

**Management of Maxillary Incisors with Complex Root Canal Anatomy – A Case Report and Literature Review**

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**Type of Publication:** Case Report

**Conflicts of Interest:** Nil

**Abstract**

A 15 year old female patient reported with discolored and malformed maxillary left central incisor (#21). The maxillary left lateral incisor (#22) was clinically missing. An intraoral periapical radiograph (IOPA) revealed double roots with maxillary left central incisor (#21) and a radiographically evident maxillary left lateral incisor (#22). Endodontic treatment was planned for both #21 and #22. Root canal access opening of #22 after mucoperiosteal flap elevation revealed presence of three root canals (Vertucci type VIII) while CBCT imaging confirmed the presence of double roots (Vertucci type IV) in #21 alongwith multiple perforations in the buccal root. A palatal access opening was done for the buccal root followed by placement of MTA whereas labial approach was used to access the palatal root followed by obturation with gutta percha of #21. Endodontic treatment was performed for #22 after elevation of mucoperiosteal flap. A post and core placement and composite build up was done for esthetic restoration of #22.

**Keywords:** Maxillary incisors, Double root, Management

**Introduction**

The knowledge of anatomical complexity is essential for the success of endodontic treatment. It helps to identify, clean, shape and obturate the root canals<sup>[1]</sup>. Maxillary central incisor with a single root and root canal is

considered to be one of the easiest tooth to perform a root canal treatment, however, an internal anatomy of tooth can exhibit a number of variations. These variations are extremely rare and mostly accompanied with developmental anomalies like gemination, fusion, presence of supernumerary root and dens invaginatus<sup>[2,3]</sup>. Although, maxillary central incisor has a single root and root canal in almost all the cases,<sup>[4,5]</sup> a few cases of double rooted maxillary central incisor have also been reported in the literature with authors surmising the incidence to be 0.6%<sup>[6]</sup>. It is extremely important for a clinician performing endodontic treatment to consider the existence of anatomical variations which also can be found in the maxillary central incisor. This case report presents one such case, wherein, the maxillary left central and lateral incisors exhibit unusual morphology.

**Case report**

A 15 year old girl reported to the Unit of Pedodontics and Preventive Dentistry, Oral Health Sciences Centre, PGIMER, Chandigarh with the chief complaint of discolored upper front tooth. On examination, the maxillary left central incisor (#21) was malformed and discolored and had a temporary restoration (Figure 1). The maxillary left lateral incisor (#22) was clinically missing but there was no history of extraction or traumatic avulsion. On eliciting history it was found that the girl had

fallen from the roof top of her house at the age of 5½ years and had developed bilateral TMJ ankylosis for which she had already received treatment. History also revealed that the patient had consulted a private practitioner for her discolored upper front tooth who had attempted endodontic treatment in #21. On IOPA radiographic examination, #21 had aberrant anatomy with two roots along with a large periapical lesion and #22 was also present alongside with only a small fragment of enamel on it (Figure 2a). A second IOPA radiograph was taken at an angle to deduce the position of the second root, however, it was not conclusive (Figure 2b). Canal negotiation was tried after isolation under rubber dam and removal of the temporary restorative material. It was observed that there were multiple perforations in buccal root (probably during previously received treatment because of the different angulations of the clinical crown and root) which bled on instrumentation. Thereafter a CBCT image was obtained to elicit the position of the perforations (Figure 3). It was observed that the buccal root had perforations in mesial, palatal and buccal directions and the palatal root was cow horn shaped. Thereafter, the buccal root was obturated with MTA (Angelus, Peterborough, UK) (Figure 4a). A buccal access opening was prepared to gain the access to the palatal root followed by obturation with gutta percha (Figure 4b) whereas #22 was accessed after elevating a mucoperiosteal flap and was seen to possess three root canals. The palatal root canal of #21 and three canals of #22 were obturated with gutta percha using lateral condensation technique. A glass fiber post cemented using flowable composite resin (Filtek Supreme Plus Flow, 3M-ESPE, USA) was used in #22 for reinforcement (Figure 5).

## Discussion

The maxillary central incisors are single-rooted, single-canaled teeth.<sup>[4,5]</sup> Ingle and Beveridge<sup>[6]</sup> reported a single canal in 100% cases of maxillary central incisors. The maxillary central and lateral incisors with more than one root is a rare condition and only few case reports have mentioned about an additional canal in the maxillary central incisor.<sup>[7,8,9,10,11]</sup> These cases were associated with germination, fusion and other developmental disturbances. The case reports documented in the literature highlighting multiple root canals in maxillary central and lateral incisors are summarized in Table 1 and 2 respectively.

The preoperative evaluation in the present case revealed a double rooted maxillary central incisor which is an uncommon finding. To best of our knowledge, presence of a cow horn shaped palatal root in a maxillary central incisor, a finding in the present case, has never been reported in the literature. Different access was prepared to gain the access to the palatal and buccal root to minimize the complications and for ease of instrumentation. Owing to the perforations in the buccal root MTA was used for obturation whereas curved palatal root canal was managed in a conventional manner. The maxillary lateral incisor in the present case showed three canals. CBCT images of the region were used to verify the same. The presence of multiple canals in a maxillary lateral incisor has a rare occurrence. Sabala et al.(1994)<sup>12</sup> in their study reported that these aberrations related to maxillary incisors were rare and bilateral in majority of cases. A retrospective look at the literature (Table 1 and 2) revealed that majority of the cases of two rooted incisors occur on the right side<sup>7-11,14-23</sup> and in females<sup>7-10,16-19,22-29</sup>. The reason for such predilection is unknown.

The careful radiographic interpretation is an prerequisite of clinical endodontics. Radiographs at two different angles are required for the correct diagnosis of two roots.

Brynolf (1970)<sup>13</sup> stated that in only 74% cases correct diagnosis was achieved with one radiograph whereas it was improved to 90% with three radiographs that comprised of an angled view. Therefore, it is recommended that a clinician should take a radiograph with atleast two different angulation. Maxillary lateral incisors with multiple canals or roots may show lingual grooves which was however not evident in the present case. The awareness about developmental anomalies of teeth and careful evaluation of diagnostic radiograph helps to locate the additional canals.

In this case, the successful treatment of a maxillary central incisor and a lateral incisor, which both presented multiple root canals with aberrant crown morphology as confirmed by CBCT, was presented. The clinician must have adequate knowledge of the variations of the maxillary incisor root canal morphology and also of advanced diagnostic and treatment modalities for a successful management of anomalous root canals.

### Conclusion

The findings in the present case revealed that the knowledge of root canal anatomical configurations alongwith careful radiographic examination can help the dentist in diagnosis, management and prevention of complications associated with additional roots and root canals.

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Legends Table and Figure

Table 1: Review of multiple root /root canals in maxillary central incisors:

Author/Year/ Country	Side	Findings	Bilateral or Unilateral	Number of root/ canals	Treatment
Mader CL, Konzelman JL/ 1980/ USA	Right	26 year, male patient, double rooted maxillary right central incisor	Unilateral	2/2	None
Sinai IH., Lustbader S./ 1984/ USA	-	Two rooted maxillary central incisor (tooth number not mentioned)	Unilateral	2/2	Apexogenesis
Michanowicz AE et al/ 1990/ USA	-	20 year, female patient, two rooted maxillary central incisor (tooth number not mentioned)	Unilateral	2/2	Surgical
Lambruschini GM, Camps J/ 1993/ USA	-	35 year, male patient, two rooted maxillary right central incisor.	-	2/2	Conventional RCT
Cabovalle M, Gonzalez MG/ 2001/ Spain	Left	37 year, female patient, two rooted maxillary left central incisor	Unilateral	½	Conventional RCT
Cimilli H, Kartal N./2002/ Turkey	Right	17 year, male patient, two root canals in maxillary right central incisor	Unilateral	2/2	Conventional RCT
Genovese FR, Marsico EM/ 2003/ Italy	Right	60 year, female patient, two roots in maxillary right central incisor	-	2/2	Conventional RCT+ Surgery
Gonzalez-Plata R. et al/ 2003/ Mexico	Right	29 year, female patient, two rooted maxillary right central incisor	-	2/2	Conventional RCT+ Surgery
Lin WC et al/ 2006/ China	Left	17 year, female patient, maxillary right central incisor	-	2/2	Conventional RCT
Sponchiado EC et al/ 2006/ Brazil	Right	27 year, female patient, two rooted maxillary right central incisor	Unilateral	2/2	Conventional RCT

Nezami MS, Mokhber N./2007/ Iran	Right	11 year, male patient, one root with three canals in right maxillary central incisor	Bilateral	1/3	Conventional RCT
Rodrigues EA, Silva S.J./2009/ Brazil	Left	25 year, female patient, maxillary central incisor (tooth not mentioned) with one root and two root canals	-	½	Conventional RCT
Krishnamurti A et al/ 2012/ India	Right	29 year, female patient, right maxillary central incisor with one root but two canals	Bilateral	½	Conventional RCT
Shivakumar TS et al/ 2012/ India	Right	23 year, male patient, right maxillary central incisor with two roots and two canals	Unilateral	2/2	Conventional RCT
Bumtaria SN et al/ 2014/ India	Left	22 year, male patient, left maxillary central incisor with single root and two canals	Unilateral	2/2	Conventional RCT
Llobet LB et al/ 2014/ Spain	Right	7 year, male patient, right maxillary central incisor with fused roots two canals	Unilateral	2/2	Conventional RCT + Surgery
Syed GA et al/ 2014/ India	Left	46 year, male patient, left maxillary central incisor with single root and two canals	Unilateral	½	Conventional RCT
Gupta SK et al/ 2015/ India	Right	32 year, female patient, maxillary right central incisor with two roots and canals	Unilateral	2/2	Conventional RCT

Elbay M et al/ 2016/ Turkey	Left	12 year, female patient, left central and lateral maxillary incisors with two roots and two canals each.	Unilateral	2/2	Conventional RCT
Present case	Left	15 year, female patient	Unilateral	2/2	Conventional RCT+ Surgery

**Table 2: Review of multiple root canals in maxillary lateral incisors**

Author/Year/ Country	Side	Findings	Bilateral or Unilateral	Number of root/ canals	Treatment
Thompson BH et al/ 1985/ USA	Right	37 year, male patient, re-treatment of #11, two canals in maxillary right lateral incisor	Unilateral	½	Conventional RCT
Walvekar SV Behbehani JM/ 1997/ India	Right	19 year, female patient, three root canals and dens formation in maxillary right lateral incisor	Unilateral	1/3	Conventional RCT
Sanchez MP, Laliga RM/1999/ Spain	Left	19 year, female patient, three root canals in maxillary left lateral incisor	Unilateral	2/2	Conventional RCT
Kottoor J et al/2012/ India	Right	16 year, male patient, four root canals in maxillary right lateral incisor	Unilateral	¼	Conventional RCT
Mohan AG et al/ 2012/ India	Left	25 year, female patient, maxillary left lateral incisor with two roots and two canals	Unilateral	2/2	Conventional RCT
Romano et al/2016/ Brazil	Left	16 year, male patient, two root canals in maxillary left lateral incisor	Unilateral	½	Conventional RCT
Hoseini A, Abbaszadegan A./ 2014/Iran	Right	16 year, female patient, maxillary right lateral incisor with two roots and two canals	Unilateral	2/2	Conventional RCT
Present Case	Left	15 year, female	Unilateral	2/3	Conventional RCT



Figures legends



Fig 1: Preoperative clinical view showing brownish discoloration with 21 and clinically missing 22

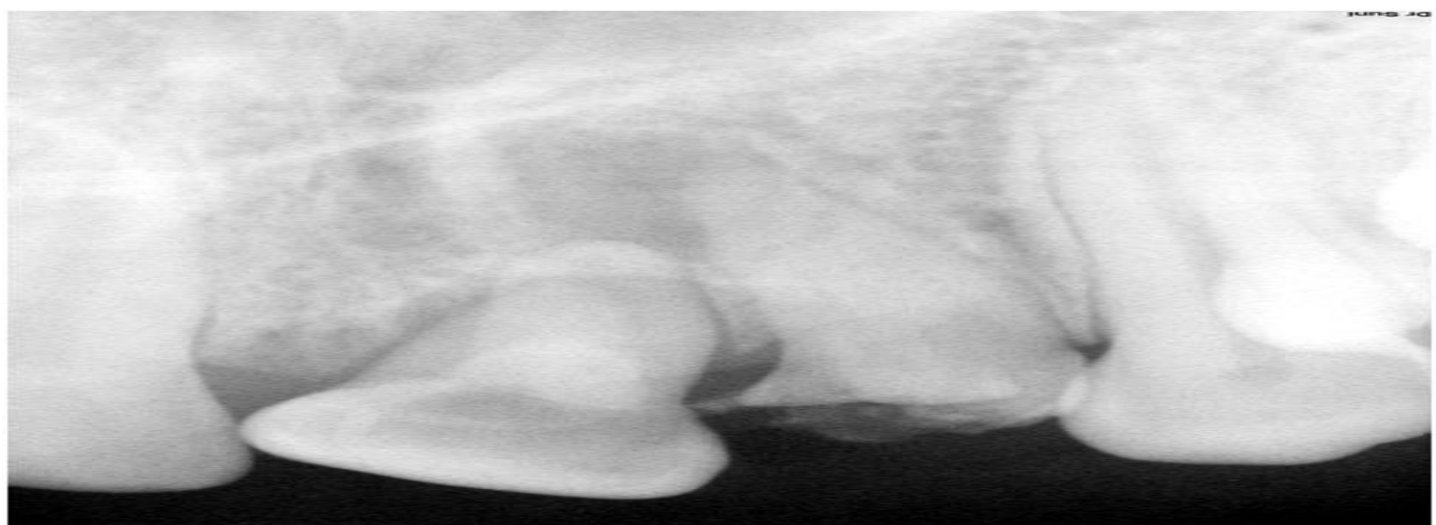


Fig 2: (a) IOPA with frontal angulation exhibiting periapical radiolucency with 21 (b) IOPA with mesial angulation showing double root with 21

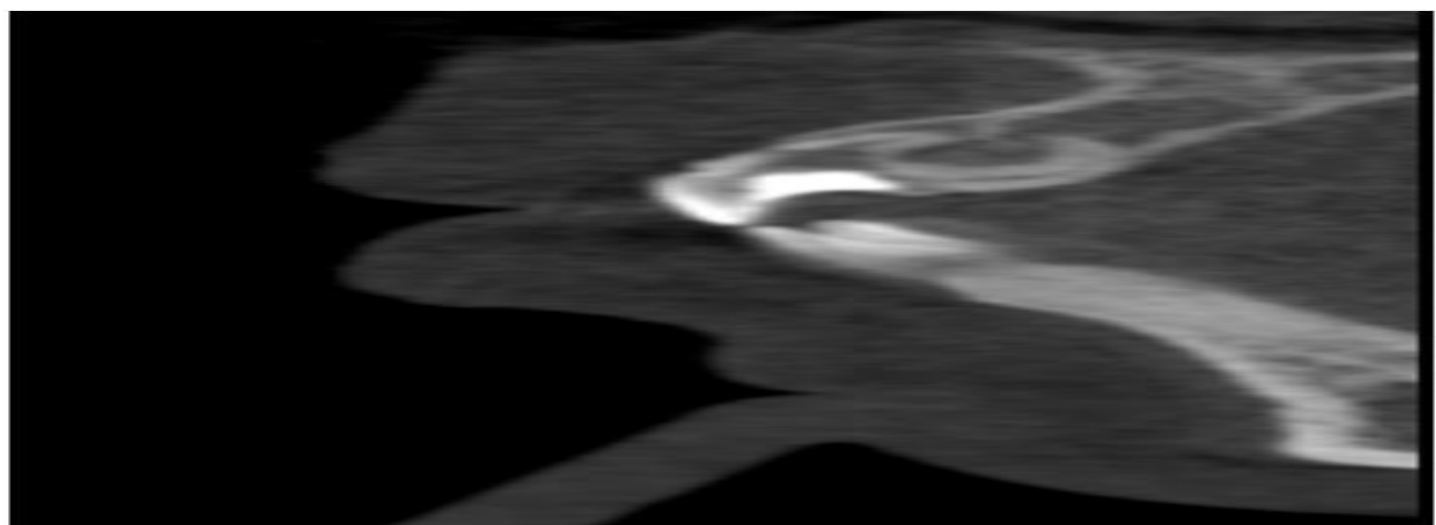


Fig. 3: CBCT confirming double root with 21 with cow horn shaped palatal root



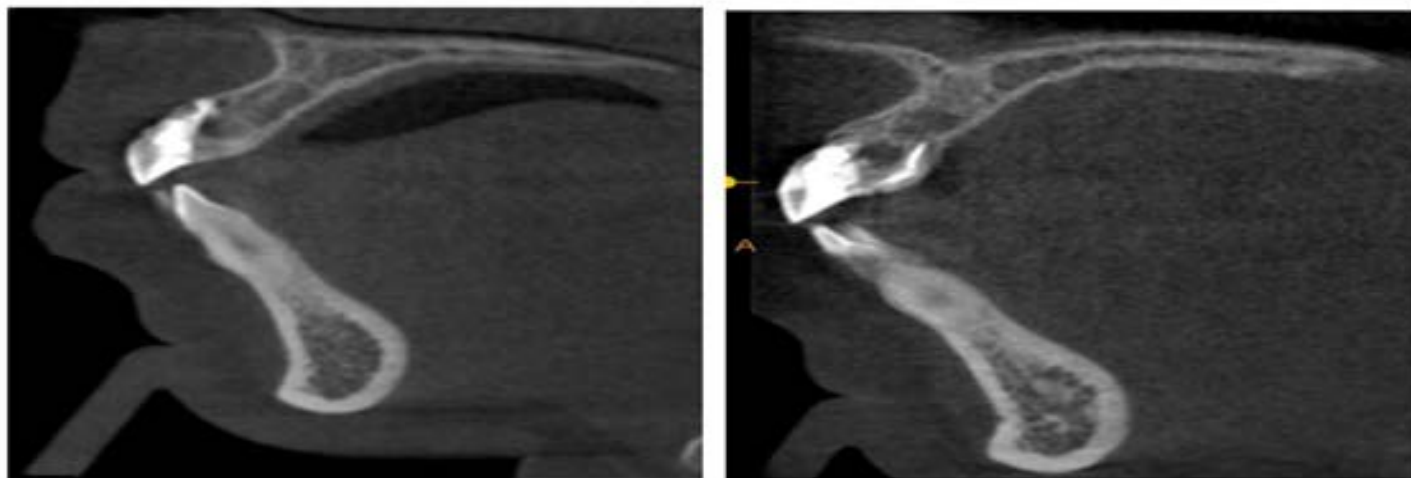


Fig. 4: CBCT image of 21 showing (a) MTA obturation with buccal root (b) Palatal root obturation using gutta percha



Fig.5: IOPA reveal three root canals of 22 obturated with gutta-percha. A glass fiber post was used to reinforce the root cana