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Research Article

Long Term Study of the Prevalence of Second Mesiobuccal canal in Maxillary First Molar of Saudi Population

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Abstract

Objectives: to investigate, in a large sample of mesiobuccal roots of maxillary first permanent molar, the prevalence of MB2 canal in Saudi Arabian population in order to establish a strong baseline data that can be significantly considered in treatment planning of endodontic cases of this tooth.

Materials and Methods: Sample population was Saudi patients who were scheduled for root canal treatment during 2001-2013 in King Abdul-Aziz Medical City in Jeddah. Endodontic procedures were done by endodontic specialists in all cases.

Statistical analysis: Data were analyzed using IBM SOSS version 19. Level of significance was determined at $p < 0.05$.

Results: Of the 1036 root canal treated maxillary first permanent molar teeth in this study, 479 were right maxillary first molar and 489 were left maxillary first molars. Ninety-seven (20.3%) of the right maxillary first molars and 101 (20.7%) of the left maxillary first molars had MB2 canals on examination; giving a total of 198 (19.1%) cases of MB2 canals.

Conclusion: The prevalence of MB2 canal in mesiobuccal root of maxillary first molar was within the normal range in Saudi population. Prevalence of MB2 was higher among male than female patients and although it was higher among young age patients (< 30 Years), only statistical significance was detected on the left maxillary molars.

Keywords: *Second Mesiobuccal Canal; Maxillary First Molar; Prevalence of MB2*

Abbreviations

MB2: Second Mesiobuccal Canal; CBCT: Cone-Beam Computed Tomography

Introduction

Early detection of accessory canals is a factor that implicates the success rate of endodontic treatment. This requires thorough knowledge about anatomical configurations of root canal system of the tooth to be treated [6,7,9-11,14]. One of the most complex in root and canal anatomy is the maxillary first permanent molar [10,12]. An accessory canal often named (second mesiobuccal canal) MB2 usually possessed in the mesiobuccal root of maxillary first permanent molar with the smallest size of all canals in this tooth [13].

Incidence of second mesiobuccal (MB2) canal in maxillary first permanent molar has been adequately reported in literatures regardless relating it with race, age, sex or nationality. Many of both *in vivo* and *in vitro* studies had reported a high incidence of second canal

in the mesiobuccal root of this tooth. During the past decades and up to date, prevalence of MB2 canal has been published in studies done clinically, radiographically, and by using microscopes or other types of magnification [12,15-23,24,25,33]. According to several researches, incidence of MB2 canal ranges between 15.1% and 78% and reaches 95% in one *in vitro* study, making it important to take into consideration the high chance of finding MB2 canal in the treatment planning [1,12].

Failure of detection of MB2 canal has been identified as a challenge for researchers to investigate more and try to find out the reasons that led to failure of locating MB2 canal. Many factors play different roles in detecting the MB2 canal including experience and knowledge of the operator and techniques that are used in root canal treatment. For example, clinical studies done with different types of magnification showed high percentage of MB2 canal detection [2,16-18,21]. Kulild and Peters evaluated the ability of detecting MB2 canal in maxillary first and second molars in three attempts; first by using an explorer with standardized access then by using bur and finally by microscope. They found that MB2 canal was detected in 95.2% of the total sample; 54.2% by hand instruments, 31.3% by bur and 9.6% by microscope [18]. Silveira L., *et al.* assessed the use of Cone-Beam Computed Tomography (CBCT) and its ability to locate and determine the negotiability of MB2 canal in maxillary first and second molars. They concluded that this method is excellent in detection but ineffective in determination of negotiability of the MB2 canals [32]. Table 1 shows incidence of second mesiobuccal canal in maxillary first permanent molar as reported by studies conducted in different world regions from 1972 till 2015 [3,7,8,10,18,20-22,25,28,31,33-36].

Author(s)	Country	Sample Size	Percentage of MB2 (%)	Type of Study	Year
Franklin Pineda and Yurg Kuttler	Mexico	262	48.5	Clinical	1972
Gary Hartwell and Ralph Bellizzi	USA	538	18.6	Clinical	1982
R. Norman Weller and Gary R. Hartwell	USA	835	39	Radiographic	1989
James Gilles and Al Reader	USA	21	2-2 (81)	SEM* and Microscope	1990
James C. Kulild and Donald D. Peters	USA	51	96.1	Microscope	1990
Essam I. Zaatar., *et al*.	Kuwait	133	2-1**(25.6), 2-2*** (15)	Radiographic	1997
Weine., *et al*.	Japan	293	2-1 (24.2) 2-2 (30.4)	Radiographic	1999
James Wolcott., *et al*.	US, Colorado	1193	60.7	Clinical	2002
Saad Al Nazhan	Saudi Arabia	352	23.3	Clinical	2006
L. Bahammam	Saudi Arabia	184	62.58	Clinical	2008
Qing-hua Zheng., *et al*.	China	775	50.4	Clinical	2010
Harry H. Peeters., *et al*.	Indonesia	308	68.5	*Ex vivo*	2011
Bestoon M. Faraj	Iraq	180	35.6	*Ex vivo*	2012
Al Fouzan K.., *et al*.	Saudi Arabia	308	51.3	Clinical	2013
Hasan M. and Khan F.	Pakistan	53	50.9	Clinical	2014
Agwan A.., *et al*.	Saudi Arabia	100	45	Clinical	2015

Table 1: *Incidence of second mesiobuccal canal in maxillary first permanent molar.*

** SEM: Scanning Electronic Microscope; ** 2 canals 1 foramen; *** 2 canals 2 foramina.*

In spite of the fact that nearly half of mesial roots of maxillary first permanent molars can have an extra canal, few studies focused on prevalence of MB2 canal in the Kingdom of Saudi Arabia. Therefore, the aim of this clinical study was to investigate, in a large sample of

mesiobuccal roots of maxillary first permanent molar, the prevalence of MB2 canal in Saudi Arabian population in order to establish a strong baseline data that can be significantly considered in treatment planning of endodontic cases of this tooth.

Materials and Methods

Sample population was Saudi patients who were scheduled for root canal treatment during 2001 - 2013 in King Abdul-Aziz Medical City in Jeddah.

Included in the study, 1036 maxillary first permanent molars that are all endodontically treated by endodontic specialists. Each tooth was isolated using rubber dam, accessed, cleaned and debrided using 5.25% NaOCl and filled with gutta percha cones. Each case was radiographically evaluated and when necessary, different angulations were used to view all root canals.

The findings were then tabulated and classified according to tooth number, gender and age. No categorization of common or separate apical foramina of mesiobuccal canals.

Data were analyzed using IBM SPSS version 19. Descriptive statistics (e.g. number, percentage) were used to represent prevalence of MB2. Z test for proportions was applied to compare proportions of MB2 according to gender and age (≤ 30 and > 30 years). Level of significance was determined at $p < 0.05$.

Results

In the present study, 1036 maxillary first permanent molars were included. It is composed of six hundred and six (58.49%) maxillary permanent first molars of females and four hundred and thirty (41.50%) of males.

Of the 1036 root canal treated maxillary first permanent molar teeth in this study, 479 were right maxillary first molar and 489 were left maxillary first molars. Ninety seven (20.3%) of the right maxillary first molars and 101 (20.7%) of the left maxillary first molars had MB2 canals on examination; giving a total of 198 (19.1%) cases of MB2 canals (Table 2).

		MB2		Total
		26	16	
Year	2001.00	1	2	3
		33.3%	66.7%	100.0%
	2002.00	8	5	13
		61.5%	38.5%	100.0%
	2003.00	8	18	26
		30.8%	69.2%	100.0%
	2004.00	5	6	11
		45.5%	54.5%	100.0%
	2005.00	9	8	17
		52.9%	47.1%	100.0%
	2006.00	4	4	8
		50.0%	50.0%	100.0%
	2007.00	10	6	16
		62.5%	37.5%	100.0%
	2008.00	12	14	26
		46.2%	53.8%	100.0%
	2009.00	11	14	25
		44.0%	56.0%	100.0%
	2010.00	8	4	12
		66.7%	33.3%	100.0%
	2011.00	8	10	18
		44.4%	55.6%	100.0%
	2012.00	8	4	12
		66.7%	33.3%	100.0%
	2013.00	9	2	11
		81.8%	18.2%	100.0%
Total		101	97	198
51.0%		49.0%	100.0%	

Table 2: *Number and percentage of MB2 canals in maxillary permanent first molars detected among study population from 2001 - 2013.*

According to gender, out of 301 maxillary right first molars of female patients there were MB2 cases (16.6%) and out of 178 maxillary right first molars of male patients there were 47 MB2 cases (26.4%) (P= 0.01). Out of 305 maxillary left first molars of female patients there were MB2 cases (16.7%) and out of 184 maxillary left first molars of male patients there were 50 MB2 cases (27.2%) (p = 0.01) (Tables 3 and 4).

	Maxillary first molars	MB2 Number (%)	P value*
Gender	Right (16) Female (n = 301) Male (n = 178)	 50 (16.6) 47 (26.4)	0.01
	Left (26) Female (n = 305) Male (n = 184)	 51 (16.7) 50 (27.2)	0.01
Age	Right (16) ≤ 30 years (n = 257) > 30 years (n = 222)	 59 (23.0) 38 (17.1)	0.11
	Left (26) ≤ 30 years (n = 259) > 30 years (n = 230)	 68 (26.3) 33 (14.3)	0.001

Table 3: *Number and percentage of MB2 canals in maxillary permanent first molars in relation to gender and age in years.*
** Z test for proportions.*

Gender	26 N (%)	16 N (%)
Female	51 (50.5%)	50 (49.5)
Male	50 (51.5)	47 (48.5)

Table 4: *Number and percentage of MB2 canals in maxillary permanent first molars in relation to gender and position.*

According to age, we classified the present cases into two age categories. The firs category is above 30 years of age and the second is 30 years of age or below. Thirty eight (17.1%) cases out of 222 maxillary right first molars of patients above 30 years old had MB2 canals compared to fifty-nine (23.0%) out of 257 maxillary right first molars of patients below 30 years old had MB2 canals. Thirty-three (14.3%) out of 230 maxillary left first molars of patients above 30 years old had MB2 canals and 68 (26.3%) out of 259 maxillary left first molars of patients below years old had MB2 canals (Table 3).

Discussion

The small size of MB2 canal orifice with close proximity to the other canal and the variance in position make it difficult to be detected [1,4]. Using different methods for locating MB2 canal may make it less challenging. Recently, cone-beam computed tomography offers 3-dimensional assessment with noninvasive approach and reproducible results unlike the conventional radiography which does not show complexities in root canal [5,30]. Furthermore, magnification provides the operator with enhanced vision, which aids in locating and negotiating MB2 canal accurately [26]. According to published researches, they reported a higher incidence of extra canal in maxillary molars with the use of magnification either by dental loupes or dental operating microscope [2,34].

Although number of researches regarding incidence of MB2 canal are well-documented, different methodologies and sample sizes have been used in each study that would affect the results and might make the conclusions confined to certain situations. Based on a clinical

investigation of endodontically treated maxillary molars done by Hartwell and Bellizzi, it had been suggested that modifying access cavity to form of cuboidal to rhomboidal shape with the consideration of occlusal table can also assess in locating the fourth canal in maxillary permanent first molar tooth [29]. Moreover, anatomical irregularities and debris during accessing the orifices can be removed with the use of ultrasonic tips and chelating agents [35].

The present clinical study may be the first conducted research that evaluates the prevalence of second mesiobuccal canal of the maxillary permanent first molar in Saudi population. In this study, 198 (19.1%) of the total reviewed cases had MB2 canal. This percentage is relatively close to that reported by Al-Nazhan (23.3%) in 2006 among Saudi population [1]. Bestoon M had reported exactly the same percentage (23.3%) as Al-Nazhan study but it was done on extracted teeth for Iraqi population in 2012 with a sample size of 180 extracted maxillary first molar teeth [10]. This may indicate that more researches might be needed to investigate if the race could be contemplated as a factor that affects the incidence of MB2 canal.

In our study we found that the incidence of MB2 canal in male was higher than female patients (26.4% and 27.2% compared to 16.6% and 17.7% in the right and left maxillary first molars, respectively, $p = 0.01$) Regarding tooth position, we classified teeth included in this study into two groups: right and left maxillary permanent first molars. Table 2 summarizes the percentages of MB2 canal in each group of teeth per year from 2001 up to 2013. On examination, 97 (20.3%) of right maxillary first molars and 101 (20.7%) of left maxillary first molars had extra canal in mesiobuccal root. Comparing these results with those of Al-Nazhan [1] and Zhing., *et al.* [3] gives similar conclusion that there is no significant difference in MB2 prevalence neither in males and females nor in tooth position. It can be stated that the operator may need to consider presence of MB2 canal bilaterally. For age perspective, reviewed cases out of 222 maxillary right first molars in patients above 30 years of age had MB2 canals and out of 257 maxillary right first molars in patients below 30 years of age had MB2 canals. Patients above 30 years old had 33 (14.3%) and 38 (17.1%) MB2 canals in maxillary right and left permanent first molar respectively. Fifty-nine (23.0%) and 68 (26.3%) MB2 canal were found in maxillary left first molars of patients below 30 years. Based on those results, there was also no significant difference of prevalence of MB2 canal in relation to age similar to another clinical study [7]. On the contrary, Pattanshetti N., *et al.* reported in their clinical study that the incidence of MB2 canal was significantly correlated to age [2].

Nearly fifth of the sample size of our study presented with extra canal in the mesiobuccal root of maxillary permanent first molar. To the best of author's knowledge, it could be considered the largest sample that studied the MB2 canal prevalence in Saudi population in Jeddah.

Conclusion

In the lights of this clinical study, it can be concluded that the prevalence of MB2 canal in mesiobuccal root of maxillary first molar was within the normal range in Saudi population. No significant difference neither in males and females nor in right and left maxillary permanent first molar teeth.

Based on this finding, it is very important to consider the presence of MB2 canal in addition to the experience and knowledge for optimum results in treating maxillary permanent first molar.

Conflict of Interest

The authors declare that there is no conflict of interest.

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