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MANAGEMENT OF THE HORIZONTAL ROOT FRACTURE USING FIBER POST AS AN INTRARADICULAR SPLINT

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Abstract : BACKGROUND: Root fractures are uncommon injuries in permanent teeth and account for only 0.5–7% of dental trauma. It occurs more frequently in fully erupted permanent teeth, in which the completely formed root with closed apices is solidly supported in the bone and periodontium. This may lead to complex consequences due to the combined damage to the pulp, dentine, cementum, bone, and periodontium. They are transverse to oblique in direction and result from a horizontal impact. Their incidence is more in the middle third of the root than at the cervical and apical thirds.
CASE REPORT: This paper describes a case of complicated horizontal root fracture at the middle third of the maxillary right central incisor. After receiving an endodontic treatment, the fractured root fragments of the maxillary right central incisors were united with the help of a glass fibre post.
CONCLUSION: Follow-up after six months revealed a well-stabilized assembly of the root fragments and the post.

IndexTerms **- Root fractures, Maxillary central incisors, splinting, glass fibre posts**

I. INTRODUCTION

Root fractures make about only 0.5–7% of all dental traumatic injuries. A root fracture is defined as "fracture including dentin, cement, and pulp." The middle third of the root is where horizontal root fracture most frequently occurs, whereas the coronal and apical thirds are only very infrequently affected. Maxillary central incisors are more prone to traumatic injuries (approximately 68%) probably due to their position in the dental arch. The maxillary lateral incisors (27%) come in second, followed by the mandibular incisors (5%), affecting patients between the ages of 11 and 20 who are male and who have had trauma from car accidents, sports injuries, and fights (5%)..[1]

A single fracture occurs in most cases and multiple root fracture is a rare finding. Clinically, the more coronal root fractures are usually more mobile. The healing of these fractures can be complicated because the wound in root fractures involves damage to all dental tissues, including the pulp, dentin, periodontal ligament, and cementum and is sometimes associated with damage to the supporting alveolar bone. Pulp necrosis, root canal obliteration, external and internal surface resorption, inflammation around the fracture, and periapical inflammation are some of the pathological consequences of horizontally broken teeth.[7]

After a tooth or teeth have been repositioned, splinting has been recommended to support the tooth or teeth and to improve the pulp's and/or the periodontal ligament's chances of healing. A splint has been defined as ‘an apparatus used to support, protect or immobilize teeth that have been loosened, replanted, fractured or subjected to certain endodontic surgical procedures’. A flexible splint allows functional movement in contrast to a rigid splint where the injured teeth are immobilized.[8]

The prognosis for root fractures in the middle third of the root is good. Repositioning the fragments should be the primary line of treatment when the coronal fragment is misaligned. After that, the coronal fragment is stabilised with a splint to give the periodontal tissues time to heal. [1] colored fiber posts have been introduced with the ever-increasing demand for esthetics that can be used as a medium to retain the two fractured root fragments in conjunction with bonding agents and composite resins. The purpose of this case report is to present horizontal root fracture at the middle third of the root, in which pieces were united with the use of glass fibre posts, followed by splinting.[5] .

II. CASE REPOST

A 30-year-old male patient who suffered trauma to the maxillary anterior region in a car accident around five weeks ago has been referred to the Department of Conservative Dentistry and Endodontics. He described having intense, shooting pain in the maxillary right central incisor for eight days. Clinical examination of the patient revealed extruded and buccally displaced maxillary right central incisor with Grade I mobility . The tooth was tender on percussion. In the middle third of the root of the maxillary right central incisor, a radiographic examination revealed oblique radiolucent lines that suggested a horizontal root fracture. **"Fig.1"**

There were no indications of an alveolar bone fracture. His upper lip's inner surface was swollen and superficially lacerated. After explaining the treatment attempt to the patient and obtaining his consent, repositioning of the coronal segment with finger pressure under local anesthesia was done. The reduction was confirmed radiographically. Teeth were isolated, etched with 37% phosphoric acid (Ivoclar Vivadent Marketing (India) Pvt. Ltd. Andheri (West), Mumbai), rinsed and dried followed by application of bonding agent (Ivoclar Vivadent Marketing (India) Pvt. Ltd. Andheri (West), Mumbai) and light-cured for 40 s. A semi-rigid ribbond splint (Ribbond Inc., Seattle, WA, USA) was placed from 13 to 23 employing a flowable, and packable light cure composite (Ivoclar Vivadent Marketing (India) Pvt. Ltd. Andheri (West), Mumbai). **"Fig.6"**

The access was established with the maxillary right central incisor. The working length was correctly determined radiographically using #15 K file**"Fig.2"** (Mani Inc., Japan) and confirmed with an apex locator (Root ZX mini, Tokyo, Japan), followed by chemomechanical preparation using K files (Mani Inc., Japan) in an exccedingly step-back manner to an apical file size #40 under copious irrigation using 2 ml of 5.25% NaOCl (Prime Dental Products Pvt. Ltd. Thane, India) and saline (Eurolife Healthcare Pvt. Ltd. Mumbai) after every instrument. The remainder of the canal was shaped to get an identical taper from the apex toward coronal. Using lentulospiral (Mani Inc., Japan), an inter-appointment calcium hydroxide dressing (Prime Dental Products Pvt. Ltd. Thane, India) was applied, and the patient was summoned back seven days later. It has been suggested to brush your teeth gently, use chlorhexidine mouthwash, eat soft foods, and refrain from chewing on your maxillary right central incisor.On the second visit, after removal of calcium hydroxide dressing, 2 ml of 17% EDTA (MAARC ENDO-L, Palghar, Mumbai, Maharashtra, India) for five min was used for final rinse followed by saline. The canal was dried using sterile paper points (DENTSPLY MAILLEFER, Ballaigues, Switzerland) of appropriate size. The root canal was sectionally obturated using gutta-percha cone (DENTSPLY MAILLEFER, Ballaigues, Switzerland) and AH plus sealer (Dentsply DeTrey GmbH, Konstanz, Germany). A gutta-percha cone of the same size of the prepared root canal (size #40, with a taper of 2%) was selected and tried into the canal to obtain a close fit**"Fig.3"** . It was then cut to obtain a section that would be 4 mm in length from the apex of the root canal**"Fig.4"**. A suitable plugger (Mani Inc., Japan) that loosely fits 4 mm short of the apical root fragment was selected and a stopper was set at this length. The obturation was carried out with sectioned gutta-percha coated with AH plus sealer. The sectioned end of gutta-percha was mounted to a heated plugger so carried into the canal to the specified length. After this, gutta-percha was disengaged from the plugger by slightly rotating the plugger in an anticlockwise direction . On the subsequent day, an appropriate glass fiber post (Dentsply Maillefer, Ballaigues, Switzerland) was tried into the canal, adjusted to the specified length until post just passively touched the apical gutta-percha. The root canal was etched with 37% phosphoric acid gel, rinsed, and dried with paper points. The canal was coated with a bonding agent and light cured for 40 s**"Fig.5"**. The fiber post was luted with dual-cure resin cement (Ivoclar Vivadent Marketing [India] Pvt. Ltd. Andheri [West], Mumbai), inserted into the canal without applying any pressure, and so light-cured for 40 s. The resin was used cautiously to lute the post only within the amount necessary to realize a desirable bond between the post and the dentin. Coating the root canal walls with resin cement was avoided to inhibit the flow of excess cement laterally between the root fragments. These fiber posts served as an intraradicular splint, stabilizing the fractured fragments in position. Following post cementation composite restoration (Ivoclar Vivadent Marketing [India] Pvt. Ltd. Andheri [West], Mumbai) was done. The splint was retained for 4 weeks and then removed . The patient was re-evaluated regularly. After 6 months of recall, the patient presented with the fractured root fragments well retained with the aid of a post and esthetically pleasing results along with sound periodontium.

III. DISCUSSION

Rare diseases called root fractures can develop as a result of severe trauma. The severity of the fracture line, the pulp tissue condition, occlusion, fragment dislocation, and the patient's overall health are some of the factors that can affect the prognosis of root fractures. In comparison to vertical fractures, horizontal root fractures located in the middle or apical third of the root have a better prognosis. [4]

The repositioning of the dislocated coronal portion and flexible stabilisation for 4 weeks are recommended by the International Association of Dental Traumatology for the management of horizontal root fractures.If the root fracture is near the cervical area of the tooth, stabilization for a longer period (up to 4 months) may be beneficial. Various treatment options include (i) endodontic treatment of the coronal fragment only, (ii) endodontic treatment of the coronal fragment with surgical removal of the apical fragment, (iii) extraction of the coronal fragment, followed by endodontic treatment and surgical/orthodontic extrusion of the apical fragment, (iv) in cases of increased mobility of the coronal segment, intraradicular splinting can be done, and (v) removal of the apical segment and stabilization of the coronal segment with endodontic implants .The coronal-middle third of the tooth root in the current case had a horizontal fracture. If the apical portion were removed, the crown-to-root ratio would suffer. Consequently, the root canal treatment was carried out.[5]

A progressive improvement in the field of adhesive dentistry allows clinician to reattach a broken tooth structure mechanically, chemically, and esthetically. In this instance, the coronal fragment was reattached using an intraradicular splint made of a fibre composite post and resin cement. The preservation of tooth integrity, ease of use, aesthetics, bonding to the tooth structure, cost effectiveness, and functional rehabilitation are a few benefits of fibre post for reattachment . Recently, new post materials such glass fibre, quartz, and carbon fibre have been used in dental procedures. [7]

The use of glass fibre reinforced posts reduced the likelihood of root fractures because they have strong tensile and fatigue strength as well as an elastic modulus that is closer to dentin. The fibre posts provide a number of benefits, including minimal tissue removal, good post-to-cement bonding, and aesthetics. The likelihood of root fractures is reduced because fiber-reinforced posts have a modulus similar to that of dentin rather than the high elasticity of typical metal supports. Gurtu and Singhal claim that using a post guarantees the tooth's support and stability. Additionally, it strengthens the repair complex, which is prone to tangential pressures, by aiding in the retention of the root pieces by radicular anchoring. Additionally, it forms a monoblock between the tooth, cement, post, and reconstructive material. In addition to bonding, post insertion offers retention via a friction bond and helps prevent dislodgment due to nonaxial stresses . In order to rehabilitate the weakened root-filled teeth both functionally and aesthetically, light-transmitting fibre posts have been employed widely.[1]

Fiber splints are made of a polyethylene or Kevlar fibre mesh and fastened with composite resin or an unfilled resin like OptibondTM FL (Kerr, USA) .Commercially accessible materials include silinated E-type glass fibres like Fiber-Splint (Polydentia SA Mezzovico-Vira, Switzerland), RibbondTM (Ribbond Inc., Seattle, USA), and EverStick (Stick Tech Ltd, Turku, Finland). In a research by Andreasen et al. of 400 root-fractured teeth, fibre splints were linked to the highest probability of successful healing results.[8]
Different techniques can be used to cure midroot fractures. Four different forms of healing sequelae were characterised by Andreasen and Hjorting-Hansen: (1) interproximal calcified tissue, (2) interproximal connective tissue, (3) interproximal bone and connective tissue, and (4) interproximal inflammatory tissue without healing. It is necessary to conduct a lengthy follow-up to look for any potential pathological changes. [5]

IV. CONCLUSION

Following trauma, horizontal root fracture cannot be used as a reason for extraction. Since many patients cannot afford an implant, the replacement of a single anterior tooth poses the largest aesthetic difficulty to the physician; as a result, maintaining natural teeth is the best option for horizontal root fracture. The treatment's primary goal is to retain the tooth's stability and place within the dental arch .Improvements in restorative resins, bonding agents, and the accessibility of more recent materials, like fibre posts and dual-cure resin cement, have given physicians various techniques for effectively treating root fractures. Fiber posts used as an intraradicular splint for the treatment of midroot fractures can be an effective substitute for reestablishing the patients' aesthetic and functional requirements.

Figures

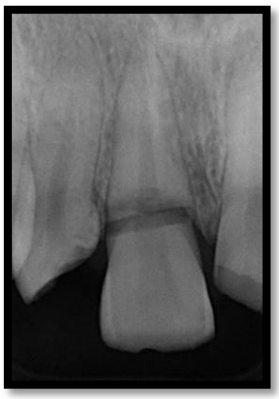

FIGURE 1 Pre-operative radiograph shows horizontal root fracture with the maxillary right central incisor

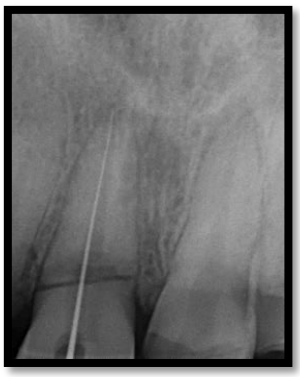

FIGURE 2 Working length determination using #15 k file

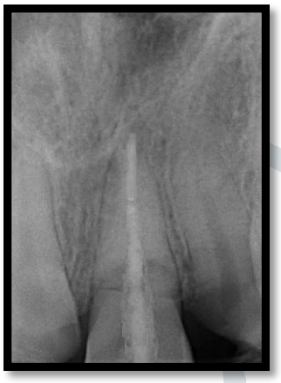

FIGURE 3 Master cone selection

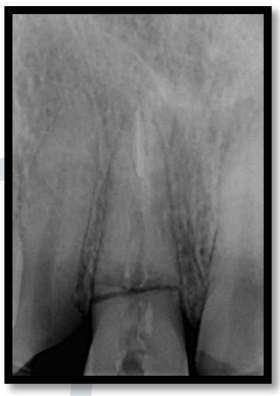

FIGURE 4 Sectional obturation

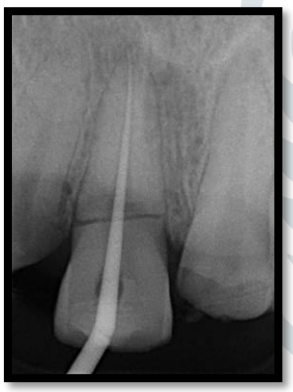

FIGURE 5Fiber post-cementation

FIGURE 6 Clinical photograph after repositioning and ribbond splinting

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