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Assessment of the prevalence and characteristics of dens invaginatus in a sample of Turkish Anatolian population

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Abstract

Objective: The objective of this study was to assess the prevalence and characteristics of dens invaginatus in anterior teeth and to classify the type of dens invaginatus in a sample of Turkish Anatolian population.

Study design: A retrospective study was performed using full-mouth periapical and panoramic radiographs of 1012 patients. Maxillary and mandibular anterior teeth were evaluated for the presence and characteristics of dens invaginatus. Statistical evaluation of the presence of dens invaginatus related to gender was performed by the Pearson chi-squared test.

Results: Dens invaginatus was observed in 13 out of 1012 subjects and in only maxillary lateral incisors. There were no periapical lesions in teeth with types I and II, whereas both of the subjects with type III had apical periodontitis at the time of referral. Males and females were almost equally affected by dens invaginatus (P= 0.98).

Conclusion: The anomaly was detected in only maxillary lateral incisors with no gender difference and the most commonly observed type of dens invaginatus was type I (81.25%).

Key words: Dens invaginatus, developmental abnormalities, dens in dente.

Introduction

Dens invaginatus, also known as dens in dente, dilated composite odontoma, or deep foramen caecum, is a developmental anomaly caused by an invagination in the surface of a tooth crown before calcification has occurred (1). Any teeth in the maxillary and mandibular arch may be affected, but maxillary lateral incisors are the most commonly observed teeth that are affected (2). Additionally, it has a frequency of 0.04 to 10% in the general population. The variation is probably due to geographical differences and different diagnostic criteria and/or investigation methods (1).

External forces on the tooth germ during development such as adjacent tooth germs, trauma, and infection, focal growth retardation on the tooth bud, focal growth acceleration on the tooth bud, and restriction of the dental arch on the enamel organ are the causal elements for the etiology of invaginated teeth (3). Dens invaginatus is known to be associated with other dental anomalies such as gemination, microdontia, macrodontia, absence of permanent tooth germs, taurodontism, supernumerary tooth, and dentinogenesis imperfect (4). The occurrence of apical root resorption of teeth with dens invaginatus during orthodontic treatment is also a well known adverse effect due to the local over compression of the periodontal ligament (5). The pulp in the invaginated canals is predisposed to infection resulting in apical breakdown. This apical breakdown may be aggravated by orthodontic forces (6).

Different classifications have been suggested to determine dens invaginatus. The most commonly used classification was described by Oehlers (7), who classified dens invaginatus into three groups according to the depth of the penetration and communication with periapical tissue or periodontal ligament: Type I. The invagination is confined to the crown of the tooth; Type II. The invagination extends apically beyond the cemento-enamel junction but remains confined within the root as a blind sac which may communicate with the pulp; Type III. The invagination also extends beyond the cemento-enamel junction, but there is no usually communication with the pulp. Additionally, a periapical or periodontal foramen is present.

There are limited studies reporting the prevalence of dens invaginatus in the literature. Therefore, the purpose of this study was to assess the prevalence of dens invaginatus in anterior teeth and to classify the type of dens invaginatus in a sample of Turkish population. This will provide the dental practitioner with information about the types of the teeth which are more likely to exhibit technical difficulties associated with the endodontic treatment of such teeth.

Material and Methods

A retrospective study was performed using full-mouth periapical and panoramic radiographs of 1138 patients ranging in age from 12 to 51 subjected to Faculty of Dentistry at the University of Ataturk (Erzurum, Turkey) between 2005 and 2008. 126 subjects with incomplete records, periapical and panoramic radiographs of poor quality were excluded. A total number of 1012 good-quality films were examined (471 females and 541 males).

Maxillary and mandibular anterior teeth were evaluated on periapical and panoramic radiographs in order to determine the presence and classification of dens invaginatus according to the classification of Oehlers (7). All radiographs were examined by investigators independently in a dark room using an X-ray viewer (Illuminator 5000, RP Beard Ltd, London UK). Initially, each radiograph was assessed separately, then a final evaluation was done together, and a combined decision was made to determine whether the tooth had dens invaginatus or not. In addition, 100 radiographs were selected at random and reevaluated by the first author 6 weeks after the first evaluation. Intra- and interexaminer reproducibility was found to be 96 and 90%, respectively. Statistical evaluation of the presence of dens invaginatus related to gender was performed by the Pearson chi-squared test.

Results

Dens invaginatus was observed in 13 out of 1012 subjects, with a frequency of 1.3%. The distribution of the dens invaginatus according to the gender of the subjects is shown in table 1. Males and females were equally affected by dens invaginatus (P= 0.98).

The distribution of the teeth with dens invaginatus is presented in table 2. 5983 maxillary and 5814 mandibular teeth were examined for the presence of dens invaginatus. The anomaly was detected in only maxillary lateral incisors (16 out of the 2011 maxillary lateral

Table 1. The distribution of the subjects with dens invaginatus.

	Female (%)	Male (%)	N (%)	P value
Subjects with dens invaginatus	6 (1.3)	7 (1.3)	13 (1.3)	0.98
No dens invaginatus	465	534	999	
Total	471	541	1012	

Table 2. The distribution of the teeth with dens invaginatus.

			No. of teeth examined	No. of teeth with dens invaginatus	Prevalence (%)
Tooth type	Maxillary	Central incisor	2021	0	0.0
		Lateral incisor	2011	16	0.8
		Canine	1951	0	0.0
		Subtotal	5983	16	0.3
	Mandibular	Central incisor	1859	0	0.0
		Lateral incisor	1987	0	0.0
		Canine	1968	0	0.0
		Subtotal	5814	0	0.0
Total			11797	16	0.1
			No. of teeth with dens invaginatus	Prevalence (%)	
Type of dens invaginatus			Type I	13	81.25
			Type II	1	6.25
			Type III	2	12.5
			Total	16	100



Fig. 1. Preoperative periapical radiograph showing the type III dens invaginatus and periapical lesion in the maxillary right lateral incisor.



Fig. 2. Periapical radiograph showing 24 months radiographic follow-up of the invaginated lateral without any signs of pathosis.



Fig. 3. Periapical radiograph showing the type I dens invaginatus in the maxillary left lateral incisor.

incisors). The most commonly observed type of dens invaginatus was type I (81.25%), followed by type III (12.5%) while 6.25% of the teeth had type II dens invaginatus. It was mostly seen unilaterally (10 out of 13 subjects), three subjects were observed with bilateral type I dens invaginatus. There were no periapical lesions in teeth with types I and II, whereas both of the subjects with type III had apical periodontitis at the time of referral (Fig. 1, 2 and 3). No associated systemic diseases and syndromes were detected.

Discussion

The reported prevalence of the teeth affected by dens invaginatus is between 0.3% (8) and 10% (9), with the problem in 0.25% (10) to 26.1 % (11) of the subjects examined. The wide variation in reported prevalence may be explained by the different cohorts studied, geographical differences and different diagnostic criteria and/or investigation methods (9,11). In the present study, dens invaginatus of the anterior teeth was observed in 13 out of the 1012 subjects examined with a prevalence of 1.3% and in 16 out of the 2011 (0.8%) maxillary lateral incisors examined. The result showing the prevalence of subjects with dens invaginatus is higher than the data reported by Ezoddini et al. (12), Poyton and Morgan (10) who reported the prevalence being 0.8% and 0.25%, respectively. Additionally, Boyne (8) assessed 1000 maxillary lateral incisors and the prevalence of teeth with dens invaginatus was found to be 0.3%. In the present

study, no dens invaginatus were observed in the mandibular anterior teeth, and maxillary central incisors and canines examined. This result is consistent with the results of Hamasha and Alomari (13), who reported no dens invaginatus in the maxillary central incisors and mandibular anterior teeth. Additionally, Kirzioglu and Ceyhan (14) did not find any dens invaginatus in the mandibular anterior teeth.

Oehlers' system is based on a two dimensional radiographic image and as such may underestimate the true extent and complexity of the invagination. However, despite its limitations it makes a distinction between complete (type III) and incomplete (types I and II) invaginations which is important as the management of each is potentially different. As such, this system may be more valuable from a clinical perspective than more complex classifications (15). Using the classification of Oehlers, the prevalence of each type of dens invaginatus was reported with type I being the most common (79%), while type II (15%) and III (5%) (1). Additionally, Alani and Bishop (15) reported 79% of the teeth with dens invaginatus being type I. In the present study, type I was the most common type of dens invaginatus with a prevalence of 81.25%.

The appearance of the symmetric dens invaginatus was considered to be a common finding by some authors. On the other hand, it has been indicated that the bilateral dens invaginatus may be related with other dental anomalies such as microdontia, gemination, fusion, and taurodontism (13,14). In the present study, the symmetric dens invaginatus in the subjects was found to be 23.1%. Furthermore, no other dental anomalies associated with the bilateral dens invaginatus.

There is a wide range of treatment choices for invaginated teeth. Function and esthetics, type of invagination, configuration of the root canal system, prosthetic and orthodontic treatment need, time constrains, economic and psychological considerations are some factors for the choice of the treatment. Extraction should be indicated as a last choice of treatment only in teeth with severe anatomic irregularities and in supernumerary teeth that cannot be treated non-surgically or apical surgery (2). In this study, two subjects with type III dens invaginatus had periapical pathosis at the time of referral and one tooth was treated with nonsurgical root canal treatment (Fig. 2), however, one was extracted due to the failure of the root canal treatment. Finally, the anomaly was detected in only maxillary lateral incisors with no gender difference and the most commonly observed type of dens invaginatus was type I (81.25%).

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