CASE REPORT

Management of Dens Invaginatus with Fractured Ni-Ti Instrument: A Case Report

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Abstract

Background: Dens invaginatus, is an uncommon condition where there is an infolding of a part of dental tissues, leaving a complex shape of the tooth, which is not a self-cleansable area and can lead to caries. This forms a portal of entry of bacteria to the root canal, causing the tooth to suffer from pulp necrosis.

Methods: This case report is about how a 19-year-old male patient with chronic apical abscess and a fractured S2 nickel-titanium (Ni-Ti) rotary instrument, during treatment in a maxiallary left lateral incisor with dens invaginatus, was treated conservatively. Treatment plan was made in accordance to the AAE guidelines and the instrument was bypassed and root canal treatment was completed instead of any surgical procedure to remove the fractured instrument. CBCT images taken 13 months apart revealed gradual improvement at the root apex, while the patient did not experience any pain. Conservative approach and reliance on advanced images are highlighted in this case as keys to a positive outcome.

Introduction

Dens invaginatus (also named dens in dente) happens rarely when the enamel organ is drawn into the dental papilla as the tooth is developing. As a result of this, an enamel-lined pit forms in the tooth and this opening may reach the root canal system. It is estimated that dens invaginatus occurs in 0.3% to 10% of people and it most often occurs in the maxillary lateral incisors. [1]

The condition means teeth normally affected are more susceptible to early pulp necrosis because bacteria can enter the tooth through damaged enamel. [2] Endodontic therapy on these teeth is often complicated since their canals are usually complex and may not be normal. Nickel-titanium (Ni-Ti) rotary instruments can break if they are used in canals with curves or complex shapes. [3] Clinicians still debate how to treat broken instruments in the root canal space, with the options to retrieve, bypass or surgically remove it from the root canal space. [4]

Conservative management of a dens invaginatus affected maxillary left lateral incisor, including healing after a Ni-Ti instrument fractured in the apical third of the root canal, is described here, noting the steps and imaging used in managing the treatment.[5,6]

Case Presentation

A male patient, who was 19 years old, came to the outpatient department of Operative Dentistry at Khyber College of Dentistry, Peshawar, having noticed frequent swelling and discharge from the gums around his maxillary left lateral incisor (tooth #22). The patient did not have any previous medical conditions that contributed to their illness.

Clinical examination showed that there was localized swelling of the gum around tooth #22 and a sinus tract close to it. It was discovered that the pulp was necrotic by carrying out pulp vitality tests. Abnormalities in the root canals seen on the periapical radiographs fitted with a large radiolucency at the end of the root which is consistent with a chronic apical abscess.

Through cone-beam computed tomography (CBCT), the procedure was done to find out how much of the lesion was there and assess the structure of the canals. The CBCT image showed a dens invaginatus extending into the root and communicating with the periodontal ligament space through the apical foramen, which is exactly what Oehlers described as Type IIIb. According to the sagittal view, the lesion measured around 9.10 mm in width and 9.84 mm in height.

As pulp necrosis with periapical pathology was identified, it was decided to initiate root canal treatment of the tooth under a dental operating microscope to manage the canals inside the tooth. [7,8]

Material and Methods

A local anesthetic was administrated and the tooth was isolated with a rubber dam. Cavity preparation made it possible to access the dens invaginatus canal system. All cleaning and shaping were performed with rotary Ni-Ti files under constant irrigation using 5.25% sodium hypochlorite to ensure effective disinfection and patient discomfort.

During Instrumentation an S2 Ni-Ti rotary file broke inside the canal in the apical third, extruding out of the apex, further complicating the treatment. Even though attempts were considered, it was believed that such procedures might result in further apical extru-

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sion and cause additional complications .[9]

After thoroughly considering the options, it was decided that bypassing the damaged bone was safer than trying to take it out. Small hand files were used initially, starting with the 06,08 K-files and the fragment was bypassed and canal prepared till F1 Ni-Ti file.

The canal was irrigated with 5.25% of sodium hypochlorite during instrumentation and medicated with calcium hydroxide as an intracanal dressing. In the following visit, the canal was obturated using guttapercha through lateral condensation and a resin base sealer. The access cavity was restored with composite resin.

Three-dimensional imaging was taken at both 9 and 13 months to observe the progress of healing at the end of the root and the position of the remaining fragment .[10]

Results

X-rays revealed the presence of a periapical lesion of about 9.10 mm x 9.84 mm associated with the tooth affected by dens invaginatus. By the nine-month follow-up after root canal therapy, the periapical lesion showed a significant decrease in size to up to 5.44 × 5.33 mm. Also, despite apically extruded Ni-Ti instrument, the patient had not experienced any symptoms, including pain, swelling or infection. This showed that the extruded body was successfully dealing with the infection and not hindering the now resolving, periapical pathology, after the root canal treatment was completed. By the time of the thirteen-month follow-up, even more improvement had oc-

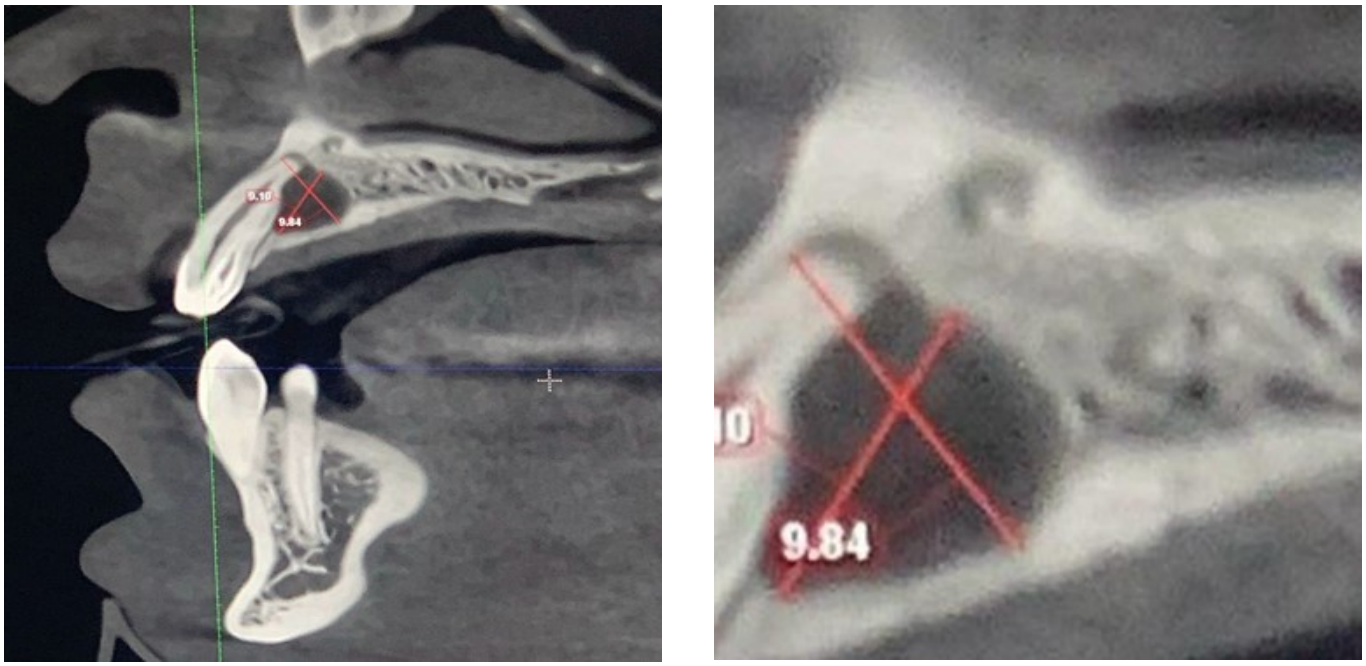

Figure 1: CBCT Sagittal full view and zoomed-in lesion area INITIAL LESION: size: 9.10 x 9.84

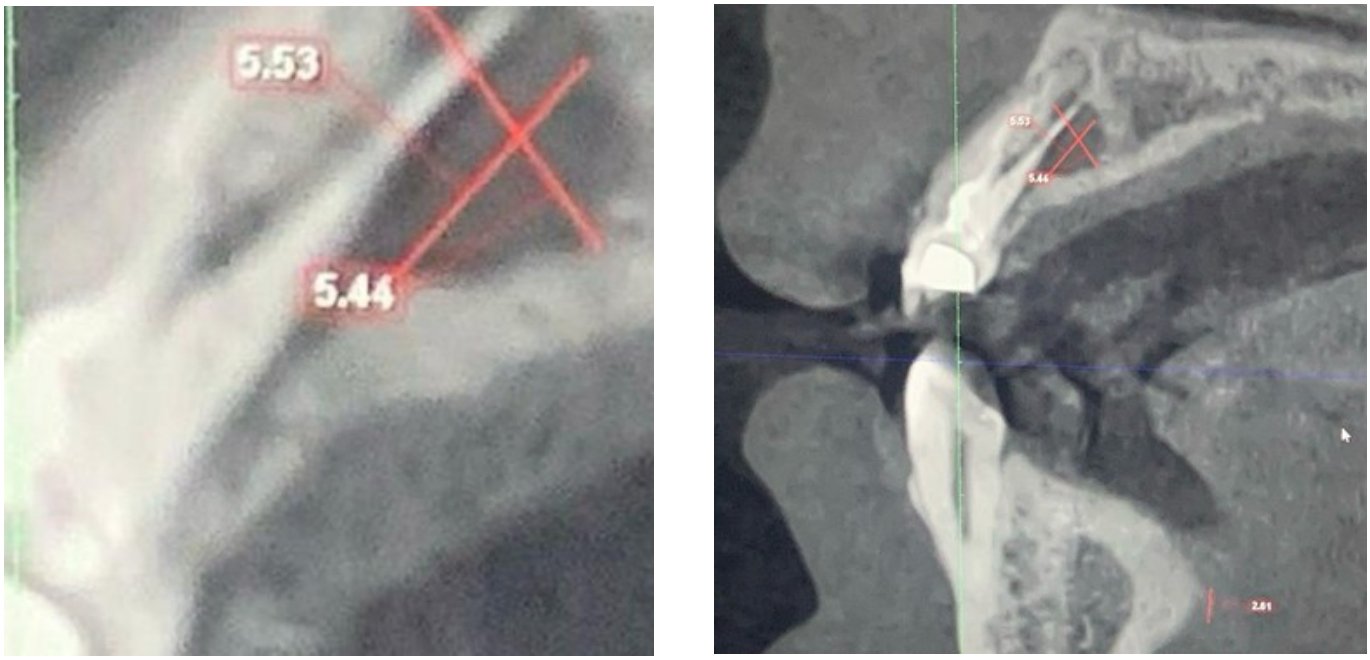

Figure 2. CBCT at 9 months showing reduction to 5.53 × 5.44 mm.

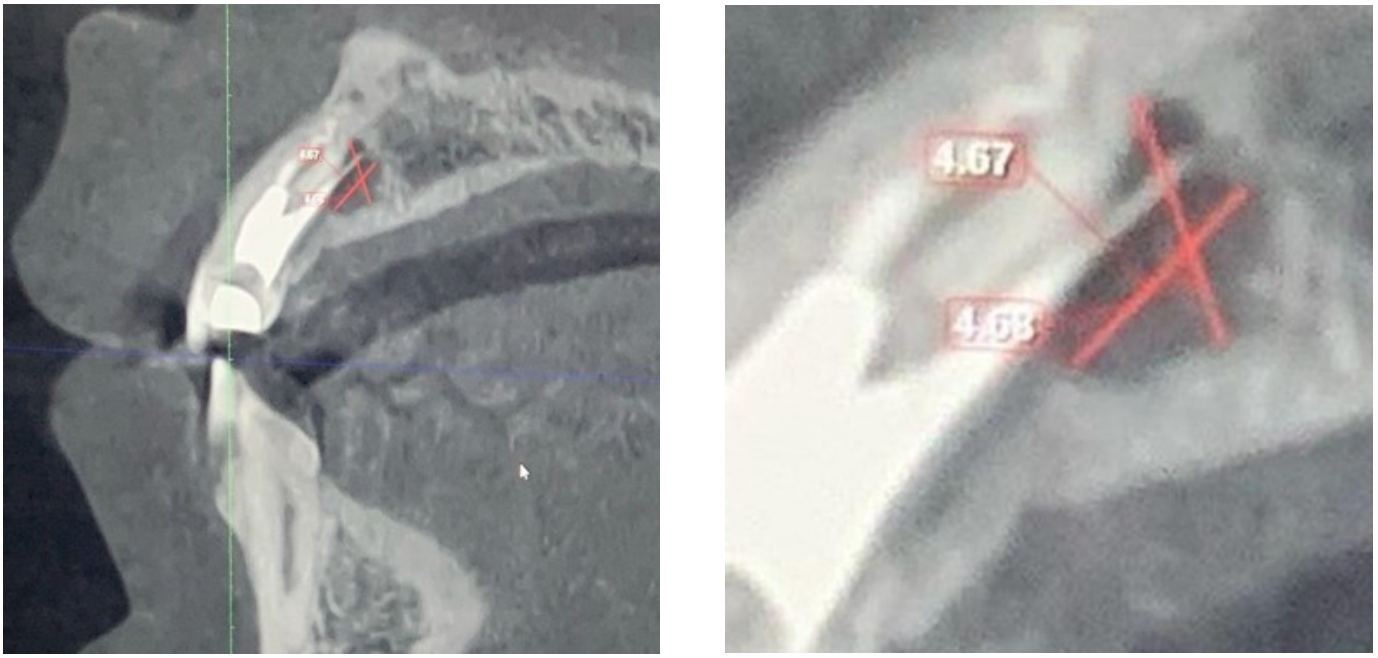

Figure 3. CBCT at 13 months showing further reduction to 4.67 × 4.68 mm.

curred. The lesion got smaller again, measuring 4.67 × 4.68 mm and it was shown by radiographs that bone had started to form around the edges of the lesion. The outcomes reveal that the extruded instrument did not cause any clinical problems; this proves that Ni-Ti instrument, a biocompatible material had not caused any hinderance of resolution of the periapical infection of the PDL space and bypassing it, while leaving it inside the canal was theright treatment choice for this case.

Discussion

Despite facing the difficult issue of an instrument lodged in the root canaland also extruding into the PDL space, successful and positive periapical healing is still achievable using just conservative endodontic methods. After evaluating the possible risks, it was decided that retrieving the fractured file was not an option as bypassing the blocked path was safer. [11] Because the treatment area is so complex, additional attempts to easily retrieve an instrument could lead to damage such as root perforation, excess dentin removal or pushing a fragment further past the root tip, possibly worsening infection. Consequently, the process selected closely matches the aims of minimally invasive endodontics because it aims to keep the natural tooth untouched, maintain its health and still eliminate infections adequately. [4]

The good biocompatibility and ability to resist corrosion of Ni-Ti alloys may also explain why this biological response occurred. The inert nature of nickel-titanium material means that if parts of the instrument stay in the canal or are extruded, the risk of a foreign body reaction or big inflammation is much lower. [6, 9] It may be that this feature allowed the tooth to recover and heal completely, despite the fractured part still present just beyond the apex.

All stages of care, starting with first diagnosis and continuing with each consultation and follow-up, relied on CBCT scans. With its advanced three-dimensional and high-resolution viewing, the dentist could precisely visualize the dens invaginatus and find the missing piece of the instrument. Additionally, CBCT enabled the accurate measurement of a periapical lesion so that the healing process could be monitored. More and more, dentists rely on CBCT to aid in diagnosing and watching advanced cases of root canal treatment. [11]

In short, treating this case effectively depended on planning with magnification and incorporating state-of-the-art imaging as part of the therapy.

Conclusion

Conservative management of a dens invaginatus case that involved breaking a nickel-titanium instrument led to satisfactory results and the resolution of all symptoms in the patient.. Due to Ni-Ti's biocompatibility and resistance to corrosion, its use results in a lower chance of inflammation in the tooth. In addition, using CBCT imaging is essential to ensure accuracy in diagnosis, help with planning treatment and monitor the healing of the tissue around the tooth. Choosing the minimally invasive treatment option in endodontics helped presereve the tooth structure as close as possible to its natural state. It is important to monitor the patient regularly for a sufficient time, check the treatment progress and promptly manage any complications to secure the successful outcome while incorporating the principles of minimally invasive endodontics.

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Author Contributions

1. **Sumbal Khan:** Conception and design of the study, case documentation, and manuscript drafting.
2. **Fawad Ali Shah:** Performed the clinical management, contributed to the interpretation of findings, supervised the case, and critically reviewed and approved the final manuscript.