Innovations

Management of Over-Extruded Separated Endodontic Instrument Using A Surgical Approach: A Case Report and Review of Literature

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Abstract

Background: *Numerous endodontic mishaps can be seen during root canal procedures. One frequent consequence of improper use or excessive use of the instrument is the separation of the endodontic instrument.* ***Case presentation:*** *We report the case of a failed attempt to manage a separated endodontic instrument non-surgically by a private dentist, which resulted in extrusion of the instrument beyond the root apex. This article describes a successful surgical procedure (apicectomy) for removing a broken endodontic instrument from periapical tissue. Novel material such as amniotic membrane was used for apexification of traumatized immature right and left maxillary central incisor.* ***Conclusion:*** *The clinical and radiographic evaluation done during the follow up visits at 1, 3 and 6, a progressive root growth with apical closure was seen. Apicectomy and Aesthetic restorations had successful outcomes.*

Keywords: *Tooth fracture, separated endodontic instrument, amniotic membrane, dental aesthetics.*

Introduction

An undesirable and irritating complication that occurs 0.5%–5% of the time is the separation of an endodontic instrument within the root.[1-5]The separated or broken endodontic instrument could cause

root canal therapy to fail by preventing cleaning and shaping procedures.[1]Such instruments can be managed either surgically or with conservative/nonsurgical methods.[1,6]Nonsurgical endodontic instrument removal is common but still challenging. There are also several devices and detailed instructions for effective surgeries. The success rate varies, though, from 55% to 79%.[7] Nonsurgical methods might sometimes result in further issues including over-extrusion beyond the root apex.[6-9]Such issues can necessitate a surgical method.[9]

The broken endodontic instrument is usually refused by patients to be left within the body.There aren't many reports on how to treat instruments that have been separated and extruded beyond the apex.[6]Only fifty percent of broken endodontic instruments that were extruded out of the apex were effectively extracted. In this case study, a broken endodontic instrument was removed from periapical tissue utilising a surgical method.

Case report

A 22-year-old male patient was referred to the Department of Conservative Dentistry and Endodontics with a complaint of pain and fracture in the upper front tooth region for a month. The patient gave a history of trauma 10 years back, following an accident during which his maxillary anterior teeth were fractured and the patient visited a local dentist for treatment of the same.

Due to a poorly filled root canal,the patient experienced pain due to which he reported to the department.His medical history was irrelevant. Upon clinical examination, there was pus discharge from the root canal.

A complete clinical investigation revealed Ellis class IV fracture with 11 and 21.(Fig 3a) An IOPA was advised of the concerned region.Radiographic analysis revealed badly obturated canals in relation to canals 11 and 21. Additionally, a radiograph showed radiopacity extending from the apex of the left maxillary central incisor, which is assumed to be a separated endodontic instrument. IOPAR w.r.t. 11 also displays an immature tooth with a wide open apex and a radiolucent area in proximity to the apex of the tooth. To determine the precise extent and to make an appropriate diagnosis of the periapical lesion, a CBCT scan was suggested.

CBCT report

Evidence of radio-opacity with serrated margins with radio density similar to that of an endodontic instrument extending beyond the apex of the root canal irt 21 suggestive of an extruded broken instrument measuring 5.49 mm superior-inferiorly. (Fig 1)

The patient was informed of the broken instrument and prognosis of the tooth. (Fig 2a)After obtaining an informed consent, a combined approach of Re-RCT for 11 and 22 was planned followed by surgicalremoval of an over-extruded endodontic instrument from the periapical tissues, retrograde apical filling, and crown prosthesis on the treated teeth.

Local anaesthetic (2% lidocaine with 1:200,000 adrenaline) was given to the patient after a thorough history was taken. The concerned tooth (11 &21) was isolated using a rubber dam. The working length was estimated on the diagnostic radiograph. The root canal filling material was removed w.r.t 11 & 21 using xylene and H files. (Fig 2b) Working length was measured to be 18mm and 22mm for 11 & 21 respectively. Using Protaper Gold rotary files up to size F5, the canals were cleaned and shaped while being alternately irrigated with saline and a 1.5% sodium hypochlorite (NaOCl) solution. (Fig 2c) After two weeks of root canal disinfection with a calcium hydroxide dressing, the canal was finally irrigated with 20 ml of 1.5% sodium hypochlorite and 20 ml of 17% EDTA.

The amniotic membrane was cut into roughly 1 mm × 1 mm pieces, soaked with saline, folded with the aid of a tweezer, and inserted into the canal till working length using an endodontic hand plugger after the canals had dried.

The patient was asymptomatic after a week, and the canal was obturated after being irrigated with sodium hypochlorite and normal saline. The canal was then dried with paper points. Roll-cone GP obturation with lateral compaction was the preferred method for obturation. (Fig 2d)

Surgical management

A semilunar vestibular incision was made under local anaesthesia. The root apices of 11 were affected by a bony defect. The right maxillary central incisor's granulation tissue was curetted using Gracey curettes on the apical and lateral root surfaces. Perpendicular to each root's long axis, a straight fissure carbide bur was used. At the apex of the left maxillary central incisor, a horizontal osteotomy was done and instrument was removed. To verify that the separated endodontic instrument had been completely removed, a postoperative radiograph was done. (Fig 2e)

After the lesion had been completely removed, the site was cleaned with saline solution and sealed with root end filling materials namely MTA Angelus and Glass ionomer cement. (Fig 3b & 3c) The mucoperiosteal flap was placed backand sutured. After 7 days, the sutures were removed.

A post space of 13mm and 17mm was made up to peso reamer #3 wrt 11 and 21 leaving 5mm of GP behind within the canal and fiber post #2 (Glass fiber post REFORPOST, Angelus) was selected. A confirmatory radiograph was taken to check the fit of the fiber post. The fiber post was cemented using self-adhesive resin cement (ColteneSolocem).It was light cured for about 30 seconds using a light ring unit (Dental curing light 2500 model,3M ESPE). The core build-up was done using composite (Filtek Z 350, 3M ESPE) w.r.t 11 and 21.

Crown preparation for E max crown (A2 shade) was done w.r.t 11 and 21. Deep Chamfer finish line was given using TR12. Crown cementation was done using Variolink Resin cement.(Fig 2f and fig 4)

Discussion and review of literature

In the event that the separated instrument in the canal is not surgically removed, formation of ledge, over-enlargement, perforation, and extrusion of the instrument beyond the apex may result.[1,6,8-9]

The "blunderbuss" architecture of the canal frequently creates a variety of challenges for achieving sufficient obturation for effective endodontic therapy. The tapering shape of GP will not fit properly when the canal is wide and the walls are parallel. In these circumstances, rolling three or more GP cones together on a glass slab is required to create a thick GP cone with an even diameter.[10]In the present instance, efforts have been made to customize the gutta-percha to the shape of the canal. By using the roll cone technique, it was successfully obturated.

Instrument separation during root canal treatment can happen for a variety of reasons. Instrument wear and tear due to extensive use and applying too much apical pressure, usually with a rotational motion, are the two main reasons of instrument separation. Instrument separation occurs most frequently in three locations in the root canal: fracture at locations of sidewall perforation, fracture at locations with wedge-shaped defects, and fracture at narrow points of the apical foramen perforation.[12]

In general, when an instrument breaks outside the root canal, the fractured needle in the cancellous alveolar bone can usually be preserved and repaired with bone tissues when there is no infection. Broken needles can also be wrapped in fibrous tissue without doing extra damage. This procedure will take 1-3 months; 2) after being wrapped in fibre, it might form a cyst if there is no infection; 3) if there is infection, an abscess will form and continue to grow in the soft tissue and around the root of the tooth; and 4) a broken endodontic instrument might affect nearby nerve tissues, causing evident clinical symptoms and unpleasantness.[12]Thus, in situations of separation of instrument outside the root canal that could result in infections (such as in the maxillary sinus), an aggravation of pre-existing root inflammation, and nerve problems, the fractured instruments should be removed via early operation, and the infection should be managed as soon as possible.

The amnion is a membrane that forms from the foetal tissue and is made up of three crucial layers: an epithelial layer, a basement membrane, and an avascular mesenchyme.[13]It can be be easily removed from thechorion as it lacks muscles, lymphatics, and nerves.[14-15] Regenerative cytokines are abundant in human-derived placental tissues, which have been tested in randomised clinical trials and have the potential to heal chronic wounds.[15-18]

The fields of periodontics, prosthodontics, and oral and maxillofacial surgery have all made substantial use of this versatile membrane in dentistry.[19-21] But there isn't much information available about using this membrane for regenerative endodontic procedures.

In contrary to previous studies [22-28], we used the amniotic membrane for apexification in the traumatic teeth with open apexes because it has the potential to be therapeutic for soft tissue repair and hard tissue regeneration. Numerous important proteins are found in it, including glycosaminoglycans, laminin, proteoglycans, fibronectin, and collagen types IV, V, and VII.[16-17, 29] It comprises a range of cytokines, including transforming growth factor beta, platelet-derived growth factor, fibroblast growth factor, and vascular endothelial growth factor.[16, 30]Another benefit of using this tissue as a scaffold is that it promotes the healing of soft tissues in in addition to serving as a matrix for cellular migration and proliferation.[16, 20]

Moreover, it functions as a natural biological barrier, lowers pain at the application site, has antimicrobial characteristics, reduces inflammation, and is nonimmunogenic.[30-32]

In addition, Chen *et al.*[16]demonstrated that this membrane enhances the osteogenic development of apical papilla cells and amplifies the osteogenic supplementation effect of dexamethasone, glycerophosphate, and ascorbic acid.

Fiberposts are in charge of preventing root fractures due to their flexural qualities.[33] Endodontically treated teeth's internal stress patterns were investigated using finite element analysis, and the results showed that the metals with the highest internal stress were stainless steel, cast gold, and carbon fibre posts.[34] A related study found that fiber-reinforced composite cores experience less dentinal stress than other systems. However, the importance of ferrule integration in reducing stress could not be disregarded. Fiber post was chosen as the post-endodontic restoration as a result.[35]

A popular form of crown is E-MAX ceramic because of its aesthetically beautiful design and high strength (470 MPa). In contrast to metal-ceramic crowns, which contain a metal band along the gum line, translucent crowns closely resemble the light-reflecting characteristics of natural teeth. Additionally, porcelain margins have been found to accumulate less bacterial plaque than metal margins.[35-37] Therefore, EMAX crowns were chosen for the cosmetic restoration of teeth 11 and 21.

Conclusion

Apicectomy and Aesthetic restorations had predictable results. Successful outcome was observed both clinically and radiographically in the present case. Amniotic membrane holds the promising future in regenerative endodontics.

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Declarations:

Ethics declarations:

Ethics approval and consent to participate: Taken from Ethical committee of Manipal College of Dental Sciences, Mangalore, INDIA.

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Authors' contributions: Data were prepared and reviewed by IS, SH, AA and SP. IS and RM reviewed radiological images. The manuscript was drafted by IS, SH, AA, and SP RM and critically edited by RM. All authors read and approved the final manuscript.

Availability of data and materials: The datasets are available from the corresponding author on reasonable request.

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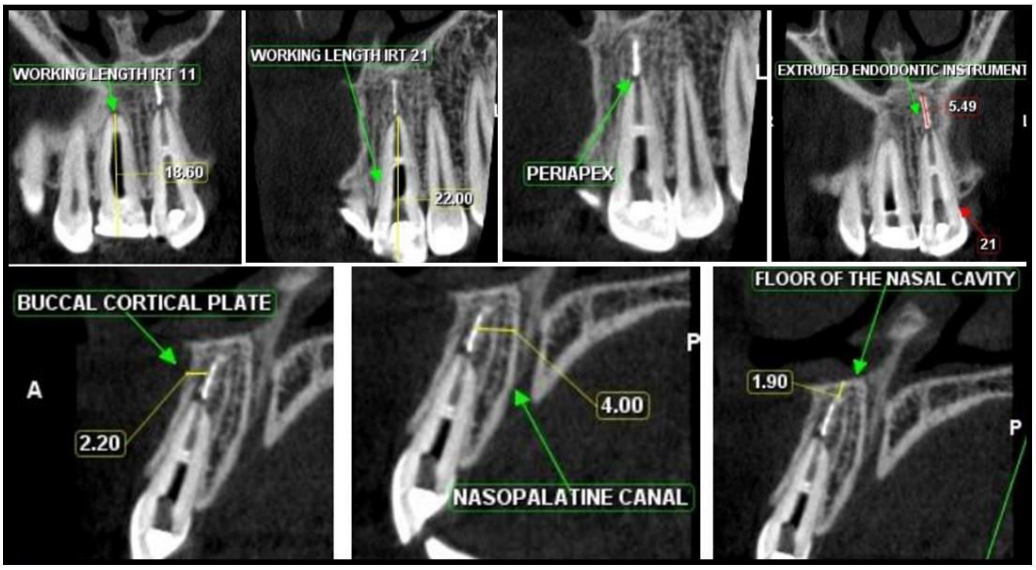

Fig 1: Multiplanar Endodontic Evaluation w.r.t 11, 21 using CBCT

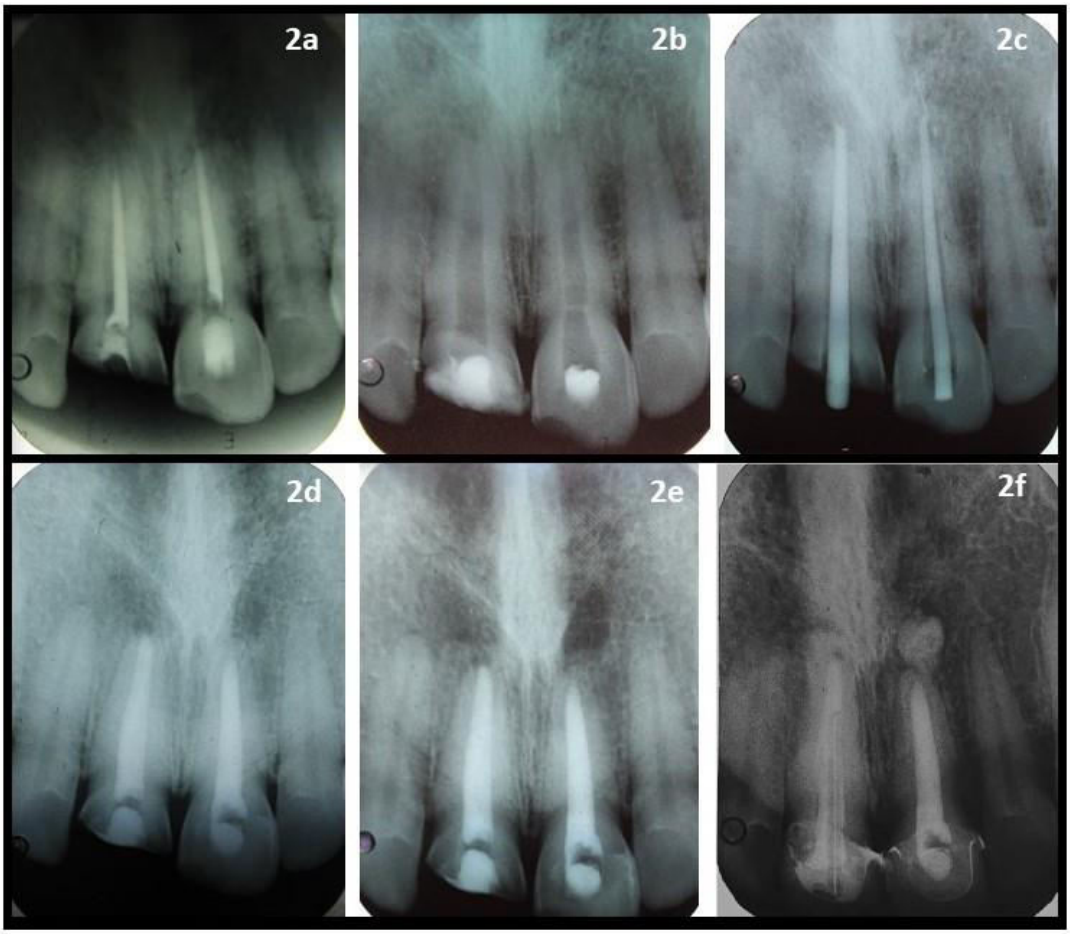

Fig 2: IOPAR w.r.t 11 & 21 reveals a) Poorly obturated canals with open apices and extruded instrument (w.r.t 21); b) Removal of Gutta percha; c) Master cone (F5); d) Obturation done using roll cone technique; e) Separated endodontic instrument removed from the periapical tissue using surgical approach; f) Fibre post placed w.r.t 11 and restored with E max crowns w.r.t. 11, 21 after 3 months of follow up.

Fig 3: Clinical pictures: a) Pre-operative picture; b) Apicectomy done w.r.t 11, 21; c) Root end filling done using MTA Angelus and Glass ionomer cement w.r.t 11, 21.

Fig 4: Post-operative clinical picture.