Dens invagination: A review of literature and report of two cases

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Abstract

Dens invaginatus occurs as a result of the invagination of the enamel organ. These cases may present difficulties with respect to its diagnosis and treatment because of canal morphology. It frequently leads to caries, pulpal, and periodontal involvement with necrosis and loss of attachment. The knowledge of classification and anatomical variations of teeth with dens invaginatus are of great importance for correct treatment. This article presents two case reports of two different types of dens invaginatus along with profound review of the literature regarding etiology, epidemiology, and histology. It discusses clinical appearance and diagnosis, and it provides guidelines for decision-making and treatment of invaginated teeth.

Key words: Case reports, classification, dens invaginatus, Etiology

INTRODUCTION

Dens invaginatus is a developmental anomaly resulting from the invaginations of the enamel organ into the dental papilla during the soft tissue stage of development. As the hard tissues are formed, the invaginated enamel organ produces a small tooth within the future pulp chamber. Dens invagination in a human tooth was first described by a dentist named 'Socrates' in 1856.[1]

Etiology

The etiology of dens invaginatus malformation is controversial and remains unclear. Over the last decades, several theories have been proposed to explain the etiology of dental coronal invaginations

Kronfeld (1934) suggested that the invagination results from a focal failure of growth of the internal enamel epithelium while the surrounding normal epithelium continues to proliferate and engulf the static area.[2]

Rushton (1937) proposed that the invagination is a result of rapid and aggressive proliferation of a part of the internal enamel epithelium invading the dental papilla.[3]

Oehlers (1957) considered that distortion of the enamel organ during tooth development and subsequent protrusion of a part of the enamel organ will lead to the formation of an enamel-lined channel ending at the cingulum or occasionally at the incisal tip. The latter might be associated with irregular crown form.[4,5]

Atkinson (1943) suggested that the problem was the result of external forces exerting an effect on the tooth germ during development.[6]

Genetic factor has been proposed to be the cause.[7,8]

Classification

The first documented attempt to classify dens invaginatus was by Hallet[9] (1953) who suggested the existence of 4 types of invagination based on both clinical and radiographic criteria. Other classifications have also been described involving a variety of criteria and standards.[10,11] For example, Schulze and Brand[12] (1972) suggested an assessment based on 12 possible variations in clinical and radiographic appearance of the invagination. However, the system described by Oehlers[4] (1957a) appears to be the most widely used, possibly because of its simple nomenclature and ease of application. This system categorizes invaginations into 3 classes as determined by how far they extend radiographically from the crown into the root [Figure 1].

Type I: The invagination is minimal and enamel-lined; it is confined within the crown of the tooth and does not extend beyond the level of the external amelo-cemental junction.

Type II: The invagination is enamel-lined and extends into

the pulp chamber, but remains within the root canal with no communication with the periodontal ligament.

Type III A: The invagination extends 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.

Type III B: The invagination extends through the root and communicates with the periodontal ligament at the apical foramen. There is usually no communication with the pulp.

In Type III lesions, any infection within the invagination can lead to an inflammatory response within the periodontal tissues giving rise to a 'peri-invagination periodontitis.'

The limitations associated with the use of conventional radiography in the classification and management of dens invaginatus may be overcome in the future with the increasing availability of computerized 3D imaging.[13,14] Currently, such clinical techniques do not provide images of sufficient quality to fully evaluate the morphology of an invagination *in situ* although for extracted teeth sufficient detail can be obtained.

Prevalence and distribution

The reported prevalence of adult teeth affected with dens invaginatus is between 0.3% and 10% with the problem observed in 0.25% to 26.1% of individuals examined [Table 1].

CASE REPORTS

Case report 1

A 12-year-old boy reported with a chief complaint of pain with respect to upper anterior tooth since 3 days. The patient was in good general health. Extra-oral examination revealed no significant findings. Intra-oral examination revealed a comparatively wider maxillary right central incisor with a deep anatomic pit on palatal surface [Figure 2]. The tooth was tender on percussion and did not respond to thermal and electric stimuli. The periapical radiograph revealed type II DI with open apex and periapical pathology with respect to maxillary right central incisor [Figure 3]. Endodontic treatment was started immediately.

Case report 2

A 10-year-old boy reported with a chief complaint of non-eruption upper right anterior tooth. The patient was in good general health. Extra-oral examination revealed no significant findings. Intra-oral examination showed fibrotic gingival eruption bulge of maxillary left lateral incisor. The periapical radiograph showed type III DI with respect to unerupted maxillary left lateral incisor [Figure 4]. Keeping in view the age of the patient and that the contralateral maxillary right lateral incisor was erupted well, it was decided that an incision should be made on the eruption bulge. The incision was made, and patient was reviewed after 1 month. After eruption, the prophylactic composite sealant was applied on the invagination.

DISCUSSION

In most cases, a dens invaginatus is detected by chance on the radiograph. Clinically, unusual crown morphology ('dilated,' 'peg-shaped,' 'barrel-shaped') or a deep foramen coecum may be important hints, but affected teeth also may show no clinical signs of the malformation. As pulpal involvement of teeth with coronal invaginations may occur a short time after tooth eruption, an early diagnosis is mandatory to instigate preventive treatment.[31]

In the first case report, there was unusual crown morphology of the tooth with pulpal involvement, whereas the second case was detected radiographically in the unerupted tooth.

The invagination allows entry of irritants into an area,

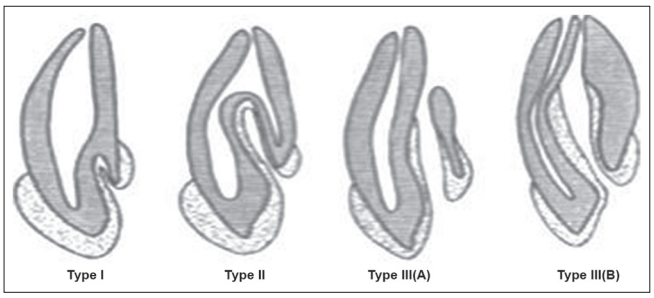

Figure 1: Oehler's classification of dens invaginatus (Coronal types)

Figure 2: Palatal surface of maxillary right central incisor of first case

Table 1: Prevalence studies on dens invaginatus

Authors	Year	Sample	Frequency
Muhlreiter[15]	1873	500 maxillary lateral incisors	2.8%
Atkinson[6]	1943	500 maxillary lateral incisors	10% of teeth
Boyne[16]	1952	1000 maxillary incisors	8%
Shafer[17]	1953	2542 Full-mouth surveys	1.3% of patients
Hallet[9]	1953	586 Full-mouth surveys	6.6% of lateral incisor 0.5% of central incisors
Amos[18]	1955	1000 Full-mouth surveys	5.1% of patients
Amos[18]	1955	203 Full-mouth surveys	6.9% of students of dentistry
Hermel[10]	1964s	500 Full-mouth surveys	2% of patients
Poyton and Morgan[19]	1966	5000 Full-mouth surveys	0.25% of patient
Miyoshi *et al*.[20]	1971	Extracted maxillary lateral incisors	38.5% of teeth
Fujiki *et al*.[21]	1974	2126 Lateral maxillary incisors	4.2% of teeth
Thomas[22]	1974	1886 Full-mouth survey	7.74% of patients
Gotoh *et al*.[23]	1979	766 Maxillary lateral incisors	9.66% of teeth
Ruprecht *et al*.[24]	1986	1581 Full-mouth surveys	1.7% of patients
Ruprecht *et al*.[25]	1987	300 Full-mouth surveys	10% of patients
Thongudomporn and Freer[26]	1998	111 Full-mouth surveys	26.1% of patients
Backman and Wahlin[27]	2001	739 Full-mouth surveys	6.8% of patients
Hamasha and Al-Omari[28]	2004	1660 Full-mouth survey	2.95% of patients and 0.65% of teeth
Ezoddini *et al*.[29]	2007	480 Dental panoramic tomograph	0.8%
Cakici *et al*.[30]	2010	1012 Full-mouth surveys	1.3%

Figure 3: Periapical view of dens invaginatus Type II in maxillary right central incisor

Figure 4: Periapical view of dens invaginatus Type III in maxillary left lateral incisor

which is separated from pulpal tissue by only a thin layer of enamel and dentine and present a predisposition for the development of dental caries. In some cases, the enamel-lining is incomplete. Channels may also exist between the invagination and the pulp.[3,32] Therefore, pulp necrosis often occurs rather early, within a few years of eruption, sometimes even before root end closure.[19,33,34] Other reported sequelae of undiagnosed and untreated coronal invaginations are abscess formation,[35,36] retention of neighboring teeth,[37,38] cysts,[35] and internal resorption.[39]

The treatments options are; prophylactic or preventive sealing of the invagination,[40,41] root canal treatment,[42] endodontic apical surgery,[43,44] intentional replantation,[45] and extraction.[46]

In the first case, endodontic management is required, which includes apexification followed by obturation of the tooth, whereas in the second case, prophylactic sealing of the invagination was done after the eruption of the tooth.

CONCLUSION

The knowledge of classification and anatomic variations of teeth with dens invaginatus is important for early detection and early management for the practitioners.

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How to cite this article: Thakur S, Thakur NS, Bramta M, Gupta M. Dens invagination: A review of literature and report of two cases. J Nat Sc Biol Med 2014;5:218-21.

Source of Support: Nil. **Conflict of Interest:** None declared.

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DOI: 10.4103/0976-9668.127341