witha minimally invasive surgical approach. The procedure involved repairing the multiple fracture lines in the root with Biodentine following the endodontic therapy and root resection. The patient was found to be asymptomatic at the end of a follow up period of ten months.

Keywords: CBCT, Comminuted root fracture, Trauma, Biodentine.

INTRODUCTION

Traumatic injuries to a tooth are very commonly encountered, especially among the young adult age group. Clinical presentation of dental trauma can be varied, from a simple enamel infraction to complete ex-articulation or avulsion of a tooth. Root fracture can be defined as a fracture involving the cementum, dentin and pulp [1]. Amongst the dental traumatic injuries in the permanent dentition, root fractures have an incidence of 0.5 to 7% and commonly occur in the age group of 11-20 years [2-4]. They occur mainly in the maxillary centrals (68%) and maxillary laterals (27%) due to frontal impact, with a rare involvement of only 5% in mandibular incisors [5]. Depending on the number of fracture lines, it can be either single or multiple (comminuted).

Root fracture cases are of interest to clinicians and are also considered challenging, as their management may involve an interdisciplinary/multidisciplinary treatment approach. Initial management of a root fracture depends on position of the fracture line, length of the remaining root segment and the presence or absence of a coronal segment [1].

Several treatment modalities such as:

- Disinfection and obturation of the coronal segment only,
- Surgical removal of the apical segment,
- Removal of the coronal segment and orthodontic /surgical extrusion of the apical segment
- Stabilization of the coronal segment with endodontic implants, have been implicated for the management of root fractures [6].

Unfortunately, comminuted root fractures are serious complications with poor prognosis. Hence, in case of a confirmed diagnosis, treatment of comminuted root fractures is extraction [7].The following case report describes the management of a comminuted root fracture in relation to maxillary left central incisor using a minimally invasive surgical approach. It involved resection of the fractured apical segment followed by retrograde root end filling using biodentine and sealing of the remaining fracture lines using biodentine. To the best of authors' knowledge there is no documentation of the management of a comminuted root fracture surgically using Biodentine.

CASE REPORT

A 33-year-old male patient reported to the Department of Conservative Dentistry & Endodontics, Army College of Dental Sciences,Secunderabad, with the chief complaint of pain in upper front tooth region for 1 week.

The patient's dental history disclosed that he had suffered a dental trauma due to accidental fall 6 months back, which resulted in broken crown with respect to upper left central incisor. The partially separated fractured crown fragments had been reattached to each other using a tooth colored filling material at a dental clinic, near the patient's home, 2 days post trauma.The patient remained asymptomatic for a period of two weeks and so, did not undergo any further treatment. He developed pain and mild intro-oral swelling in relation to the same tooth and then visited our institute to seek advice. Medical and family histories were non-contributory.

Intraoral examination revealed a discolored crown with respect to 21 which was tender to percussion and showed Grade I mobility. Soft tissue evaluation revealed an intraoral swelling with vestibular obliteration and a sinus opening with pus dischargeat the mid root region of tooth #21[Figure 1]. Tenderness on palpation was also present in relation to the same tooth. Periodontal probing revealed normal intact gingiva. The tooth showed no response to thermal and electric pulp tests. The adjacent teeth responded within normal limits to testing.

Figure 1: Preoperative intraoral photograph

Radiographic examination revealed the fracturelines to be extending subgingivally. A series of angled radiographs were taken whichshowed two oblique fracture lines, one from mesio-incisal part of crown extending subgingivallyonthe disto-cervical surface of the root, and the second fracture line running obliquely in the mid root region of tooth #21. A diagnostic radiograph was taken after inserting a gutta-percha cone(# 25; 2%, Dentsply, Tulsa Dental Specialties, United States) into the sinus tract to confirm its origin [Figure 2].

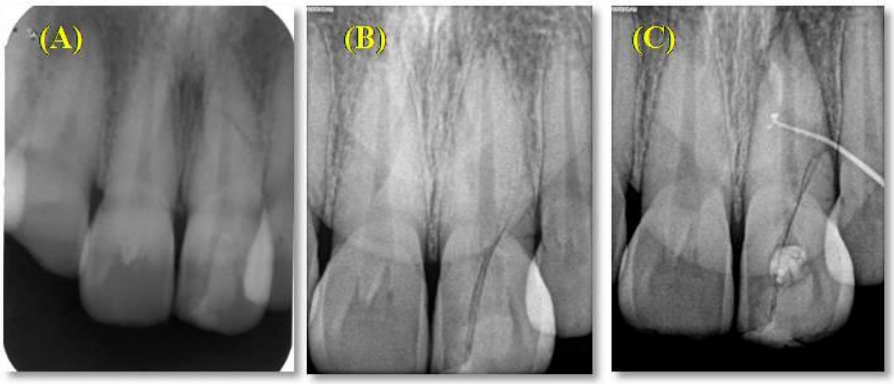

Figure 2: (A) Pre operative IOPAR (B) Preoperative RVG image (C) Sinus tracing

A CBCT scan was advised to further elucidate the extent of the fracture lines [Figure 3]. The CBCT revealed multiple fracture lines passing obliquely through the root with loss of labial cortical bone with respect to tooth # 21. A diagnosis of complicated crown root fracture was deduced and both an immediate as well as definitive treatment plan was formulated. As the prognosis of this tooth was questionable, extraction followed by replacement of tooth was advised to the patient. However, the patient desired retention of his tooth for as long as it remained functional. Hence, root canal therapy, followed by surgical repair of the fracture externally for tooth # 21was planned.

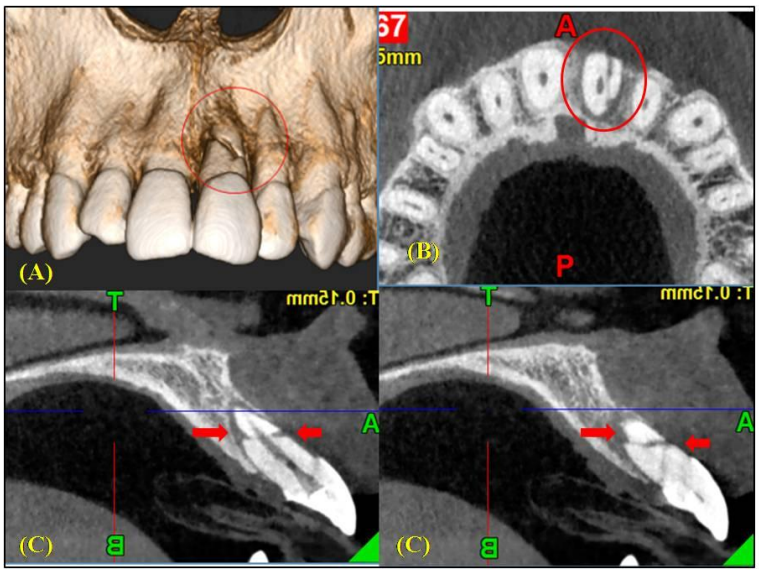

Figure 3: Preoperative CBCT images of tooth #21. (A) Multiple oblique fracture lines seen on the mid and apical root region. Labial cortical bone in relation to 21 is lost. (B) Axial section showing the labiolingual extent of the fracture line and (C) Sagittal sections showing the comminuted fracture lines along with displacement of the fractured middle and apical root segments.

TREATMENT PLAN

Written informed consent was obtained from the patient prior to the commencement of treatment.

Immediate treatment: Root canal therapy

The goal of this phase was to provide immediate relief from pain and reassure the patient. Access was gained to the root apex. The working length of the root canal [WL=27 mm] was determined using RVG. Cleaning and shaping of the canal was performed using hand K files(MANI, INC. Utsunomiya, Tochigi, Japan) and ProtaperUniversal rotary files(Dentsply Tulsa Dental; Tulsa, Oklahoma)upto #25 (F2) tip size and 6% taper. The root canal was irrigated with 5.2% sodium hypochlorite and normal saline between each instrument change. The canal was finally flushed with normal saline and dried with absorbent paper points. An intracanal medicament comprising of a paste of calcium hydroxide powder mixed with saline (Deepashree products, Ratnagiri, India) was placed in the canal for 1 week.

After 1 week, the swelling was found to have subsided and the tooth was asymptomatic. Obturation was done using Gutta Percha (Dentsply, France, SAS) coated with MTA Fillapexsealer (Angelus, Londrina, Parana). Finally, the access cavity was sealed with glass ionomer cement (Ketac Molar Easymix, 3M ESPE AG, Seefeld, Germany) [Figure 4].

Figure 4: (A) Working length determination (B) Master cone xray (C) Obturation

Definitive treatment: Surgery

After 1 week following the obturation, the surgery was planned. The procedure was performed under local anesthesia with 2% lignocaine containing 1:80,000 adrenaline. A crevicular incision was given from the mesial aspect of the maxillary right lateral incisor till the mesial aspect of the maxillary left canine. A mesial releasing incision extending into the vestibule was taken to raise a triangular flap. Sub-periosteal reflection was done. Apical4 mm of the root was resectedto

include the oblique apical fracture line. Retrograde cavity was prepared using micromotor handpiece and filled with Biodentine (Septodont) as aretrograde restorative material.

The gaps between the fractures lines in the mid and cervical root region were gently curetted, and irrigated with betadine. The fractured defects were sealed with Biodentine. To compensate for the loss of labial cortical plate over tooth #21, a thin layer of Biodentine was applied and stabilized by a PRF membrane placed over it. The gingival flap was repositioned and sutured[Figure 5].

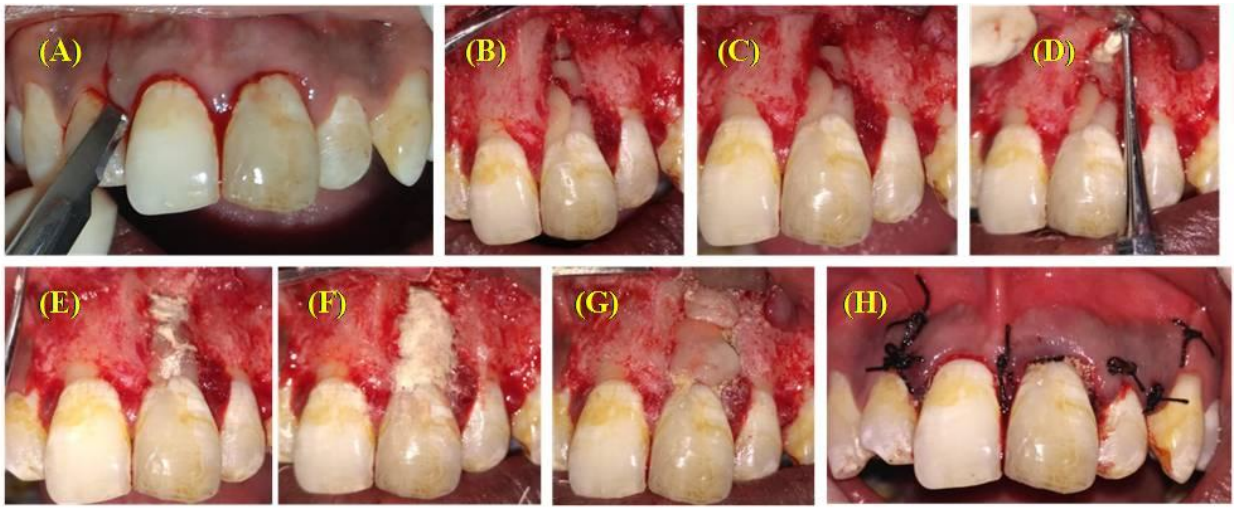

Figure 5: (A) Incision (B) Raised flap (C) Apicoectomy (D) Retrograde filling of biodentine (E) Fractured defects sealed with biodentine (F) Biodentine coverage over exposed root (G) PRF placement (H) Sutures

Post operatively the patient was prescribed Augmentin 625 mg T.D.S, Metrogyl 400 mg T.D.S, Acecloran T.D.S for 5 days and 0.12% Chlorhexidine Gluconate mouthwash twice a day for 7 days. After 7 days, the patient was recalled for suture removal. Periodic evaluation was done after 2 months, 6 monthsand 10 months [Figure 6]. Figure 7 shows the CBCT scan of the tooth #21 at the 10^{th} month evaluation. Clinically the patient was asymptomatic. Radiographically, periapical healing was evident. Figure 8 shows theclinical comparison of the pre-operative and post- operative status of the patient.

Figure 6: Follow up of 6 months (A) and 10 months (B)

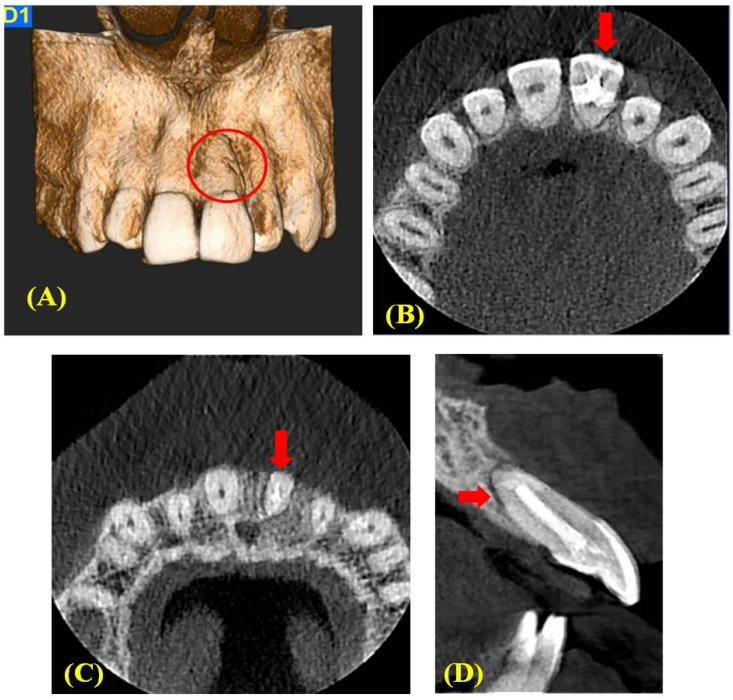

Figure 7: Postoperative CBCT images of tooth #21. (A) Healing seen on the mid and apical root region. Labial cortical bone in relation to 21 is regained. (B) Axial section in coronal third showing the labiolingual extent of the restored fracture line (C) Axial section in middle third showing the labiolingual healing of radiolucency (D) Sagittal section showing periradicular healing.

Figure 8. Clinical photograph (A) Pre operative (B) Post operative (10 months follow up)

DISCUSSION

Management of complicated crown-root fractures remains a challenge.So far treatment options for comminuted root fractures are very limited. It is a complication, which leads to extraction in nearly every case [6]. Hence, in the present case, extraction of tooth #21 and replacement by implant, fixed partial (FPD) or removable denture was discussed with the patient. However, all the suggested treatment options,for replacement of tooth #21were neither affordable (implant, FPD) for the patient nor favored because of aesthetic reasons. Thus, an alternative treatment plan to restore thefunctionality of the tooth for as long as possible was suggested.

Conventional dental radiography serves as an aid in assessing the status of the pulp and periodontium, but gives little or no information on the direction and extent of the fracture. Depending on the extension of the fracture line towards the root and its relationship with the periodontium (below alveolar crest) the treatment is going to vary. For example, if a fracture is limited to the crown surface, it can be restored, however, ifit extends below the alveolar crest,the prognosis is generally poor. Making a proper treatment decision in such cases is a challenge for

the endodontist as there are limited noninvasive tools to assess the length of the fractures below the soft tissues and alveolar crest.

Newer methods of analysis, such as Cone Beam Computed Tomography (CBCT), are currently being studied in order to help identify root fractures in a nondestructive fashion [7]. The joint position statement by the American Association of Endodontists (AAE) and American Academy of Oral and Maxillofacial Radiology (AAOMR) regarding the use of CBCT in Endodontics states that "the patient's history and clinical examination must justify the use of CBCT by demonstrating that the benefits to the patient outweigh the potential risks" [8].

In this case, we have used multi-slice view of CBCT to detect the fracture in various planes and to determine their apical extent and proximity to the pulp thereby predicting the prognosis. The volume of data acquired in a single scan not only allows visualizing a tooth from coronal, sagittal, or axial view, but also gives a provision to reslice the volume at any slice thickness. This volume of data can be manipulated repeatedly to gather large amount of information about the tooth and its periapical tissues.

In the present case report, the tooth #21, was obturated using MTA Fillapex sealer (Angelus, Londrina, Parana) as it is a mineral trioxide aggregate-based, salicylate resin root canal sealer which is designed to provide a high flow rate. It contains 13% MTAand salicylate resin for their biocompatibility and antimicrobial properties. It also shows calcium ion release, inducing rapid tissue regeneration in sites of bone lesion and microbial activity [9].

In the present case, an apical root resection of 4mm was planned to include the apical most fracture linefrom the apex in the resected segment of the tooth. The tooth had a working length of 27mm, and so, the crown- root ratio was maintained post apicoectomy. The prepared retrograde cavity was restored withbiodentine, and the remaining fracture lines on the mid and cervical root region, were also sealed using the same material.

Biodentine, which is a bioactive cement mainly consisting of tri- and dicalcium-silicate, was used as the preferred choice of material in the current case, as it can develop a hydroxyapatite-like surface in the presence of body fluids containing calcium or phosphate. This surface is biocompatible and displays good conditions for cell attachment and proliferation of the PDL [8]. A thin layer of biodentine was coated on the labial surface of the root of tooth #21, as it shows significantly higher levels of calcium and silicon ion release [10,11]The silicon in its composition plays an important role in its bioactivity. It increases bone calcification, [12,13]stimulates bone growth [14-16] and has a positive effect on the mineralization of dentine. [17,18]

CONCLUSION

The management of the present case involved a novel approach.However, it must be borne in mind that it is difficult to extrapolate the results of a single case with a follow up period of 10 months to a more general conclusion. Thus, more number of such cases should be monitored over a longer periodto prescribe a general recommendation. Nonetheless, endodontic therapy, followed by surgical exposure of the site andfilling the fracture gaps with Biodentine is anexcitingclinical treatment option for teeth with comminuted root fracture with a questionable prognosis. Hence, the described treatment option may contribute to changing the clinical management of such cases in future.

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