



Diagnosis and Regenerative Endodontic Treatment of Mandibular Premolar with Type II Dens Invaginatus: A Rare Case Report

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Abstract

The purpose of this report is to present a case with dens invaginatus (DI) and to demonstrate the outcome of regenerative endodontic treatment (RET) with platelet rich fibrin (PRF) of the associated periapical lesion. DI is an enamel lined developmental malformation that occurs through an invagination of the dental papilla during the soft tissue stage of tooth development. Although often seen in maxillary lateral incisors, it very rarely occurs in mandibular premolar teeth; only 10 cases have been defined between 1993 and 2016. Its accurate diagnosis using 3D imaging methods is essential to examine the complex root canal structure and to prevent any associated caries, pulp necrosis, periapical lesions and periodontal problems. In the present case report, a mandibular right second premolar with DI and related periapical lesion was treated by using RET with PRF, which is defined as a biologically-based procedure to replace the damaged structures of the pulp-dentin complex and to restore the normal physiologic functions. A follow-up examination after 12 months showed that the tooth was free of any clinical symptoms, and its periapical condition was normal radiographically.

Keywords: CBCT; Dens in dente; Dens invaginatus; Mandibular premolar; PRF

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Introduction

Dens Invaginatus (DI) is a developmental malformation of teeth that results from an invagination or infolding of enamel organ into dental papilla before the mineralization phase [1-3]. It is also referred as dilated odontoma, invaginated odontome, dens in dente [1,4-6]. Even though there is a lack of consensus about the etiology of DI [4,7-9], retardation of the growth of a small area of the internal enamel epithelium [10], or focal growth stimulation of a portion of the internal enamel epithelium into the neighboring dental papilla, or localized internal pressure from adjacent developing tooth germs to certain areas of the tooth germ have been suggested as the causal factors of this malformation [4,8,11]. Its prevalence ranges from 0.04% to 10% [12] and is mostly observed in the maxilla [3,4,6,9]. DI rarely occurs in mandibular posterior teeth and only a few cases have been reported in mandibular premolars [13,14]. Since DI acts like a portal for entry of irritants into pulp space through a thin hypo-mineralized enamel and dentin layer, pulp necrosis, abscess and/or cyst formation, tooth displacement or internal resorption may also observed with affected teeth [13,15-18]. Radiographic interpretation of DI forms the basis of its classification, which was introduced by Oehlers in 1957 according to the degree of invagination.

Type I: Invagination ends as a blind sac within the crown.

Type II: Invagination invades the root but remains confined as a blind sac.

Type III: Invagination extends through the root and communicates with periodontal ligament.

Provided that only few cases of DI rarely have been identified in mandibular premolars [13,14], this case report aimed to reveal the clinical and radiological findings of a Type II DI of mandibular second premolar and to present the nonsurgical regenerative endodontic treatment (RET) with the aid of cone beam tomography of the wide periapical radiolucent lesion associated with the tooth.

Case Presentation

A 23-year-old male patient was referred to the Outpatient Clinic of Ege University, School



Figure 1: Preoperative panoramic view.

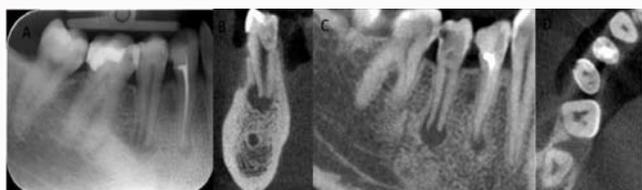


Figure 2: Preoperative intraoral radiograph and cone beam computed tomography images of the mandibular right second premolar tooth. (A) Intraoral radiograph, (B) Sagittal view, (C) Coronal view, (D) Axial view.



Figure 3: Preoperative intraoral radiograph and cone beam computed tomography images of the mandibular left second premolar tooth. (A) Intraoral radiograph, (B) Sagittal view, (C) Coronal view, (D) Axial view.

of Dentistry, Department of Oral and Maxillofacial Radiology for treatment of pain in his mandibular right second premolar tooth. The patients' medical history was noncontributory. After receiving informed consent, thorough extraoral and intraoral examinations were implemented. His extraoral examination revealed no abnormalities, whereas intraoral examination disclosed a vestibular sinus tract in the periapical area around the mandibular right second premolar tooth. The tooth was sensitive to vertical percussion and electrical pulp sensitivity test was negative. No mobility was observed. In order to examine all teeth, a panoramic radiograph was taken (Kodak, 70 kVp, 10 mA) (Figure 1). Conventional periapical and panoramic radiographs revealed dens invaginatus at the coronal region of the mandibular right second premolar. Its root canal was widened and a radiolucent lesion at the periapical region was observed. Additionally, thickened distal wall of the pulp chamber with a radiolucent nidus was observed (Figure 2). Mandibular right first premolar had inadequate endodontic treatment, but the patient did not recall any information regarding the occurrence of any abnormality associated with this tooth (Figure 2). An abnormal coronal structure of the mandibular left second premolar was revealed on panoramic film, thus, a periapical radiograph was obtained from this tooth. Tear shaped radiolucency within the distal part of the crown of mandibular left second premolar was noticed (Figure 3). All other teeth appeared normal, having dental problems not related to developmental anomalies (Figure 1). A cone beam computerized tomography (CBCT) evaluation was scheduled in order to determine the most appropriate treatment plan for the patient. Under standard exposure conditions, CBCT images of the tooth were acquired (KODAK 9000 3D[®] CBCT Machines, Marne-la-Vallée, France). The sagittal image of the mandibular right second

premolar revealed that the lingual part of the pulp chamber was invaded by a dentin-like structure which includes a radiolucent area within. The apex of the tooth was immature and a radiolucent area with the radiological appearance of periapical infection which was penetrating buccally was prominent. The coronal image disclosed that the invaginated tissue reached to the bottom of the pulp chamber, but a thin radiopaque band separated this space from the remaining root canal tissue (Figure 2). Radiographic examination with conventional radiography and CBCT imaging revealed Type II dens invaginatus and chronic apical abscess with intraoral sinus tract associated with mandibular right second premolar. RET using Platelet Rich Fibrin (PRF) was decided for the mandibular right second premolar. Additionally, retreatment was planned for mandibular right first premolar tooth, while preventive composite restoration was done for the mandibular left second premolar tooth with no apical lesion.

Clinical treatment protocol

Tooth #35 did not have a clinically detectable entrance, but a minimal invagination was present radiographically. The prophylactic composite sealant was applied on the invagination. The patient was informed about treatment options for tooth #45, and RET were selected as the treatment of choice. After rubber dam isolation access cavity was opened. Working length was established radiographically by placing a hand #80 K-file into the root canal. Without mechanical instrumentation, the pulp chambers and the root canals were gently irrigated with copious amounts of 10 ml 2.5% sodium hypochlorite (NaOCl). Then, the canal was dried with paper points and triple antibiotic paste consisting ciprofloxacin, metronidazole, and minocycline was applied with lentulo spiral filler 3 mm beyond the working length. The cavity was sealed temporarily with glass ionomer cement (Ketac-Molar, 3M ESPE, Seefeld, Germany) that was placed over a sterile cotton pellet. The patient was scheduled for a second visit after 3 weeks, and during this duration, he remained asymptomatic and sinus tract disappeared. Following local anesthesia administration and rubber dam isolation, the access cavity was reopened and was thoroughly irrigated with 20 mL of 2.5% sodium hypochlorite, 20 mL of 17% EDTA, and 20 mL sterile saline and then, was dried with paper points. The 5 ml sample of whole blood was drawn intravenously from the patient's right antecubital vein and blood was then centrifuged at 2,400 rpm for 12 min to prepare the PRF according to Choukroun's method. Induction of bleeding into the canals was performed by using a sterile hand #35 K-file to provoke the periapical tissues. PRF clot was condensed up to the level of the cemento-enamel junction. Three millimeters thick white Mineral Trioxide Aggregate (ProRoot MTA; Dentsply) was placed over the mixture of blood clot and PRF. A moist cotton pellet was placed over the MTA and temporarily restored with glass ionomer cement. The patient returned two days later and he was asymptomatic. Temporary filling was replaced with a bonded resin restoration (G-aenial, GC Corporation, Tokyo, Japan). At the 8-months follow-up, the patient was asymptomatic and the clinical examination was normal. Tooth was non-sensitive to percussion and palpation, and periodontal probings were within normal limits. Radiographic examination showed partial healing of periapical radiolucency (Figure 4). The patient was scheduled for further follow-up in 12 months. At the time of the annual control, in addition to the lack of clinical symptoms, significant improvement was noticed at the apical third of the root on CBCT images. Narrowing of the canal was apparent when compared to the initial radiographic evaluation; however, apical radiolucent area was not completely eradicated (Figure 5).

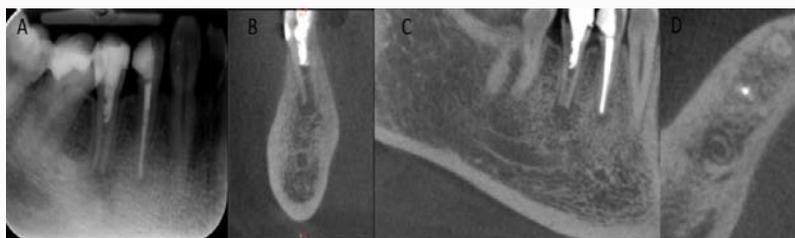


Figure 4: 8 month radiographic examination of the mandibular right second premolar tooth. (A) Intraoral radiograph, (B) Sagittal view, (C) Coronal view, (D) Axial view.



Figure 5: 12 month radiographic examination of the mandibular right second premolar tooth. (A) Sagittal view, (B) Coronal view, (C) Axial view.

Table 1: A compilation of mandibular premolar occurrences of DI and their clinical features.

Author	Age	Gender	Tooth/teeth	Apical lesion	Completed Apexogenesis Vitality		Treatment	Imaging modality	Ohlers Type	Follow up
Altınbulak	20	M	44	No	Yes	Yes	(-)	Periapical, OPG	NA	(-)
			45	Yes	NA	No	Root canal therapy	Periapical,OPG	NA	8 months
Tavano	15	F	44	Yes	Yes	No	Root canal therapy	Periapical	2	3 months
Er K	17	F	44	Yes	Yes	No	Root canal therapy	Periapical, OPG	3	3 months
Canger	33	M	34	No	Yes	Yes	Fissure sealant	Periapical,OPG	1	still under follow up
			44	No	Yes	Yes	Fissure sealant	Periapikal,OPG	1(m)+2(d)	still under follow up
Beena	20	F	45	Yes	NA	NA	Extraction	OPG	2	(-)
Holliday	25	M	34	Yes	NA	No	Root canal therapy	Periapical	1	NA
			44	Yes	NA	No	Root canal therapy	Periapical	1	NA
Neves	16	F	44	Yes	NA	NA	Extraction	Periapical,OPG,CBCT	3	(-)
Vier Pelissr	11	M	45	Yes	No	Yes	Root canal therapy + apical resection with MTA	Periapical,OPG,CBCT	3	6 months
Kharangate	25	M	35	Yes	No	No	Apexification with MTA	Periapical,OPG,CBCT	1	6 months
			45	Yes	No	No	Apexification with MTA	Periapical,OPG,CBCT	1	6 months
Agrawal	13	F	35	Yes	No	No	Regenerative endodontic treatment with PRF and MTA	Periapical,CBCT	3	6 months
Present case	23	M	45	Yes	No	No	Regenerative endodontic treatment with triple antibiotic paste, PRF and MTA	Periapical,OPG,CBCT	2	8 months

Discussion

In 2004, a review of the English language literature showed only 10 cases involving 13 mandibular teeth and of those, three mandibular incisor cases were reported [19]. In the present report, a recent PubMed search was performed by using the key words “dens invaginatus, dens in dente, mandibular, premolar, CBCT” in English literature (1993-2016). Between 1993 and 2016, there were ten DI cases with 16 mandibular premolar teeth (Table 1) of these, female to male ratio was almost similar (5 females, 5 males) and patient’s ages ranged between 11 and 33 years. Apexogenesis was completed in 43.75% of the teeth, and a periapical lesion was observed with the involved teeth (68.75%) in all cases, except two [20,21]. The mandibular right

first permanent premolar tooth (#44) was the most involved one among the mandibular premolars, followed by mandibular right second permanent premolar tooth (#45). Bilateral DI occurrence was observed in four cases (40%), and the most common type was Type I DI, according to Oehlers classification. In the literature, there is only one case which is done RET using PRF in premolar teeth with dens invaginatus as we did in our case. Depending on the degree of malformation and on the presence of clinical symptoms, there are different treatment modalities for DI, including periodic observation, preventive restoration, endodontic treatment of the root canal and the invagination, combined endodontic and surgical treatments, intentional replantation and extraction. For DI in mandibular premolar teeth, the treatment of choice was root canal therapy (8/16),

root canal therapy and apical resection (1/16), extraction (2/16) and fissure sealant application for the teeth with no apical lesion (2/16). With early diagnosis of DI, a prompt preventive treatment can be assessed since teeth with coronal invagination have rapid pulpal involvement shortly after eruption, sometimes even before root end formation. With early diagnosis, fissure sealants and conservative restorative procedures can be performed effectively in asymptomatic Type I and some Type II forms. For Type III DI, nonsurgical root canal treatment should be the first treatment alternative before turning to endodontic surgery, replantation or extraction of the tooth even though root canal treatment of such teeth is often complicated by the unusual forms and location of invaginated and pulpal spaces that complicate thorough debridement. Surgical treatment should be considered as an option only when the non-surgical treatment fails, or is not possible. To the authors' knowledge, the present case is the second one that has received RETS with PRP for the tooth with Type II DI, and achieved complete resolution of the clinical signs or symptoms at 12 month follow-up. Additionally, CBCT images revealed significant improvement in apical closure and narrowing of the root canal walls at the apical third of the root; but the apical radiolucency was still observable.

In the literature, calcium hydroxide (Ca(OH)₂) and MTA have been the most commonly used materials during endodontic treatment of mandibular premolar teeth with DI [21-25]. It's proposed that voluminous irrigation, ultrasonic cleaning and Ca(OH)₂ dressings may aid to increase debridement and disinfection, thereby improve long-term success. Even though it was not used in the present case, Ca(OH)₂ is thought to be the best intracanal dressing because it permits hard tissue formation, inhibits microbes, and detoxifies residual lipopolysaccharide in the root canals.¹⁶ When pulp necrosis which is common in an invaginated tooth occurs before root completion, Ca(OH)₂ may permit root development and close the open apex. Apart from apexogenesis, apexification and conventional root canal therapy; regenerative endodontic procedures offer the potential for treating tooth, with resolution of signs and symptoms. Moreover this treatment protocol leads to root development. Using PRF as a scaffold to induce revascularization showed successful outcomes [26-29]. PRF constitutes key growth factors which promote the proliferation and differentiation of progenitor/stem cells into canal space [30]. Platelet-rich fibrin increases proliferation and differentiation of human dental pulp cells. Detection of DI on the radiograph is usually coincidental, but in most cases of DI, conventional radiographs are unsatisfactory since they present only a 2D view of a complex anatomy [31] and give incomplete information about the internal root morphology, the relationship between the invagination with the pulp chamber or the root canals and the degree of the obturation [15,32]. Eventually, adequate endodontic treatment may be hampered due to these problems. Employment of CBCT for imaging which provides 3D information was mentioned in recent literatures, probably due to the availability of this advanced imaging system in more recent years. With CBCT, periapical pathologies may be detected earlier and the actual size, nature and position of periapical and resorptive lesions may be revealed more accurately. Additionally, important information about dental anatomy, inclination of roots and bone thickness may be obtained before endodontic surgery. Even though it's suggested that CBCT scan used for endodontic purposes exposes the patients approximately to same magnitude of 2-3 standard periapical exposures CBCT application should be saved for very complicated cases such as the suspected cases of DI and "as low as

reasonably achievable" ALARA radiation dose concept should be ruled.

Conclusion

The complex canal anatomy of teeth with DI complicates the endodontic treatment and thus, may lead to less successful treatment outcomes. Since CBCT system is the ultimate imaging method that provides accurate preoperative assessment of endodontic architecture, its employment is essential to determine the canal anatomy and to choose the appropriate treatment in teeth with DI. PRF is a potentially ideal scaffold for regeneration of vital tissue in necrotic teeth. Based on our findings, it was concluded that total canal disinfection followed by RET with PRF was an effective treatment for pulp-dentin complex regeneration for the tooth with Type II DI, because the patient was symptom-free during 12 month follow-up and significant apical closure was observed on CBCT images at the time of the control.

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