

*Full Length Research Paper*

# Prevalence of MB<sup>2</sup> canal in maxillary first molars: An *in vitro* study on the Sulaimani population

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**Knowledge of canal anatomy is essential. Failure to find a canal influences the prognosis of endodontic treatment. The aim of this study is to investigate the prevalence of Mesiobuccal canal number two (MB<sup>2</sup> canal) in the extracted permanent maxillary first molars of a Sulaimani population. An *ex vivo* study on 180 extracted permanent maxillary first molars was conducted and the floor of the pulp was clearly exposed. The canal orifice was examined clinically by the aid of a chelating agent and magnifying lens. Patency of each canal was established by a no.10 k-type file. The results showed that 23.3% of the examined teeth had two canals in the mesial root (17.0% with one apical foramen and 6.3% with two separate foramens). The occurrence of MB<sup>2</sup> canals of the permanent maxillary first molar of a Sulaimani population were within the normal range.**

**Key words:** Prevalence, MB<sup>2</sup> canal, maxillary first molar, Sulaimani population.

## INTRODUCTION

A thorough knowledge of the anatomy of root canal systems is required to achieve successful root canal treatment. Extra roots or root canals if not detected are a major reason for failure (Slowey, 1974; Karthikeyan and Mahalaxmi, 2010). Smadi and Khraisat (2007) reported that the maxillary first molar has some of the highest failure rates in endodontic treatment. The failure often is due to the presence of a second canal in the mesiobuccal root that the operator fails to explore, prepare and obturate three dimensionally.

Maxillary first molar largest in volume and has a complicated details in root and root canal configuration, and possibly the most treated teeth endodontically. The mesiobuccal (MB) root of the maxillary first molar has generated a lot of interest toward a new research and clinical investigation than has probably any other root in the mouth (Cohen and Burns, 1997). The incidence of having two canals in the mesial root of the maxillary first molar has been well established by several authors. Different approaches were available and applied on extracted teeth such as radiographs (Pineda and Kuttler, 1972; Pineda, 1973), decalcification (Ibarrola et al., 1997;

Vertucci, 1974), sectioning (Weine et al., 1969; Seidberg et al., 1973; Tam and Yu, 2002; Pomeranz and Fishelberg, 1974; Hartwell and Bellizzi, 1982; Neaverth et al., 1987; Saad, 2005; Gary et al., 2007; Emel et al., 2008), ultrasonics, lous and dental operating microscope (Alaçam et al., 2008; Tuncer et al., 2010).

Recently, unusual morphology, number of canals was confirmed through *in vivo* studies with the aid of spiral computed tomography (CT) scanning. The mesiobuccal root of the first maxillary molar can be challenging during endodontic therapy, due to the high incidence of two MB canals (Gary et al., 2007; Alaçam et al., 2008; Emel et al., 2008; Tuncer et al., 2010).

The most common cause of treatment failures in maxillary first molars have been attributed to missed canals especially in the mesiobuccal root and therefore has resulted in more research and clinical investigation than any other root. The orifice for the MB<sup>2</sup> canal usually lies lingual to the mesiobuccal canal toward the palatal canal. The effective way for exploration of MB<sup>2</sup> canal clinically is to move mesially from the mesiobuccal canal toward the lingual (Weine et al., 1969). The purpose of



**Figure 1.** Crown sectioning procedure.

the present study was to determine the incidence of two root canals in the mesial root of the extracted permanent maxillary first molars of a Sulaimani population.

## MATERIALS AND METHODS

A total of 180 badly carious extracted permanent maxillary first molar teeth of Sulaimani patients were collected from clinical procedures performed in different hospitals and private clinics of Sulaimani between May-2010 and October-2010. The extracted teeth had been cleaned with ultrasonic scaler and stored in 50% ethanol for a maximum of 6 months. Teeth were subjected to visual examination and digital radiography, after that and by using a diamond disk with a straight hand piece, the coronal portion of each tooth was removed to the level of the roof of the pulp chamber, and the floor of the pulp chamber was clearly exposed. Patency of each canal was established by passing a no.10 k-type file through the apical foramen and canal orifices (Figure 1). A bubble test with sodium hypochlorite in the pulp chamber and chelating agents (EDTA) was occasionally used for removing the smear layer and softening calcifications inside the pulp chamber, allowing for easier access to canal openings, and the following features were evaluated by the aid of a magnifying lens: (1) number of root canals in mesiobuccal root, (2) number of apical foramen of mesiobuccal root canal(s) (Table 1).

## RESULTS

Of the 180 extracted maxillary first molar teeth collected for this study, 116 teeth (64.4%) had one root canal in mesiobuccal root and the remaining 64 teeth (35.6%) had two root canals. The two root canals in the mesial roots were mostly connecting in the apical third, ending in one foramen (32.2%), and only (3.3%) ending in two apical foramen. The results are summarized in Table 2.

## DISCUSSION

The commonness of two root canals in the mesial root of

the permanent maxillary first molar has been ingrained in the literature, without adequate information regarding the races, so it was designed to conduct this exploration. This study could very well be the first research which assesses the incidence of two root canals in the mesial root of the permanent maxillary first molars of a Sulaimani population.

An examination of the floor of the pulp chamber offers keys to the type of canal configuration present. When there is only one canal, it is regularly located rather easily in the centre of the access preparation. If only one orifice is found and it is not in the centre of the tooth, it is plausible that another canal is present and the operator should search for it on the opposite side (Acosta and Trugeda, 1978).

The morphology of root canal systems in permanent maxillary molars deviate by definition according to the method and criteria used to detect it. *In vitro* studies show more fourth canals than *in vivo* studies (Wolcott et al., 2005; Kulild and Peters, 1990).

It is almost always accepted that the maxillary first molar has three canals with an MB<sup>2</sup> canal seen in 56.8-80.9% of the cases (Cleghorn et al., 2006; Imura et al., 1998). Similar finding was recorded in the present study.

The closer the orifices are to each other, the greater are the chances that the two canals would join at some point within the body of the root. In this study, most of the located two canals were joined in the apical (1 to 4 mm) of the root canal and exited through one foramen. This is similar to the findings of Neaverth et al. (1987), Saad (2005), and Kulild and Peters (1990).

In this study, magnifying lens were used during the exploration of canal orifices, since magnification has been found to increase the detection rate of MB<sup>2</sup> canals from 17.2% with the naked eye, to 62.5% with loupes and 71.1% using the surgical operating microscope (Buchrley et al., 2002). The use of radiograph to study the canal morphology might appear to have certain limitations, since it is a two dimensional image of a three dimensional object. In the present study, only a small number of second MB canals were detected during the

**Table 1.** Root canal and apical foramina of mesiobuccal root of maxillary first molar as reported in the literature.

Investigator(s)	Teeth sample	Method	One canal and one foramen (%)	Two canals and one foramen (%)	Two canals and two foramen (%)
Weine et al. (1969)	208	<i>In vitro</i> sections	48.5	37.5	14.0
Pineda and Kuttler (1972)	262	<i>In vitro</i> radiographs	39.0	12.5	48.5
Pineda (1973)	245	<i>In vitro</i> radiographs	41.0	17.0	42.0
Seidberg et al. (1973)	100 201	<i>In vitro</i> sections <i>In vivo</i>	38.0 66.7	37.0 33.3	25.0
Pomeranze and Fishelberg (1974)	71	<i>In vivo</i>	72.0	17.0	11.0
Hartwell and Bellizzi (1982)	538	<i>In vivo</i>	80.7	18.6	
Vertucci (1974)	100	<i>In vitro</i> clear and dyed sections	45.0	37.0	18.0
Neaverth et al. (1987)	228	<i>In vivo</i>	19.3	16.7	60.0
Ibarrola et al. (1997)	87	<i>In vitro</i> clearing	23.0	77.0	
Tam and Yu (2002)	50	<i>In vitro</i> sections	36.0	40.0	24.0
Saad Al-Nazhan (2005)	352	<i>In vivo</i>	76.7	17.0	6.3
Gary Hartwell et al. (2007)	121	<i>In vivo</i>	29.76	70.2	
Alacam et al. (2008)	100	<i>In vitro</i> dental operating microscope and ultrasonics.	18	53	29
Emel et al. (2008)	202	<i>In vivo</i>	29.8	20.2	14.3
Tuncer et al. (2010)	110	<i>In vitro</i> unaided vision ,dental loups and dental operating microscope	22	78	

**Table 2.** Percentages of root canals and apical foramina in mesiobuccal root of maxillary first molars as reported in this study.

No. of teeth	One canal and one foramen (%)	Two canals and one foramen (%)	Two canals and two foramen (%)
180	116 (64.4%)	58 (32.2%)	6 (3.3%)

interpretation of the diagnostic radiographs taken.

In this study, more than 16 teeth presented with different quantities of pulp chamber and/or canals orifice

calcification. For easier access to canal openings, a bubble test with sodium hypochlorite in the pulp chamber and chelating agents (EDTA) were infrequently used for

removing the smear layer and softening calcifications. It is well-known that chelating agents and ultrasonic instrumentation can be used to remove debris and anatomical irregularities that interfere with negotiation of the MB canal (Ibarrola et al., 1997).

In the present study, the orifice of the second mesiobuccal root canal was commonly located lingual to the main mesiobuccal canal orifice. Similar finding was reported by other investigators (Pineda and Kuttler, 1972; Tam and Yu, 2002). In their findings, mesiolingual canal was present in 64 (35.5%) of 180 cases, this percentage is much lower than the range reported of other *in vivo* and *in vitro* studies (Neaverth et al., 1987; Ibarrola et al., 1997; Gary et al., 2007; Alaçam et al., 2008; Tuncer et al., 2010) and slightly higher than the results recorded in other researches (Vertucci, 1974; Saad, 2005; Emel et al., 2008).

### Conclusion

The occurrence, location and apical foramina of second MB canals in the mesial root of the permanent maxillary first molar of a Sulaimani population were within the normal range.

### REFERENCES

- Acosta V, Trugeda B (1978). Anatomy of the pulp chamber floor of the permanent maxillary first molar. *J. Endod.*, 4: 214-219.
- Alaçam T, Tinaz A, Genç Ö, Kayaoglu G (2008). Second mesiobuccal canal detection in maxillary first molars using microscopy and ultrasonics. *Aust. Endod.*, 34: 106-109.
- Buchrley L, Barrows M, BeGole E, Wenckus C (2002). Effect of magnification on locating the MB2 canal in maxillary molars. *J. Endod.*, 28: 324-327.
- Cleghorn B, Christie H, Dong C (2006). Root and root canal morphology of the human permanent maxillary first molar: a literature review. *J. Endod.*, 32; 9: 813-820.
- Cohen S, Burns C (1997). *Pathways of the pulp* 6th Ed. Harcourt Brace and Company, Asia PTE Ltd.
- Emel O, Mete Ü, Ersin Ö (2008). Canal Configuration of the Mesiobuccal Root of Maxillary Molars. *Hacettepe Diş Hekimliği Fakültesi Dergisi*. 32: 2-9.
- Gary H, Crig M, Appelstein W, Lyous W, Mary E (2007). The incidence of four canals in maxillary first molars. *J. Am. Dent. Assoc.*, 138: 1344-1346.
- Hartwell G, Bellizzi R (1982). Clinical investigation of *in vivo* endodontically treated mandibular and maxillary molars. *J. Endod.*, 8:555-557.
- Ibarrola J, Knowles K, Ludlow M, Mickinley B (1997). Factors affecting the negotiability of second mesiobuccal canals in maxillary molars. *J. Endod.*, 23: 236-238.
- Imura N, Hata G, Toda T, Otani S, Fagundes M (1998). Two canals in mesiobuccal roots of maxillary molars. *Int. End. J.*, 31; 6: 410-414.
- Karthikeyan K, Mahalaxmi S (2010). New nomenclature for extra canals based on four reported cases of maxillary first molars with six canals. *J. Endod.*, 36: 1073-1078.
- Kulild J, Peters D (1990). Incidence and configuration of canal systems in the mesiobuccal root of maxillary first and second molars. *J. Endod.*, 16: 311-317.
- Neaverth E, Kutler L, Kalten B (1987). Clinical investigation (*in vivo*) of endodontically treated maxillary first molars. *J. Endod.*, 13: 506-512.
- Pineda F (1973). Roentgenographic investigations of the mesiobuccal root of the maxillary first molar. *Oral Surg. Oral Med. Oral Pathol.*, 36: 253-260.
- Pineda F, Kuttler Y (1972). Mesiodistal & buccolingual roentgenographic investigation of 7,275 root canals. *Oral Surg. Oral Med. Oral Pathol.*, 33: 101-110.
- Pomeranz H, Fishelberg G (1974). The secondary mesiobuccal canal of maxillary molars. *J. Am. Dent. Assoc.*, 88: 119-124.
- Saad A-N (2005). The prevalence of two canals in mesial root of endodontically treated maxillary first molars among a Saudi Arabian sub-population. *Saudi Dent. J.*, 17: 15-21.
- Seidberg B, Altman M, Guttuso J, Suson M (1973). Frequency of two mesiobuccal root canals in maxillary permanent first molar. *J. Am. Dent. Assoc.*, 87: 852-856.
- Slowey R (1974). Radiographic aids in the detection of extra root canals. *Oral Surg. Oral Med. Oral Pathol.*, 37: 762-72.
- Smadi L, Khraisat A (2007). Detection of a second mesiobuccal canal in the mesiobuccal roots of maxillary first molar teeth. *Oral Surg. Oral Med. Oral Pathol. Oral Radiol. Endod.*, 103(3):77-81.
- Tam A, Yu D (2002). Location of canal isthmus and accessory canals in the mesiobuccal root of maxillary first permanent molars. *J. Can. Dent. Assoc.*, 68: 28-33.
- Tuncer A, Haznedaroglu F, Sert S (2010). The Location and Accessibility of the Second Mesiobuccal Canal in Maxillary First Molar. *Eur. J. Dent.*, 4: 12-16.
- Vertucci FJ (1974). The endodontic significance of the mesiobuccal root of the maxillary first molar. *US Navy Med.*, 63:29-31.
- Weine F, Healey H, Gerstein H, Evanson L (1969). Canal configuration in the mesiobuccal root of the maxillary first molar and its endodontic significance. *Oral Surg. Oral Med. Oral Pathol.*, 28: 419-425.
- Wolcott J, Ishley D, Kennedy W, Johnson S, Minnich S, Meyers J (2005). A 5 yr clinical investigation of second mesiobuccal canals in endodontically treated and retreated maxillary molars. *J. Endod.* 31: 262-264.