Original Article

International Journal of Dental and Health Sciences
Volume 02,Issue 06

THE PERMANENT MAXILLARY FIRST MOLAR: CANAL NUMBERAND ONFIGURATIONS IN A TUNISIAN POPULATION

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ABSTRACT:

Introduction: Canal morphology of the maxillary first molar is very particular and the knowledge of root canal anatomy is necessary in the success of endodontic therapy. The purpose of this study is to determine the frequencies of root and canal morphologies of permanent maxillary first molar in a sample of 85 molars in Tunisia.

Materials and methods: In this study, we used 85 maxillary first molars extracted for periodontal reasons. Each tooth is macroscopically examined to determine the number of roots and then we grind progressively at the root surface to highlight the path of the root canals. Canal number and configurations of both mesial and distal roots are observed and analysed using sections.

Results: In the present study, most of maxillary first molars were 3 rooted(96.9 %) and 3.4% were 2 rooted. This study showed in the mesio buccal root the predominance of Vertucci type I cases(67%). In the disto buccal root, this study showed the presence of a single canal in 100 % of cases. Palatal root had mainly one canal (97.6%).

Conclusion: The prevalence of two roots was 3.4%. In the mesio buccal root, the most prevalent configuration was type I (67%). In the disto buccal root, we found vertucci type I on 100% of cases. Palatal root had mainly one canal (97.6%).

Key words: Anatomy, maxillary first molar, morphology, root, canal

INTRODUCTION

Complete and thorough chemo mechanical debridement of the root canal system is pivotal for the optimal outcome of the root canal treatment. The clinician should be aware of the possible root canal configurations and the presence of additional canals, which are of vital importance to the complete instrumentation and disinfection of the root canal system, thus minimizing the risk of treatment failure [1].

Root and canal morphologies can vary in different populations and ethnic groups. Thus, identifying the root canal anatomy of different ethnic populations is essential for successful endodontic treatment [2].

MATERIALS AND METHODS

In this study, we used 85 molars that have been extracted mainly for periodontal reasons. The teeth were stored in a sodium hypochlorite solution

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diluted to 5% during 3 days and then washed in running water and then dried.

Each tooth is macroscopically examined to determine the number of roots and then we grind progressively at the root surface to highlight the path of the root canals.

Canal number and configurations are observed and analysed using sections:

-Mesio buccal and disto buccal root:bucco-lingual sections

-Palatal root: mesio-distal sections.

RESULTS

1- Number of roots by tooth (table 1)

Table 1: Number of roots by tooth:

Rootnumber	**1 root**		**2 roots**		**3 roots**		**4 roots**	
tooth	number	**%**	number	**%**	number	**%**	number	**%**
	0	**0%**	**3**	**3.4%**	**85**	**96.9%**	**0**	**0%**

2- Number of canals by root (table 2)

Table 2: number of canals by root

	1 canal	2 canals	3canals
Mesiobuccalroot	67%	33%	0%
Distobuccalroot	100%	0%	0%
Palatal root	97.6%	2.4%	0%

3- Canal configurations (table 3)

Table 3: canal configurations

root	Canal configuration (class. Vertucci)							
	I	II	III	IV	V	VI	VII	VIII
Mesio buccal	67	21.1	0	9.4	1.2	1.2	0	0
Disto buccal	100	0	0	0	0	0	0	0
Palatal	97.6	2.3	0	0	0	0	0	0

4- Different canal configurations observed at the mesio-buccal root (Figures 1-5)

5- Different canal configurations observed at the disto-buccal root (Figure 6)

6- Differents canals configurations observed on the palatal root (Figure 7-8).

DISCUSSION

Number of roots

In the present study, most of maxillary first molars were 3 rooted (96.9 %) and

3.4% were 2 rooted. The sample didn't include 1 or 4 rooted molars (table 4).

Table 4: Roots number

Authors	year	Sample	2 rooted	3 rooted
Cleghorn BM [3]	2000	83	2,4%	97,6%
Ng et al [4]	2001	90	0%	100%
Alavi et al [5]	2002	52	0%	100%
Neelakantan P et al [6]	2010	220	1.3 %	96.8%
Zheng Q.H [7]	2010	627	2.23%	97.29%
Sert S [8]	2011	355	6.47%	92.96%
Kim Yet al [9]	2012	814	1.11%	97.91%
Gu Y et al [10]	2015	1365	2.12 %	97.58%
Alrahabi Met al [11]	2015	100	6%	94%
Personal study	2015	88	3.4%	96.9%

The Percentage of 3 rooted maxillary first molars was variable for consulted studies from 92.96% [8] to 100% [4, 5]. For the 2 rooted molars, it was from 0% [4, 5] to 6.47% [8].

Internal morphology :

- **Mesio buccal root:**

- **Number of canals:**

Our study showed that 67% of the sample had only one canal in the mesio buccal root and 33% had 2 canals.

Our results are in agreement with those of Semipra et al [12] who found that 66,9% had one canal and 33,1% had 2 canals by using operating microscopeon a sample of 130 maxillary first molars .

Others studies reported various results: from 0% [13] to 75% [14] had one canal and from 25% [14] to 100% [13] had 2 canals in the mesial root (table 5).

These differences can be explained by the sample size or the difference of used techniques.

Table 5: Canals number in the mesio buccal root.

Authors	Year	Technique	sam ple	1 canal	2 canals
Weine [15]	1969	sectionning	208	48,5%	51,5%
Vertucci [16]	1984	Clearing	100	45,0%	55,0%
Kulild et al [17]	1990	telescopy	51	4,0%	96,0%
Pecora et al [14]	1992	Clearing	120	75%	25%
Weine et al [18]	1999	radiographic in vitro	293	42,0%	58,0%
] Cleghorn BM [3]	2000	Clearing	83	22,0%	78,0%
Sempira et al [12]	2000	Clinic (Microscope)	130	66,9%	33,1%

Alavi et al [5]	2002	Clearing	52	35,0%	65,0%
Sert et al [19]	2004	Clearing	200	6,5%	93,5%
Filho et al [20]	2009	Microscope and radiographic	140	7.15%	92.85 %
Degerness et al [21]	2010	sectionning	90	20%	79 ,8%
Zheng et al [9]	2010	Conebeam	624	47.59	51.92
Domark J D[13]	2013	Conebeam	13	0%	100%
Al-Fouzanet al [22]	2013	Clearing	308	48.7%	51.3%
Faramarzi et al [23]	2015	Conebeam	156	30.77%	69.23 %
Alrahabi et al [11]	2015	Conebeam	100	29.6%	70.6%
Personal study	2015	sectionning	85	67%	33%

- **Canals configurations:**

In this study, the most prevalent configuration on the mesio buccal root was type I (67%). type II represented 21.1% and Type IV 9.4%.

Consulted studies showed significant diversified results about canals configurations: from 0% [23] to 66.7% [24] for type I, from 5.5% [6] to 71.3% [24] for type II, from 0% [23] to 11.8% [11] for type III, from 8.9% [24] to 59.87% [25] for type IV. Types V and VI presented the fewer percentages with respectively from 0% to 6.6%and from 0% to 0.66% (table 6).

The differences in results may be explained by the heterogeneity of the studied population or related to the variety of the teeth number per sample.

Table 6: canal configurations in the mesio-buccal root.

Study	Year	Canal Configuration (Vertucci) (%)					
		I	II	III	IV	V	VI
Eder et al [25]	2006	5.92	31.58	0	59.87	0.66	0.66
Weng et al [24]	2009	66.7	8.9	8.9	8.9	6.6	0
Neelakantan et al [6]	2010	51.8	5.5	0	38.6	0	0
Faramarzi et al [23]	2015	0	71.3	0	28.7	0	0
Alrahabiet al [11]	2015	29.4	47	11.8	11.8	0	0
Personal study	2015	67	21.1	0	9.4	1.2	1.2

- **Disto buccal root:**

- **Number of canals:**

In the present study, all disto buccal root had one canal (100%) which is in agreement with many others sudies: Vertucci [11, 14,16, 26] (Table 6).

Othor authors identified second canals in this root but with lower percentage, those varied from 1.6% for Caliskan et al [27] to 9.5% for Sert et al [19] (table 7).

The difference of results can be explained by population heterogeneity.

Table 7: Canal number in the disto buccal root

Authors	Year	Technique	Sample	1 canal	2 canals
Pineda et al [28]	1972	Radio. In vitro	262	96,4%	3,6%
Vertucci [16]	1984	Clearing	100	100%	0%
Pecora et al [14]	1992	Clearing	120	100%	0%
Caliskanet al [27]	1995	Clearing	100	98,4%	1,6%
Zaatar et al [26]	1997	Radio. RTC	133	100%	0%
Cleghorn BM [3]	2000	Clearing	83	97,5%	2,5%
Alavi et al [5]	2002	Clearing	52	98,1%	1,9%
Sert et al [19]	2004	Clearing	200	90,5%	9,5%
Zheng et al [7]	2010	Conebeam	624	98.88%	1.12%
Alrahabi et al [11]	2015	Conebeam	100	100%	0%
Personal study	2015	sectionning	85	100%	0%

- **Canals configurations:**

In this root, we found type I of vertucci on 100% of cases.

Our results are in correlation with those of Alrahabi [11] who reported that typeI was observed in all distobuccal roots. However, Neelakantan et al [6] and Weng et al [24] found type I configuration on respectively 90.4 % and 88.9% of distobuccal roots.

For Médioni et al [29], when the disto buccal root had 2 canals (0 à 3.6% of cases), it was frequently type IV and for Neelakantan et al [6], type II was more prevalent.

- **Palatal root:**

- **Number of canals:**

The present study showed that palatal root had mainly one canal (97.6%); we found only 2.3% of cases with 2 canals. Our results indicate similar incidences to those reported on the Literature with a percentage of 2 canals from 0% [3; 28] to 7% [27] (table8).

Table 8: Canals number in the Palatal root

Authors	Year	Technique	Sample	1 canal	2 canals
Pineda et al [28]	1972	Radio. In vitro	262	100%	0%
Vertucci [16]	1984	Clearing	100	100%	0%
Pecora et al [14]	1992	Clearing	120	100%	0%
Caliskan et al [27]	1995	Clearing	100	93%	7%
Zaatar et al [26]	1997	Radio. RTC	133	100%	0%

Cleghorn BM [3]	2000	Clearing	83	98,8%	1,2%
Alavi et al [5]	2002	Clearing	52	100%	0%
Sert et al [19]	2004	Clearing	200	94,5%	5,5%
Zheng et al [7]	2010	Conebeam	624	98.24%	1.76%
Alrahabi et al [11]	2015	Conebeam	100	100%	0%
Personal study	2015	sectionning	85	97,6%	2,3%

The differences in results may be explained by the heterogeneity of the techniques used or related to the variety of the teeth number per sample.

- **Canals configurations:**

In the presentstudy,thisrootwas type I on 97.6% and type II on 2.3% of sample whichis in agreement with the study of Médioni et al [29] (99% Type I, 1% Type II).

Alrahabi M [11] found that thecanal configuration for palatal roots was Vertucci's class I in all cases (100%), however Neelakantan et al [6] reported only 88.1%.

Canal configuration of this root can be complex; Wong [30] reported one rarely case in which the palatal root had one orifice, but presented trifurcation in the thirdapical with 3 separated foramina.

Maggiore et al [31] reported one case with trifurcation in the third apicalof palatal canal. These reports were based on preoperative and postoperative radiographic examination of the teeth.

CONCLUSION

The present study showed that most of maxillary first molars were 3 rooted (96.9 %) and 3.4% were 2 rooted. In the mesio buccal root, the most prevalent configuration was type I (67%), type II represented 21.1% and Type IV 9.4%.In thedisto buccal root, we found vertucci type I on 100% of cases. Palatal root had mainly one canal (97.6%); we found only 2.3% of cases with 2 canals.

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FIGURES:

Figure 1 : type I (Vertucci)

Figure 2 : type II (Vertucci)

Figure 3 : type IV (Vertucci)

Figure 4 : type V (Vertucci)

Figure 5 : type VI
(Vertucci)

Figure 6 : type I
(Vertucci)

Figure 7 : type I
(Vertucci)

Figure 8 : type II
(Vertucci)