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## **Endodontic Management of Maxillary Canine with Two Canals**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Authors KK and AS designed the study and wrote the protocol. Author MC wrote the first draft of the manuscript. Authors AVP and RK did the literature search and also wrote part of the manuscript. All authors read and approved the final manuscript.*

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**Case Study**

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### **ABSTRACT**

**Aim:** To report a case of endodontic treatment of a maxillary right canine in which an extra canal was located and successfully treated.

**Presentation of Case:** A 35 year old male reported with pain in maxillary right canine. Pain was dull and intermittent in nature. Instrumentation revealed the presence of another root canal. Endodontic treatment was performed and the patient reported complete relief of pain and found to be asymptomatic after a 3-month period.

**Discussion:** A thorough knowledge of both the external and internal anatomy of teeth is an important aspect of root canal treatment and is essential for the highest possible chances of success. Failure to locate and treat an extra canal/s is one of the most common causes of failure of root canal treatment. In the teeth particularly with additional root canals or anatomical variations, root canals are often left untreated because the clinicians fail to identify their existence.

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**Conclusion:** This case report shows presence of two canals in single-rooted maxillary canine. Practitioner must have a thorough understanding of the internal anatomic relationships of teeth and be able to visualize this relationship before understanding the endodontic therapy. The clinician must be familiar with the various pathways of root canals to the apex. The pulp system is complex, and canals may branch, divide and rejoin.

**Keywords:** Maxillary canine; endodontic treatment; root canal anatomy; two root canals.

## 1. INTRODUCTION

Most practitioners begin root-canal treatment with preconceived ideas about the anatomy and position of pulp chamber and root canals. Such attempts lead to large number of endodontic failures which are mainly due to missed canals. Failure to find and fill a canal has been demonstrated to be a causative factor in the failure of endodontic therapy [1]. It is important to be familiar with variations in tooth anatomy and characteristic features in various racial groups because such knowledge can aid location and negotiation of canals as well as their subsequent management [2]. Thus it becomes very important that all canals be located and treated during the endodontic therapy so as to debride the root canals of pulp tissue remnants, microorganisms and bacterial products completely to ensure successful endodontic treatment.

Documented literature with regard to the maxillary canine shows that it is largely single-rooted with a single canal, and diversions from this pattern are relatively rare [3]. The objective of the following case is to report endodontic treatment of a maxillary canine with two root canals. The additional root canal was initially a chance discovery with a K-file while negotiating and widening the anticipated root canal and was later, confirmed with radiographs.

## 2. PRESENTATION OF CASE

A 35 year-old male reported to the Department of Conservative dentistry and Endodontics, Sharad Pawar Dental College with chief complaint of pain in the maxillary right canine. The pain was dull, intermittent and relieved only on taking medication. Radiographically, a deep carious lesion was identified on the distopalatal aspect of #13 (Fig. 1) and the tooth was tender on percussion. Subsequently vitality testing was performed using an electric pulp tester which showed delayed response with 13. The tooth was diagnosed as having irreversible pulpitis. The medical history was not contributory.

Local anaesthesia was administered and a medium thickness rubber dam of 6 × 6 inches (Hygienic; Coltent Whaledents) was placed to isolate tooth #13. Access to pulp canal space was achieved using a round diamond abrasive (Mani Inc., Japan). The root canal was located and accessed using K file #10 (Dentsply Maillefer, Switzerland) and working length was established at 23 mm with an apex locator and was confirmed by radiographic verification. During instrumentation of the root canal, the K file #10 (Dentsply Maillefer, Switzerland) appeared to enter another orifice located palatally, which seemed unexplored on tactile perception (Fig. 2). On assessment of the new orifice, an H file #10 (Dentsply Maillefer, Switzerland) extended entirely to 23 mm length. On careful radiographic evaluation, with K file #10 in the buccal canal and H file #10 (Dentsply Maillefer, Switzerland) in the palatal canal, it was found that the palatal canal joined the buccal canal just in the apical third of the root (Type II canal configuration of Vertucci's classification) (Fig. 3). The two canals were shaped to a size 40 master apical file using a step-back technique. One ml of 3% sodium hypochlorite (NaOCl) and normal saline was used for the irrigation between each instrument. After the final irrigation with 2% Chlorhexidine, the canals were dried with paper points. An apical tug back was achieved with an ISO 40 gutta percha cone and an RVG was taken for confirming the master cone length (Fig. 4). The canals were obturated with lateral condensation technique using gutta percha and ZOE sealer (Fig. 5). The tooth was restored with composite resin (Filtek Z-350, 3M ESPE). The patient was recalled after 3-month and was found to be asymptomatic.

## 3. DISCUSSION

Maxillary central and lateral incisors have single canals. The anatomical studies of Vertucci [2], Pineda and Kuttler [3] all state that maxillary incisors have a single root most of the time. However, aberrations of maxillary anterior teeth have been reported in the literature [4–7], involving two roots and two canals in maxillary

central incisors [4], two roots and two root canals in maxillary lateral incisor [5], maxillary lateral incisor with two root canals [6] and lateral incisor with three root canals [7]. This case report describes two canals in a single rooted maxillary canine which is extremely rare. Vertucci classified root canal anatomy into 8 types. Type I

(1-1), Type II (2-1), Type III (1-2-1), Type IV (2-2), Type V (1-2), Type VI (2-1-2), Type VII (1-2-1-2), Type VIII (3-3). The occurrence of Vertucci's Type II documented in literature is 2-3%. Various studies have reported maxillary canine with two root canals in the possibility of the ranges of approximately 2-3% [8,9].



**Fig. 1. Preoperative radiograph showing the missed canal**



**Fig. 2. Clinical picture with two separate orifices**



**Fig. 3. Working length radiograph showing the canals joining at apical third**



**Fig. 4. Master cone with apical tug back**



**Fig. 5. Post obturation radiograph**

Caliskan et al. [8] in 1995 reported presence of type V canal and type III canal configuration in permanent maxillary canines. However, they could not find any type II canal configuration in their study. Alapati et al. [10] and Onay et al. [11] reported a maxillary canine with type II canal configuration. Weisman [12] reported a bi-rooted maxillary left canine. Nandwani et al. [13] and Bolla et al. [14] reported a case with two canals in a single-rooted maxillary canine. The presence of additional canal should be suspected whenever an instrument demonstrates an eccentric direction on deeper penetration into the canal, termed directional control, as reported by Green [15], or if the working length file appears off center in the radiograph.

A thorough knowledge of both the external and internal anatomy of teeth is an important aspect of root canal treatment and is essential for the highest possible chance of success. Failure to locate and treat an extra canal/s is one of the most common causes of failures of root canal treatment. In the teeth particularly with additional root canals or anatomical variations, root canals are often left untreated because the clinicians fail to identify their existence.

Teeth with type II canal configuration may present problems in treatment. Although one of the two canals, the one most continuous with the large main passage, is usually amenable to adequate enlarging and filling procedures, the preparation and filling of the other canal is often extremely difficult.

Although the prevalence of the root canal anomalies is rare, they can be detected by careful examination. Prior to the beginning of radiographs from several different angles and a careful endodontic exploration may lead to suspicion or identification of additional canals and is certainly essential to give the highest possible chance for success [16].

#### 4. CONCLUSION

This case report shows presence of two canals in single-rooted maxillary canine. Practitioner must have a thorough understanding of the internal anatomic relationships of teeth and must be able to visualize these relationships before understanding endodontic therapy. The clinician must be familiar with the various pathways root canals take to the apex. The pulp canal system is complex, and canals may branch, divide and rejoin.

#### CONSENT

All authors declare that 'written informed consent was obtained from the patient for publication of this case report and accompanying images.

#### ETHICAL APPROVAL

Not Applicable

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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