

PREVALENCE OF DENS INVAGINATUS IN NORTH INDIAN POPULATION

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Abstract

Background: The aim of the study was to investigate the prevalence of dens invaginatus in a sample of North Indian dental patients and their distribution among different types of teeth.

Material and methods: The data were collected from radiographic examination of 6048 periapical films showing 18754 teeth from a random sample of 3320 patients. A tooth was considered having dens invaginatus if an infolding of a radio-opaque ribbon-like structure equal in density to enamel was seen extending from the cingulum into the root canal.

Results: Dens invaginatus were detected in 104 teeth (tooth prevalence = 0.55%). Maxillary lateral incisors were the most commonly affected teeth (88.3% of cases and prevalence of 5.6%), followed by maxillary canines (21.7% of cases prevalence of 1.5%). Teeth with dens invaginatus were found in 80 subjects (person prevalence = 2.4%). Bilateral dens invaginatus were seen in 24 patients.

Conclusions: Attention should be paid to the presence of dens invaginatus and the treatment problems associated with it.

Keywords: Dens invaginatus, dens in dente, prevalence, India.

Introduction

Dens invaginatus is a dental anomaly which results from invagination of enamel organ into dental papilla, beginning at the crown and sometimes extending into the root before calcification.¹ This condition is also known as “dens in dente”, “dilated composite odontome”, “gestant odontoma”, “dentinoid in dente” or “telescopic tooth”.² Hallet introduced the term dens invaginatus in order to clarify the point that enamel is located centrally and the dentine peripherally due to the invagination. Since then it has been a preferred term, although dens in dente is a more commonly used term. The involved tooth crown as well as root may exhibit variations in size and form which was first

noticed in whale's tooth by Ploquet in 1794.³ Salter first described this anatomical anomaly as “a tooth within tooth” in 1855, and was the first person who described dens invaginatus in human tooth in 1856.^{3,4} Clinically, a morphologic alteration of the crown or a deep foramen coecum can serve as an indication for the diagnosis of dens invaginatus.⁵ On the other hand, the main reasons for consultation are acute pain and inflammation. Most cases of dens invaginatus are detected after a routine radiographic evaluation with a panoramic x-ray and confirmed with a periapical radiograph.⁶

The etiology is controversial and remains unclear, the possible factors responsible are, lateral fusion of two germs,

constriction of dental arch in the enamel organ, increased external pressure, focal growth retardation and focal growth stimulation in certain areas of tooth buds. Along with these factors genetic factors are believed to be involved in a small percentage of cases.⁷

There are limited studies in the literature reporting the prevalence of dens invaginatus and problems encountered according to the types of this malformation. Therefore, the aim of this retrospective study is to know the prevalence and to classify the type of dens invaginatus in North Indian population, so that the technical difficulties during the endodontic treatment of these teeth can be identified and referred to an endodontist.

Material and methods

The present study comprised of examining 3320 dental patients ranging in age from 15 to 60 years attending the Department of Oral Medicine and Radiology, Jodhpur Dental College General Hospital, Jodhpur during the period from September 2008 to October 2011. A total number of 6048 periapical radiographs showing 18754 teeth were examined for the presence of dens invaginatus. Selection of the subjects was based on the availability of radiographs, however a presenting criteria for having at least two comparable periapical radiographs for both side of jaw was set. Permission from the institutional ethical committee was obtained. Two experienced Oral Radiologists examined all radiographs in a dark room with a 10X magnifying lens and an X-ray viewer (Illuminator 5000, RP Beard Limited, London). A tooth was considered having dens invaginatus if an infolding of a radio-opaque ribbon-like structure equal in density to enamel was seen extending from the cingulum into the root canal.

Distorted, elongated, over or underexposed radiographs and those with superimpositions were excluded. Each radiograph exhibiting this criterion was re-examined carefully by both examiners twice to

consider the tooth having dens invaginatus or not and then a combined decision from both was made. The examiners were calibrated by reading 200 radiographs separately, containing 20 different cases of dens invaginatus prior to the investigation. The diagnosis given by both examiners were compared to their original diagnosis which resulted in 100% agreement. No inconsistencies were noted between the two examiners during the examination. The examined teeth from periapical radiographs were recorded on a proforma as normal teeth or teeth with dens invaginatus. The observations were entered and analyzed using the computer program, SPSS 12 (SPSS Inc. Chicago, USA).

Results

Of the teeth examined, 11266 (60.1%) were for males and 7488 (39.9%) were for females. Ages ranged between 15 and 60 years, with a mean age of 27.3 years (SD = 7.42). Almost equal numbers of maxillary (9426) and mandibular teeth (9328) were examined. The per tooth prevalence of dens invaginatus was meaningful as the number of each tooth type was comparable. 104 teeth out of a total of 18754 teeth showed dens invaginatus to give a tooth prevalence of 0.55%. The prevalence of dens invaginatus among different tooth types is presented in Table 1. All 104 teeth exhibiting dens invaginatus were in the maxillary arch, so the maxillary teeth prevalence was 1.1%. Maxillary lateral incisor teeth were the most commonly affected teeth in the mouth (88.3% of cases), followed by maxillary canines (21.7% of cases). No dens invaginatus was detected in any other tooth types. Table 2 presents the distribution and prevalence of dens invaginatus according to the gender of patients. Males had more teeth with dens invaginatus (64 teeth) than females (40 teeth). The prevalence of dens invaginatus for males and females was 0.57% and 0.53%, respectively. However the difference was not statistically significant using chi square test ($\chi^2 = 0.05$, $p = 0.47$). The distribution of the type of dens invaginatus can be seen in Table 3.

The most commonly seen type of dens invaginatus was type I (85%) followed by type II (15%) while none of the patients had type III dens invaginatus. The distribution of patients with dens invaginatus is presented in Table 4. Teeth with dens invaginatus were found in 80

subjects (52 males, 28 females) out of 3320 subjects examined, thus the person prevalence was 2.41%. Bilateral dens invaginatus were seen in 24 patients (30%), whereas 56 patients (70%) exhibited unilateral dens invaginatus.

Table 1: The prevalence of dens invaginatus among different tooth types

Tooth type	No. of teeth examined	No. of teeth with dens invaginatus	Prevalence %
Maxillary			
Central incisor	1158	0	0.0
Lateral incisor	1642	92	5.6
Canine	1466	22	1.5
First premolar	1018	0	0.0
Second premolar	1260	0	0.0
First molar	1440	0	0.0
Second molar	1424	0	0.0
Third molar	1216	0	0.0
Subtotal	9426	104	1.1
Mandibular			
All mandibular teeth	9328	0	0.0
Total	18754	104	0.55

Table 2: Distribution of subjects with and without dens invaginatus among different gender.

Gender	No. of teeth (% of teeth)		Total
	With dens invaginatus*	Normal teeth	
Male	64 (0.57)	11202 (99.43)	11266
Females	40 (0.53)	7448 (99.47)	7488
Total	104 (0.55)	18650 (99.45)	18754

Table 3: Distribution of the type of dens invaginatus.

Type	No. of patients n = 80 (%)	No. of teeth n = 104 (%)
I	68 (85.00)	88 (84.61)
II	12 (15.00)	16 (15.38)
III	0	0

Table 4: Distribution of subjects with dens invaginatus

Subjects with:	Male	Female	Total
Dens invaginatus	52	28	80
None (All normal teeth)	1942	1298	3240
Total	1994	1326	3320
Percentage	2.61	2.11	2.41
Subjects with			
Bilateral dens invaginatus	12	12	24
Unilateral dens invaginatus	40	16	56
Total	52	28	80
Percentage of bilateral dens invaginatus (out of those with dens invaginatus)	23.1	42.9	30.0

Discussion

Dens invaginatus is commonly seen in maxillary arch and mandibular occurrence is a rare situation.⁸ Dens invaginatus has been classified by Ohlers into the following 3 types according to the depth of the invagination and the degree of communication with the periodontal ligament or the periradicular tissue. Type I: Invagination confined inside the crown, not extending beyond the cemento-enamel junction (CEJ), Type II: Invagination extending beyond the CEJ, it may or may not communicate with the pulp and does not reach the periradicular tissue, Type III: Invagination extending beyond the CEJ penetrating the root and exhibiting second foramina in the apical third within the periradicular tissue.⁹ In most cases a dens invaginatus is detected by chance on the radiograph. Clinically, unusual crown morphology or a deep foramen coecum may be important hints, but affected teeth also may show no clinical signs of the malformation. As maxillary lateral incisors are the teeth most susceptible to coronal invaginations these teeth should be investigated thoroughly clinically and radiographically, at least in all cases with a deep pit at the foramen coecum. If one tooth is affected in a patient the contralateral tooth should also be

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investigated. Dens invaginatus is clinically significant due to the possibility of the pulp being affected. Due to the tortuous lingual anatomy, it is possible for caries to develop inside the dens invaginatus without any clinically detectable lesion. Since the enamel lining is thin and in close proximity to the pulp chamber, a carious lesion could easily perforate the pulp chamber. Further, there are sometimes thin canals within the enamel of the dens invaginatus, forming a direct communication with the pulp. Therefore, pulpitis and necrotic pulps are often associated with this anomaly; the other reported sequelae of undiagnosed and untreated coronal invaginations are retention of neighboring teeth, displacement of teeth, cysts and internal resorption. Dens invaginatus is often a surreptitious finding. Upon radiographic evidence of a dens invaginatus, the apical periodontium should be examined. If the radiographic appearance is unremarkable, pulp sensitivity testing should be performed. If the results suggest vital and unaffected pulpal tissue, then the tooth should be promptly restored to curtail access of the dens invaginatus to the oral environment.⁵

Depending on the classification system and the methods used the prevalence

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of dens invaginatus varies between 0.04-10%.^{3,10} In the present study dens invaginatus was found in 104 teeth out of a total of 18754 teeth to give a tooth prevalence of 0.55% and a person prevalence of 2.41%. In a recent study Colak et al. noted an overall prevalence of 2.95% for individuals and 0.65% for all teeth examined which was almost similar to the observation of the present study.¹¹ Whereas Cakici et al. noted a person prevalence of 1.3% which was comparatively less¹² as opposed to Grahnen et al. who reported a 2.7% person prevalence of dens invaginatus while Ulmansky and Hermel reported it to be 2%.^{13,14}

The results of the present study showed that the maxillary lateral incisors are the most commonly involved tooth with a prevalence of 5.6% whereas Gotoh et al. and Kirzioglu and Ceyhan noted a prevalence of 9.66% and 8.7% respectively in maxillary lateral incisors which was comparatively higher than the findings of the present study.^{15,16} Fujiki et al. reported a prevalence of 4.2% in maxillary lateral incisors which was almost similar as that of the present results.¹⁰ The reason behind the common involvement of maxillary incisor was thought to be its unfavorable position during its formative stages and it being the last of the anterior teeth to calcify.¹⁷ This malformation is frequently seen to occur bilaterally, hence the symmetrical teeth also should be considered during the clinical examination. In the present study bilateral involvement was seen in 30% cases. Colak et al. observed a bilateral occurrence of dens invaginatus in 25% of cases, while Kirzioglu and Ceyhan noted 82% of the cases with bilateral involvement.^{11,16} These contradictory variations might be explained by the marked differences in the size of sample, case selection and the methodology used. Thus, further investigations are necessary to clarify the issue.

In the present study 84.61% of patients were seen with type I, 15.38% of patients were with type II and no cases were

found with type III dens invaginatus. Colak et al. noted type I in 73% followed by type II 20% and type III dens invaginatus in 7% of the patients.¹¹ In contrast to this Kirzioglu and Ceyhan estimated the prevalence of type I, type II and type III dens invaginatus to be 94%, 3% and 3%, respectively.¹⁶ In the present study, males presented a higher prevalence of dens invaginatus as compared to females. This finding is consistent with the observations by Colak et al. whereas studies from Turkish population noted an equal frequency among males and females.^{11,16}

Literature review on microscopic, ultrastructural and micro-radiographic investigations of teeth with dens invaginatus malformations reveal a wide range of findings and thus reproduce the macroscopic variety of this anomaly. The dentine below the invagination may be intact without irregularities but also may contain strains of vital connective tissue or even fine canals with communication to the dental pulp. The structure and thickness of the enamel lining the invagination also may vary widely. The internal enamel exhibited atypical and more complex rod shapes and its surface presented the typical honeycomb pattern but no perikymata, which however, were observed on the outer surface of the tooth.³ Dens in dente are known to be associated with other anomalies such as taurodontism, microdontia, talon cusp, gemination, supernumerary tooth and dentinogenesis imperfecta.¹⁸

The treatment of dens invaginatus ranges from preventive and restorative treatment procedures to non-surgical root canal or surgical treatment. A review of the literature shows that extraction of teeth with invaginations was the preferred therapy until the 1970's. Grossman and Creaven were the first to describe root canal treatment of the invagination and Hovland and Block first presented cases treated with conventional root canal therapy.¹⁹ Root canal treatment may present several problems because of the irregular shape of the root canal system.²⁰ If there are no radiographic signs of pulp

pathosis and no communication between the invagination and the root canal, root canal treatment or, in minor cases, even a composite or amalgam filling of the invagination will be adequate. When the invagination has a separate apical or lateral foramen, root canal treatment of the invagination is indicated. In some cases it may be possible to bur through the invagination to get access to the apical foramen. When pulp necrosis occurs before root-end closure, apexification procedures with calcium hydroxide may be necessary. The large and irregular volume of the root canal system makes proper shaping and cleaning difficult. Irrigation, supported by ultrasonic cleaning of the root canal system has been described as an efficient means of disinfection and has therefore been recommended for cleaning of the complex morphology of the root canal system in teeth with dens invaginatus. For obturation of such teeth warm gutta-percha techniques including vertical condensation or thermoplastic filling techniques have been recommended.³ In recent practice collagen membrane and mineral trioxide aggregate (MTA) is routinely used in treatment of dens invaginatus associated with a chronic periapical lesion.²¹ Surgical treatment has to be considered in cases of endodontic failure and in teeth, which cannot be treated non-surgically.

Conclusion

An early diagnosis of dens in dente is crucial and requires thorough clinical examination of all teeth especially lateral incisors. Endodontic treatment of teeth with dens invaginatus requires careful evaluation of the root canal morphology. These invaginations act as niche for bacterial growth and may jeopardize the status of the main canal. An early detection and a suitable treatment plan with follow-up programme, can effectively prevent these complications. Because dens invaginatus is diagnosed as an incidental radiographic finding, radiographic examination is a valuable diagnostic aid in conjunction with clinical examination.

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