

Dens Invaginatus (Type IIIA) with an Associated Caries on Right Maxillary Second Molar

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Received: September 17, 2018; **Published:** September 26, 2018

Abstract

Dens Invaginatus (DI) is a rare dental developmental anomaly in which the enamel in-folds into dentin and presents in various forms. The coronal portion of tooth and permanent maxillary anteriors are commonly affected. A rare type IIIA dens invaginatus of maxillary right second molar with an associated caries in a 32-year female is reported. The tooth was painless, non-vital and had a cariously-broken down crown. Orthopantomogram revealed a fine deep fissure running laterally on a round necrotic pulp cavity on the mesial aspect of a bulbous root of the tooth and exits at the root apex, depicting a type IIIA dens invaginatus. The mesial root aspect of the invaginated tooth appeared in contact with the distal root of the adjacent first molar. There are limited cases of this type of invaginatus reported on the upper second molar with associated dental caries. Given the unfavorable root morphology, extensive caries and threat imposed on the root of the adjacent first molar in this case, restorative treatment including root canal therapy was contraindicated, and hence extraction was considered and performed. The etiology, clinical presentation, radiographic features and treatment modalities of DI have been briefly reviewed.

Keywords: Dens Invaginatus; Dental Caries; Pulp Necrosis

Introduction

Dens Invaginatus (DI) is a rare dental malformation due to invaginations of enamel organ into dental papilla which involves the crown and sometimes extends to the root before calcification occurs [1]. It is usually during the hard tooth tissue development stage that the invaginated enamel forms a small tooth within the pulp chamber. Some investigators first used synonyms such as dens in dente to describe the appearance of tooth within a tooth until Hallet suggested the term dens invaginatus since it appropriately characterized the in-folding of the outer portion of tooth, the enamel into the inner portion (dentin) with the formation of a pocket and a dead space [2].

Radiographically, the in-folding of enamel and dentin may extend into the pulp cavity and sometimes exit at the root apex [3]. However, both the crown and root structures can be affected in various sizes and forms. The first description of this condition was dated back in 1794 by Plaquet in a whale's tooth and the first human case was recognized by a Scottish dentist in 1856 [2].

Most of the studies published in literature found that the commonly affected teeth are permanent maxillary lateral incisors, followed by maxillary central incisors, premolars, canines and least found in molars. Some investigators have also reported cases of bilateral, multiple occurrence and double dens invaginatus [4,5]. It is frequently observed in permanent dentition with a male to female prevalence ratio of 3:1 [6]. DI's population based prevalence is 0.4 - 10% [7,8]. Its morphological involvement has two forms, the coronal and radicular with the former being the commonest [9].

Classification of DI was first published in 1953 by Hallet. However, the classification suggested by Oehlers in 1957 is widely used today whereby he described the occurrence of dental invagination in three forms as shown in the diagram below (Figure 1) [6,10].

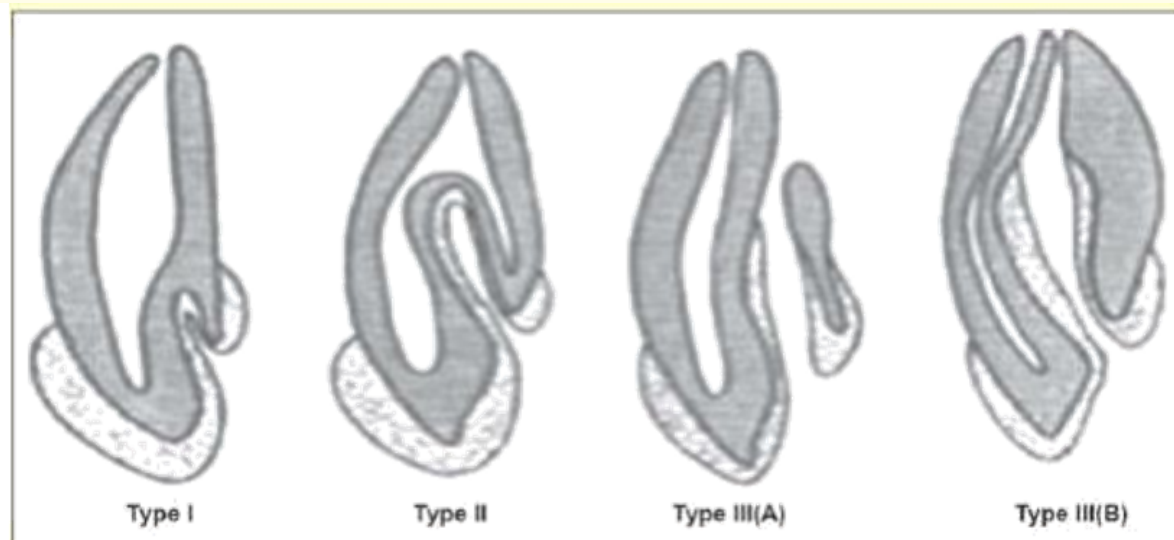


Figure 1: Types of dens invaginatus (Oehler's classification).

Described in this case report is a unique presentation of a type IIIA DI associated with dental caries on the maxillary right second molar.

Case Presentation

A 32-year old female patient came to the hospital after noticing a painless carious tooth on the right maxillary molar region two days ago. The patient's medical history and extra oral examinations revealed no significant abnormality worth noting and her general health was normal. Intra oral examinations revealed normal soft and hard tissues; however the following dental conditions were noticed. In the upper right quadrant, #17 had a cariously-broken down crown with only a thin distal portion of the crown remaining with an enlarged pulp chamber exposed and #18 was missing (Figure 2). Upper left quadrant had #24 with a distal proximal caries, #25 and #26 with crown restoration extending over missing #27 and #28 was missing without any restorations. Tooth #36 had retained roots and wisdom tooth was missing in the lower left quadrant, while in the lower right quadrant #45 and #48 were missing, #46 and #47 had crown restorations in the fourth quadrant. Orthopantomogram (OPG) revealed maxillary right second molar with a thin portion of distal crown with a round, enlarged bulbous root, with a thick circular radiolucent pulp cavity centrally located indicative of a necrotic pulp cavity confirming the clinically non-vital pulp and a fine radiolucent deep fissure running laterally and exiting at the apex on the distal aspect of the pulp cavity. The pulp showed no extension to the root apex, but remained enclosed within the pulp cavity. A thin tissue layer appeared radiopaque between the pulp cavity and the invagination which may have paved some degree of communication as indicated with the necrotic status of the pulp. These features well described type IIIA dens invaginatus. The mesial portion of the root of the invaginated tooth was seen bulging in contact with the distal root portion of the adjacent first molar; appeared to potentially weakening the root (Figure 2). Having presented with complex root morphology, a necrotic pulp, less bone support on its (#17) distal aspect and weakening the root of the adjacent molar #16; all these indications required extraction of the invaginated tooth #17 and was performed. The appearance of 'tooth within a tooth' was clearly noticed at the pulp chamber after the invaginated tooth #17 was extracted (Figure 3). Treatments required on other teeth were booked for later date and referral.



Figure 2: Orthopantomogram showing dens invaginatus in relation to tooth #17 (arrow). Note the enlarged bulbous root, with a thick circular radiolucent pulp cavity centrally located indicative of a necrotic pulp cavity and a fine radiolucent deep fissure running laterally and exiting at the apex on the distal aspect of the pulp cavity of the tooth.

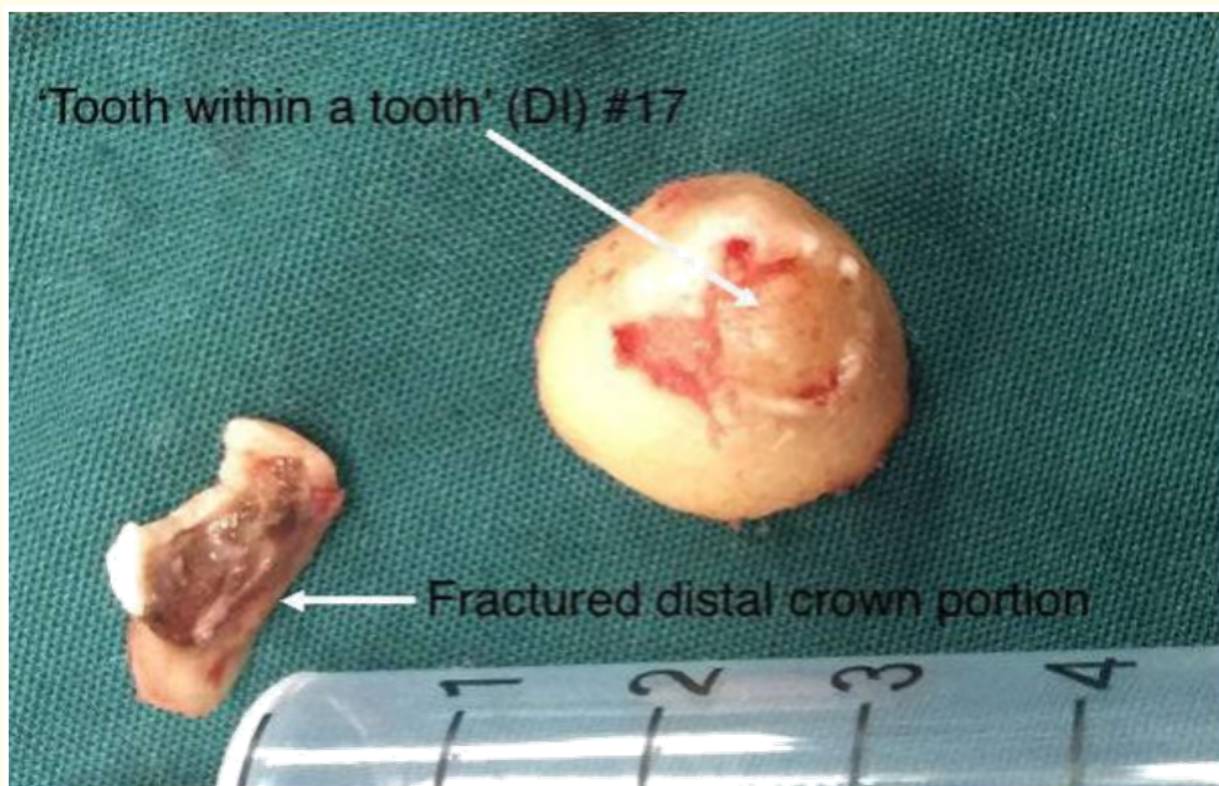


Figure 3: Extracted invaginated tooth #17 exposing the appearance of a 'tooth within a tooth' clearly visible at the pulp chamber area (top right) and the fractured distal crown portion of the tooth (bottom left).

Discussion

Dens invaginatus, a malformed tooth due to its developmental anomaly was first described in the seventeen and eighteen centuries on animal and human respectively. Ploquet in 1794 described DI in a whale's tooth and the first human case of DI was described by Socrates, a French dentist in 1856 [2]. Since then numerous theories have been postulated to establish the etiology behind this rare dental malformation but still remains unclear. Amongst them, the "twin-theorie" was the earliest theory suggesting the incomplete fusion of two tooth-germs [11]. Oehler's claimed that there was distortion and abnormal proliferation of enamel organ invading into the pulp during tooth development [12]. Another author, Kronfeld suggested that the failure of the internal enamel growth while the proliferation of the surrounding normal epithelium could explain the cause of invagination. [13]. However, some authors proposed that deep in-folding of the apical foramen during tooth development could result in formation of the second apical foramen and engulf the static area [14]. Pressure due to dental arch growth, localized cellular hyperplasia, trauma, and infection are among other theories that have been considered. Genetic and syndromatic associations cannot be ruled out, for example, a study by Mann., *et al.* observed an association of DI with Ekman-Westborg-Julin syndrome [3].

Dens invaginatus is classified according to its various forms on the tooth's morphological structure. Its first classification was published in 1953 by 'Hallet' [6,10]. Other classifications were proposed but Oehler's classification is widely accepted for its simplicity and practical usability. Oehler's type I describe the invaginatus confined to crown, type II extending below the cement-enamel junction and ending in a blind sac that may or may not communicate with the adjacent dental pulp and type III A is a complete invagination form which penetrates through the root and communicates laterally with the periodontal ligament space through a pseudo-foramen. There is usually no communication with the pulp, which lies compressed within the root, while type B is a form that penetrates through the root and perforates at the apical area through the pseudoforamen [1,15].

Clinically, DI usually appears as a deep lingual pit which may be filled with soft tissue similar to dental follicle that becomes necrotic after eruption. This groove creates a favorable environment for lodgment of food debris thus increases the risk of caries development [16]. The depth of the invagination varies that from an enlarged lingual pit to a deep invagination extending into the apex of the tooth. The pulp can however remain vital if the invagination extend from crown to the periodontal tissue without involvement of the root canal system. Therefore pulp necrosis often occurs at early stages within years of eruption, sometimes even before root canal closure [17].

Radiographically, type I and II DI generally appear with a narrow undulated fissure beginning from the coronal aspect. Type I has a uniglobular mass limiting itself within the coronal portion while type II invades into the radicular portion, with changes in pulp outline resulting in 'blunting' of pulpal horns. The size and shape of the defect may appear as a loop like pear-shaped or slightly radiolucent structure to a severe type resembling tooth within a tooth. The shape of the invagination is defined by a radio opaque layer of enamel [15,18]. Type IIIA usually appears as a deep fissure extending and exiting laterally on the root surface whereby the root canal adjacent to the invagination may be undulating and abnormal or sometimes necrotic and becomes non-vital due to infection through the intricate communication between the invagination and root canal. Whereas in type IIIB, there is a superimposed appearance indicating the root canal system exiting apically from within the root canal. This invagination is favorable for periapical lesion formation [15].

Treatment of DI depends on the extent of the invagination and varies from prophylactic fissure sealing to root canal treatment or extraction. Composite restoration addition to fissure sealing with periodical review is recommended for preventive and restorative therapy [19]. Root canal treatment (RCT) of DI is indicated in invagination having separate apical or lateral foramen, however due to root canal system with large and irregular volume, RCT may be difficult [7]. Apexification and calcium hydroxide therapy may be required when pulp necrosis occurs before root end closure [7,8]. In the case of morphologically complex DI and invaginated tooth with RCT failure, surgical treatment such as apical surgery should be considered. Invaginated teeth that cannot be treated non-surgically or surgically due to their anatomical irregularities and those posing aesthetic problems should be considered for extraction [20].

Conclusion

This rare dental malformation in dens invaginatus is usually difficult for early detection. Any shape anomaly and hypoplasia suspected especially in anteriors followed by posteriors particularly in maxillary teeth should prompt further radiographic investigations. Endodontic treatment should be the treatment of choice but often the complexity of the root canal system including the presence of pulp stones coupled with the associated sequela such as pulp necrosis and extensive dental caries, usually complicates the endodontic therapy as well as the surgical treatments, thus extraction is suitably indicated. Nevertheless, early detection, preventive treatment and restorative intervention are essentially required to avoid loss of tooth.

Acknowledgement

The authors thank Professor Ma Xun, Director, Department of Oral and Maxillofacial Surgery at the Affiliated Hospital of Xuzhou Medical University for providing the state-of-the-art facility for treating the patient reported in this case.

Conflict of Interest

None declared.

Consent of Patient

Patient consent: Obtained.

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Volume 17 Issue 10 October 2018

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