Abstract

Aim: To report the use of cone beam computed tomography (CBCT) in the treatment of an infected lateral incisor #10 with dens invaginatus (DI), spontaneous closure of an open apex and apical periodontitis.

Summary: The CBCT scan revealed the extent of the invagination (below the level of the CEJ) and revealed no communication between the invagination and the main canal (Figure 15). Spontaneous closure of an open apex in immature teeth has been documented. The hard tissue barrier (HTB) formed in apicification contains cementum-like bone with islands of connective tissue giving the barrier a “Swiss cheese” histological appearance. The CBCT indicates that this may have occurred here (Figure 16). The thinness of the divergent root canal walls in the immature root was demonstrated. The endodontic treatment involved uniting the invagination and the main canal into one confluent canal. Treatment was successful after proper disinfection, obturation with MTA, and restoring with a resin reinforced fiber post to minimize damage to the thin remaining walls.

Key learning points
- The nature of the HTB and of the dens invaginatus cannot always be estimated from conventional radiographs and CBCT is useful in treatment planning.
- The HTB may have served to impede the progress of the periapical infection, but bacteria or their by-products were still able to penetrate it and induce periapical inflammation.
- Conservative disinfection and obturation of the infected immature tooth, even without gaining apical patency due to the presence of an apical HTB, is possible using advanced endodontic materials and methods.

Case Report

A 22 year old male was referred to the graduate endodontic clinic at USD forevaluation. A periapical radiolucency (PARL) had been detected on tooth #10 in radiographs taken as part of a hygiene recall exam. Clinical exam revealed the patient was asymptomatic and #10 exhibited a lingual pit invagination (Figure 2) suggestive of DI.

Radiographic findings: Periapical intraoral radiograph revealed large (10 mm x 8 mm) PARL centered on root tip #10 (Figure 6). The pulp canal was large (2.5 mm mesiodistal width at a point of largest dimension) and there was an invagination of enamel and dentin in the cingulum area extending apically indicative of dens invaginatus. An apical barrier (approximately 2.75 mm x 3.25 mm) of calcified dental tissue can be appreciated. CBCT scan reveals that the apical calcified barrier is somewhat porous, and that almost all the cancellous bone in the area of the PARL has been resorbed, leaving only the labial and palatal cortical plates intact (Figure 12).

Diagnosis: #10 Pulp necrosis with Asymptomatic Apical Periodontitis

Treatment:
First appointment: Anesthesia obtained (lidocaine 2% w/ epinephrine 1:100k). Apical patency was attempted with hand files but could not be achieved through the apical mineralized barrier (Figure 7). The root canal system (RCS) was disinfected primarily via irrigation rather than by mechanical debridement. A layer of Mineral Trioxide Aggregate (MTA) 5mm in depth was placed apically, and the tooth was temporized (Figure 8).

Second appointment: the interim restoration was removed. A final irrigation was performed with 6% NaOCl. The canal was dried, and acid etch (phosphoric acid 17%) was placed in the canal for 20 seconds, followed by a thin layer of bonding agent which was then light cured. The canal was then filled with a fiber post and core build-up material (Figures 4, 9).

Conclusions

Five and six month post-operative radiographs (Figures 10,13) reveal deposition of cancellous bone around the margins of the radiolucent area, suggestive of healing. The CBCT, however, revealed no communication between the invagination and the main canal, thereby supporting the efficacy of this treatment protocol for this clinical scenario.

Dens invaginatus

Tooth #10 presents with an Oehlers Type II dens invaginatus. Dens invaginatus (DI), or dens in dente, is a developmental malformation of teeth that is a result of the dental papilla in-folding during tooth development. In DI Type II the enamel-lined invagination extends below the proximal cements-enamel junction into the root space (Figure 15). The most common maxillary lateral incisors are affected. The contralateral tooth #9 also presents with a DI Type II (Figure 5). The CBCT shows that the invagination in #10 is very close to the pulp cavity (Figure 16). Clinically, the treatment of the root canal preparation the invagination was made confluent with the main canal (i.e. the two canals were not treated separately – Figure 3).

Spontaneous Apical Closure and Apexification

Treatment of the immature tooth with an open apex requires the creation of an apical barrier (HTB) to contain the obturating material within the root canal system (RCS). Various materials have been used to induce a HTB, the most commonly used are Ca(OH)2 and recently mineral trioxide aggregate (MTA). A HTB has also been known to occur spontaneously and is thought to be a response to mild irritation by surviving dental cells with regenerative potential in the apical area (fibroblasts, cementoblasts, odontoblasts and osteoblasts). The HTB has been shown to contain dentin, cementum and bone. It is highly irregular and has been found to contain islands of soft connective tissue giving the barrier a “Swiss cheese” histological appearance. The case reported in the CBCT (Figure 11) supports this finding although the exact content of the detected CBCT voids cannot be known. Using CBCT can help determine DI classification and subsequently, determine if the tooth can be saved via endodontic therapy.

Etiology of Apical Periodontitis

The apical periodontitis around the apex of the tooth indicates that the root canal system is infected. We hypothesize that when the patient was young, trauma occurred when the tooth had already completed crown formation but root length was incomplete and the apex was half closed. It can be estimated that the patient’s age at the time was 8-11. This coincides with the patient’s history. The compromised pulp was more susceptible to infection that could have occurred by the accumulation of plaque in the dens or through exposed dentinal tubules in the fractured crown. The walls of the infected immature root are thin, and appropriate disinfection with minimum instrumentation was done to prevent damage to the fragile walls.

References