

**Nonsurgical management of permanent maxillary canine associated with type III Dens invaginatus with three canals**

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**Abstract**

Dens invaginatus (DI) is a rare anatomic malformation found predominantly in maxillary lateral incisors. This case report showcases the successful endodontic management and 1 year follow up of a Type III DI in a maxillary canine with three canals which has not been reported to date. Follow up visit performed at 6 months and one year revealed satisfactory healing and absence of any signs or symptoms which would indicate a deviation from the normal.

**Keywords:** Cone-beam computed tomographic imaging, dens invaginatus, root canal anatomy, maxillary canine

**Introduction**

Dens invaginatus (DI) is a developmental anomaly due to invagination of enamel organ into dental papilla, before the calcification of dental tissues. <sup>[1]</sup> It is synonymous with

terms such as ‘dens in dente’, ‘dilated composite odontome’, dens telescopes and gestant anomaly.

Many theories and classifications have been put forth to explain this anomaly. <sup>[2]</sup> However the most acceptable classification is given by Oehler’s in 1957. <sup>[3]</sup>

The incidence of DI varies from 0.04% to 10 % with maximum occurrence in permanent maxillary lateral incisors and least involvement in maxillary canine with only .002% <sup>[4]</sup>.

This rare malformation poses a serious challenge during endodontic treatment. The conservative endodontic treatment of teeth with DI is not an easy task due to its complicated anatomy. <sup>[1-4]</sup> The inception of the Cone beam Computed Tomography (CBCT) has been believed to remove many a myth surrounding this anomaly thus

paving the way for a definite and predictable treatment outcome of such cases. [5-8]

Several modalities suggested for the management of DI include precautionary closure of invagination part to avoid further propagation of infection, conventional root canal treatment, apicoectomy, retreatment, intentional re-implantation or extraction. [4,9,10]

Although cases of permanent maxillary canine having type III Oehler's classification have been successfully managed by traditional endodontic therapy there is no report to date of the occurrence of DI in maxillary canine with three canals.

### Case Report

A 17-year-old female patient was referred to the Department of Conservative Dentistry and Endodontics, Manav Rachna Dental College, Faridabad by a private practitioner due to inability to complete the treatment in the left maxillary canine. Medical history was non-contributory. Clinical examination revealed mild inflammation of the labial mucosa opposite the maxillary canine, with no evidence of a patent sinus tract. Periodontal probing depth was less than 3 mm with no accompanying mobility. The tooth was non tender to vertical percussion. Pulp sensibility test vide electric pulp test revealed a non vital tooth.

Further clinical examination showed the overextended access cavity prepared in order to locate the canals. Pre-operative radiographic evaluation revealed abnormal root canal anatomy and a periapical radiolucency extending from apex to the adjacent mesial aspect of maxillary canine [Figure 1a].

The invagination appeared to extend from the crown to the root apex (Pseudocanal) with two separate canals. In order to obtain a clearer picture of the aberrant anatomy it was unanimously decided to subject the patient to a Cone Beam Computed Tomography (CBCT, Giano, Newtom

Italy) scan with exposure parameters of 10 Kv, 8mA, and 9 seconds after obtaining the required signed informed consent from the patient's parents. The CBCT images revealed larger size periapical radiolucency compared to conventional radiograph. The 3D reconstructed images showed bulky canine [Figure 1c]. Axial view of CBCT shows an invaginated part, one main canal and one additional root canal [Figure 1d]. Sagittal view of CBCT showed infolding in enamel [Figure 1e]. Corroborating the clinical and radiographic finding a diagnosis of chronic apical abscess with Oehler's type III DI was made. A non surgical approach was decided after obtaining the informed consent of the patient's parents.

During the first appointment, tooth was isolated under rubber dam and the three canal orifices were located. It was further refined by removing any unsupported and carious tooth structure. The main canal portrayed a C shape along with two small orifices [Figure 1b].

Biomechanical preparation was completed with hand K files. Intermittent and copious irrigation of alternating solutions of 3 % sodium hypochlorite agitated using EndoActivator (Dentsply Maillefer) and a final flush with 17 % EDTA. Root canals were prepared with hand instrumentation till working length using circumferential filling. Calcium hydroxide medicament was placed. A dry sterile cotton pellet was placed in the access cavity followed by temporization with Cavit (3M, ESPE, Seefeld, Germany) and recalled after one week. Subsequent appointment after one week revealed that the tooth was asymptomatic. The temporary restoration was carefully removed using ultrasonics and canals irrigated. The canals were dried and obturated with the corresponding gutta percha coated with AH plus sealer using a combination of warm vertical compaction technique and the inject able gutta-percha technique (Obtura, SybronEndo) [Figure 1f]. A suitable post

endodontic restoration was placed and patient recalled after 3 months, 6 months and 12 months. Radiographic images at 6 month and 12months revealed satisfactory periapical healing [Figure 1g, 1h].

### Discussion

The present case report exhibits the unsuccessful attempt to manage this case by a private practitioner which was ultimately referred to the department for best treatment option. Detailed analysis of clinical and CBCT images<sup>[9]</sup> led to the unanimous decision of carrying out a non surgical approach conforming to the fundamental principles of root canal treatment.

Disinfection protocol was carried out using copious and ultrasonic agitation of 3% NaOCl to ensure that the solutions reached into the intricate root canal system. The final flush was done with 17% EDTA keeping in mind the antibacterial activity and ability to remove biofilms. Hand rather than rotary instrumentation was carried out as the latter may lead to instrument fracture owing to the thin enamel lining.<sup>[11, 12]</sup> Thermoplasticized technique of obturating the root canal space was adhered to as per the accepted norms. As far as uniqueness of the case is concerned it can be ascertained by the PubMed literature search which was done for documented case reports for 1974 till 2020 [Table-1]. This is the only case to the best of our knowledge and literature search where in a maxillary canine with three canals has been successfully managed. Furthermore, there is no case reported after 2016 which clearly shows the paucity in occurrence of DI in permanent maxillary canine. Out of the documented 8 cases featuring maxillary canine ours is the only case where three canals are reported and successfully obturated.

Among the latest treatment options available today regenerative endodontic therapy would not apply to the present case as the patient's mature apex would have

offered a limited reserve of pluripotent cells in the periapical tissues, which is the prime requisite for the success of the procedure. Lastly we realize the importance of longer periods of follow up to strengthen the value the present case. Keeping that in account periodic follow ups are being carried out and it has been conveyed to the patient that CBCT images will be desired at the end of 2 years, 3 years and 5 years. Since this is a very rare occurrence or might we say the first of its kind we decided to publish our findings after a minimum follow up of one year.

### Conclusion

This case report further emphasizes the importance of amalgamating CBCT in management of endodontic cases so that the correct diagnosis is made and best suitable treatment plan can be carried out keeping in the mind the interest and welfare of the patient.

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### Legend Table and Figure

**Table 1:** Case reports showcasing successful endodontic management of Type III DI in maxillary anterior teeth

Sno	Tooth affected	Number of canals found	Diagnosis	Treatment	Reference
1.	Maxillary Canine	1 canal with 1 invagination	Chronic Abscess closed apex	Apical RCT with Apicoectomy	Vincent-Townend (1974)
2.	Maxillary Canine	1 canal with 1 invagination	Chronic Abscess closed apex	Apical RCT with	Teplisky & Singer (1987)
3.	Maxillary Canine	1 canal with 1 invagination	Chronic Abscess closed apex	Apical RCT only of the invagination	Schwartz & Schindler (1996)
4.	Maxillary Lateral Incisor	1 canal with 1 invagination	Periapical abscess with closed apex	RCT only of the invagination	Tsurumachi (2004)

5.	Maxillary Canine	1 canal with 1 invagination	1 Chronic Abscess closed apex	Apical with	RCT	Lichota et al. (2008)
6.	Maxillary Lateral Incisor	1 canal with 1 invagination	1 Periapical with closed apex	Abscess	RCT	Moradi et al. (2008)
7.	Maxillary Central Incisor	1 canal with 1 invagination	1 Acute Abscess apex	Alveolar with open	RCT Apicoectomy	with Fregnani (2008)
8.	Maxillary Lateral Incisor	1 canal with 1 invagination	1 Periapical with closed apex	Abscess	RCT	Kusgoz et al. (2009)
9.	Maxillary Canine	1 canal with 1 invagination	1 Chronic Abscess apex	Apical with open	RCT with MTA	Shadmehr & Farhad. (2011)
10	Maxillary Central Incisor	1 canal with 1 invagination	1 Periapical with closed apex	Abscess	RCT with MTA only of the invagination	Kfir et al. (2013)
11	Maxillary Canine	1 canal with one invagination	1 Chronic Abscess closed apex	Apical with	RCT	Brooks & Ribera. (2014)
12	Maxillary Canine	1 canal with one invagination	1 Acute Abscess apex	Apical with open	RCT with MTA only of the invagination	Teixido et al. (2014)
13	Maxillary Lateral	1 canal with one invagination	1 Periapical with closed apex	Abscess	RCT only of the invagination	Heydari et al. (2015)
14	Maxillary Canine	1 canal with one invagination	1 Chronic Abscess closed apex	Apical with	RCT	Mittal et al. (2016)
15.	Maxillary Lateral Incisor	1 canal with one invagination	1 Apical Periodontitis closed apex		RCT	Solomonov et al. (2016)
16.	Maxillary Central Incisor	1 canal with one invagination	1 Periapical with closed apex Periapical abscess	abscess	RCT	Bahmani et al. (2016)
17		1 canal with one	with closed apex		RCT and Surgery	Ranganathan

	Maxillary	invagination				(2016)
	Lateral					
	Incisor					
18.	Maxillary	1 canal with one	Apical	RCT only of the	Soares et al.	
	Lateral	invagination	Periodontitis with	invagination	(2017)	
	Incisor		open apex			
19.	Maxillary	1 canal with one	Periapical Abscess	RCT and Surgery	Sharma et al.	
	Lateral	invagination	with closed apex		(2018)	
	Incisor					
20.	Maxillary	1 canal with one	Periapical Abscess	RCT	De Oliveria	
	Lateral	invagination	with closed apex		(2018)	
	Incisor					
21.	Maxillary	3 canals with	Periapical Abscess	RCT	Izaz et al.	(2018)
	Lateral	one invagination	with closed apex			
	Incisor					
22.	Maxillary	1 canal with 1	Periapical cyst with	RCT and Surgery	Demdinskaite	
	Lateral	invagination	open apex		(2018)	
	Incisor					
23.	Maxillary	1 canal with 1	Periapical Abscess	RCT with MTA	Hui-Na Lee et al.	
	Lateral	invagination	with open apex		(2019)	
	Incisor					
24.	Maxillary	2 canals with	Chronic Apical	RCT	Present case	
	Canine	one invagination	Abscess with		report	
			closed apex			



Figure 1 (a) - Pre-operative radiograph of the tooth showing an invagination of enamel.



Figure 1(b) - location of canal orifice.



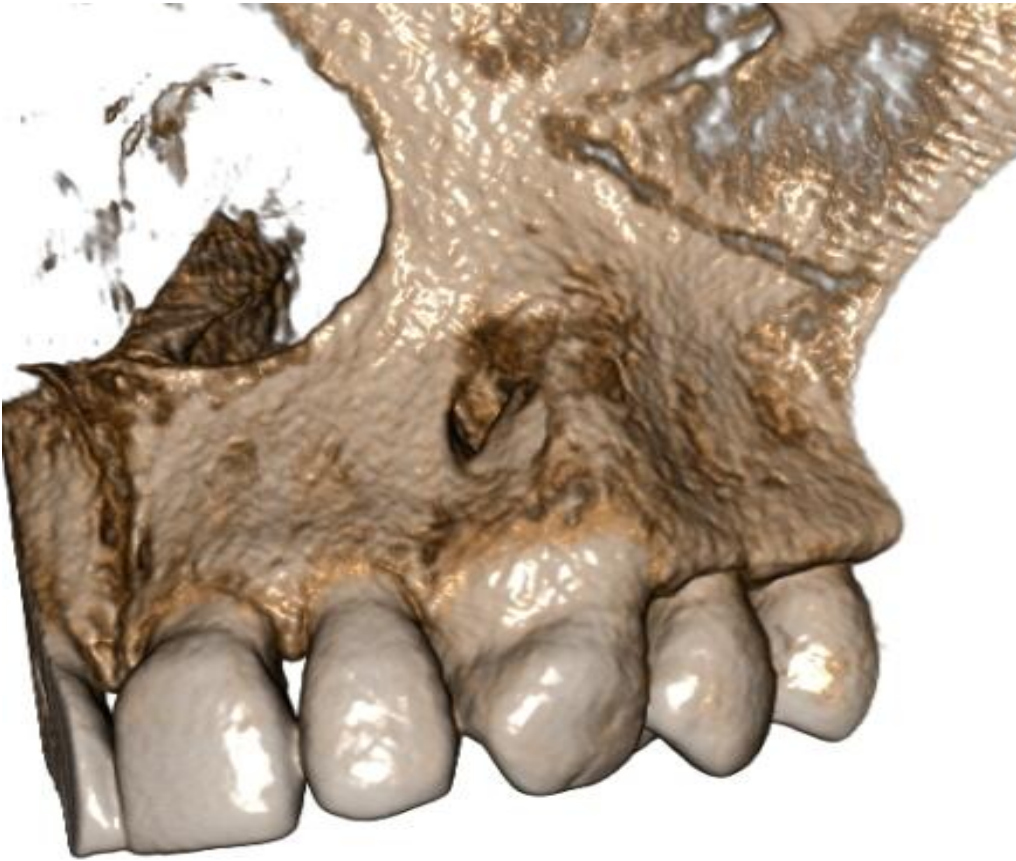


Figure 1(c) - 3 D reconstructed section shows bulky canine.



Figure 1(d) – Axial section showing the invagination part lined by radiopaque tissue.

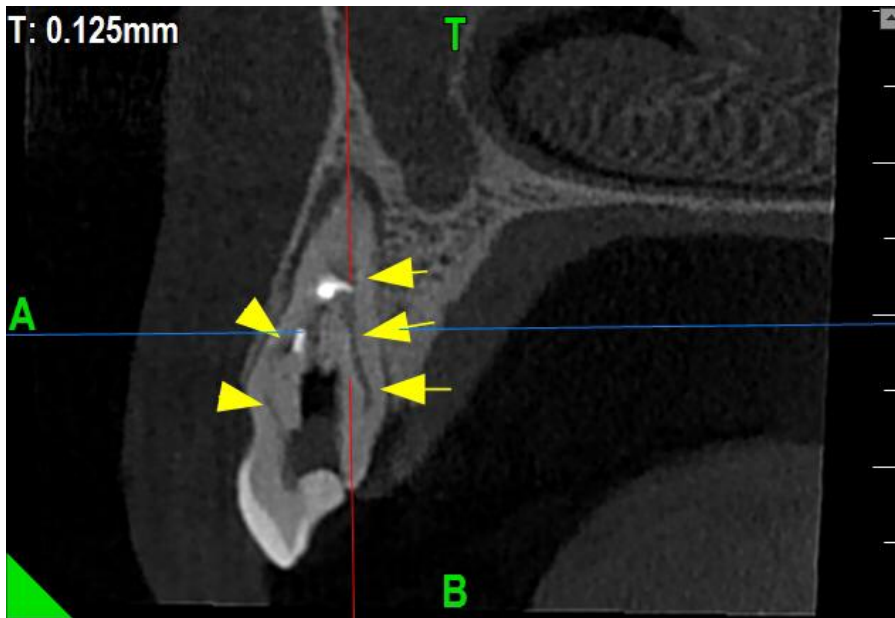


Figure 1(e) – Sagittal section of CBCT showing invagination with associated periapical radiolucency



Figure 1(f) – post obturation

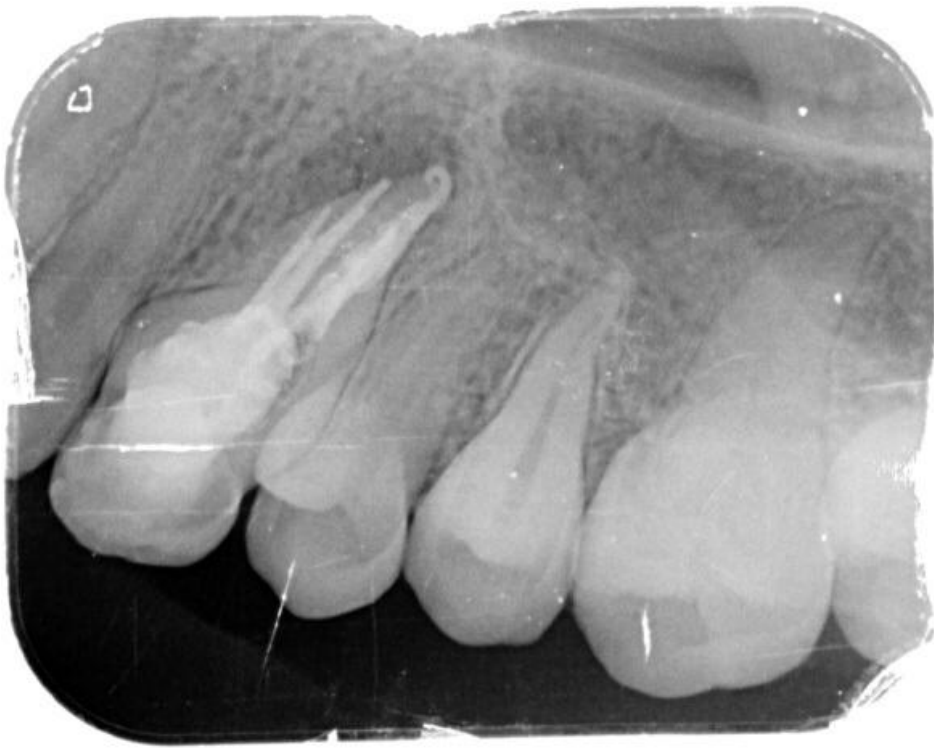


Figure 1(g) – 6 month follow up Figure 1(h) - 12 months follow-up