

Original Research Article

The Permanent Mandibular Second Molar: Canal Number and Configurations in a Tunisian Population

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ABSTRACT

Introduction: The knowledge of root canal anatomy plays an important role in the success of endodontic therapy. Complete knowledge of the root canal anatomy is mandatory because the inability to detect all of the canals can lead to endodontic failure.

The purpose of this study was to examine the root and canal morphology of mandibular permanent second molars in a Tunisian population.

Materials and methods: We used in our study 76 second mandibular molars extracted mainly 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 buccolingual sections.

Results: Our results showed that the second mandibular molar presents in 78.5% of cases two roots, 1 root in 15.3% and 3 roots in 6.1% of cases.

This study showed in the mesial root the predominance of the cases with two canals (84.3%), a single canal (14.3%) and rarely 3 canals (1.3%); the most frequent configurations are type II (42.8%) and type IV (41.5%) of Vertucci. In the distal root, this study showed the presence of a single canal in 72.7% of cases and two canals in 27.3% of cases; the most frequent configurations are type I (72.7%) and II (22%) of Vertucci.

Conclusion: The prevalence of three roots was 6.1%. The most prevalent canal configuration in the mesial root was type II of Vertucci (42.8%) and type IV (41.5%); in the distal root type I configuration (72.7%).

Key Words: Anatomy, mandibular second molar, morphology, root, canal.

INTRODUCTION

Successful root canal treatment depends on adequate debridement and filling of the entire root canal system. Such therapy may be unsuccessful because the dentist has failed to recognize the presence of an additional canal and it is important to be familiar with variations in root canal morphology as such knowledge can aid

location and negotiation of canals as well as their subsequent management. [1]

The knowledge of root canal anatomy plays an important role in the success of endodontic therapy. Complete knowledge of the root canal anatomy is mandatory because the inability to detect all of the canals can lead to endodontic failure. [2]

The purpose of this study was to examine the root and canal morphology of mandibular permanent second molars in a Tunisian population.

MATERIALS AND METHODS

We used in our study 76 second mandibular molars extracted mainly for periodontal reasons. The teeth were not all sound, some with superficial or deep carious attacks.

The teeth were stored in a Clona solution diluted to 5% for 3 days and then washed under running water and then dried.

Each tooth was examined macroscopically and then cut by progressive grinding until highlighting the path of the root canals.

Observation of canal configuration was performed on bucco lingually sections on the mesial and distal roots. [3]

RESULTS

Table 1: Number of roots per tooth:

1 root		2 roots		3 roots		4 roots	
Number	percentage	Number	percentage	Number	percentage	Number	percentage
15*	15.3%	77	78.5%	6	6.1%	0	0%

* 15 cases of which 10 cases (10.2 %) that have a root configuration type 'C'.

Table 2: Percentage of canals by root

Root	1 canal	2 canals	3 canals
M	14.3	84.3	1.3
D	72.7	27.3	0

Table 3: canal configurations (percentages)

Root	% Canal Configurations (class. Vertucci)							
	I	II	III	IV	V	VI	VII	VIII
M	14.3	42.8	0	41.5	0	0	0	0
D	72.7	22	1.3	3.9	0	0	0	0

Different canal configurations observed at the mesial root (Figures 1-4)

At the mesial root, we found 1.3 % type 3-2 (as classified by Gulabivala).



Figure 1 : type I (Vertucci)



Figure 2 : type II (Vertucci)



Figure 3 : type IV (Vertucci)

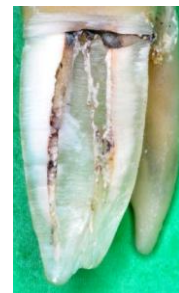


Figure 4 : Type (3-2) (Gulabivala)



Figure 5 : type I (Vertucci)



Figure 6 : type II (Vertucci)



Figure 7 : type III (Vertucci)

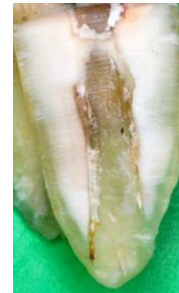


Figure 8 : type IV (Vertucci)

Different canal configurations observed at the distal root (Figures 5-8)

DISCUSSION

Number of roots:

We found in our study that the mandibular second molar contains in 78.5

% of cases two roots, one mesial root and one distal. All studies found that the percentage of two roots was dominant.

We found in 6.1 % of cases second lower molar with three roots, studies describe a percentage of three rooted teeth that goes from 0% in the Jordanian population [1] to 31% of the Indian population. [4]

Our study showed that 15.3 % of cases have fused roots one of which 10.2 % has a root configuration type 'C'.

The percentage of the Type C configuration varies from 0.4 % for JS Song [5] to 22.4 % for Gulabivala. [6] Whereas, in a sample of 518 teeth on a Chinese population, Yang and al [2] found a very high frequency of this kind of root morphology (31.5 %) (Table 4). 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 4: number of roots

Authors	Year	Population	Number of teeth	1 root	Roots type C	2 roots	3 roots
Gulabivala [6]	2001	Birmane	134	4.5%	22.4%	73.1%	
Al-Qudah A [11]	2009	Jordanian	355	7%	10%	82%	0%
Song J S [5]	2010	Korean	2783	0.3%	0.4%	99.3%	0.7%
Neelakantan P [4]	2010	Indian	345	0%	7.5%	83.4%	31%
Silva E [7]	2013	Brazilian	226	9.5%	3.5%	87 %	3.5 %
Zare JahromiM [8]	2013	Iranian	100	6%	3%	89%	2%
Nur B G [9]	2014	Turkish	1165	10%		90%	0%
Kim SY [10]	2015	korean	1920	41%		58%	1%
Personnal study	2015	Tunisian	76	5.1	10.5	78.5%	6.1%

Number of Canals:

Mesial Root:

We found in our study that the mesial root has two canals in the majority of cases (84.3% of cases), it has only one canal in 14.3% and rarely three canals (1.3%).

Our results have the same trends with those reported by Green [11] (87% of cases have two canals and 13% of cases have a single canal).

Vertucci [12] found that only 73% of cases have two canals and 27% have a single canal which is close to the result of Barsness S et al [13] (72.2% had two canals, 11.1 % had only one and 16.7% had three canals).

Pineda et al [14] found more mesial roots that contain one canal (58%) while Weine [15] and Nur BG [9] found more mesial roots with 2 canals (96% for Weine and 90% Nur BG).

Distal Root:

We found in our sample that in 72.7 % of cases this root has a single canal and in 27.2 % of cases it has two canals. These results are close to those reported by Green, [10] Pineda et al [14] and Vertucci [12]

who found that the configuration of a single canal predominated.

Nur BG [9] found that majority of distal roots had one canal (97%) and only 3% had two canals.

Weine [15] found a much higher frequency of roots having a second distal canal (96%); only 4% have a single canal.

Canal configurations:

Mesial Root:

According to our study, we found a predominance of type IV (41%), type II (42.8 %) and type I (14.3 %) these results converge to those of Weine [15] and Green. [11]

The Type V was found with a frequency of 7.6 % for Pineda et al [14] and for Vertucci [12] 9%.

Vertucci [12] found much more mesial roots that have type I (58%) compared to other studies.

These dissimilarities between the different results reported by different authors are due firstly to the variability of the number of teeth per sample and also to the heterogeneity of the populations studied by these authors.

We found only one case (1.3%) with a configuration type (3-2) (class. Gulabivala); this type has 3 canals which extend from the pulp chamber to exit by 2 canals at the apical level.

Nur BG [9] Who did his study in function of the kind found that type IV configuration canal was The most

prevalent in the mesial roots (76% for female and 84% for male), type I was represented by 15% for female and 10% for male, type II by 2% for female and 2.6% for male, type III by 0.2% for female and 1.2% for male, Type V by 8% for female and 2.6% for male (Table 5).

Table 5: canal configurations at the mesial root (percentage)

Authors	Number	% Canal Configuration of Mesial root (class. Vertucci)					
		Type I	Type II	Type IV	Type V	Type VI	Type VII
Green [11]	100	13	49	38	0	0	0
Pineda et al [14]	300	58	20.6	13.8	7.6	0	0
Vertucci [12]	100	27	38	26	9	0	0
Weine [15]	75	4	52	40	0	0	0
Barsness SA [13]	18	11.1	0	0	55.55	16.66	33.3
Personal Study	76	14.3	42.8	41.5	0	0	0

Distal Root:

Type I is the most frequent in this root (72.7% of cases in our study) which is consistent with the results reported by different authors.

When this root has two canals their configuration would be, according to our study, mostly Type II (22%) then type IV (3.9%), rarely types III and V.

Our results are in similarity with the study of Barsness SA [13] who confirmed that type I was most commonly found (61.1%).

For Nur BG, [9] the most common root canal configuration was type I (95% for females and 93% for males). Zare Jahromi M [8] found that 35% were type II, 28% were type III and 37% were type IV (Table 6).

The differences between the Results may be due to the heterogeneity of the population, the various methods used in the studies and the number of teeth per sample.

Table 6: Canal configurations at the distal root (percentage)

Authors	Number	% Canal Configuration of distal Root (class. Vertucci)				
		Type I	Type II	Type III	Type IV	Type V
Green [11]	100	92	5	-	3	0
Pineda et al [14]	300	94.4	2.1	-	3	0.5
Vertucci [12]	100	92	3	-	4	1
Weine [15]	75	4	85.3	-	9.3	1.3
Barsness SA [13]	18	61.1	5.55	27.7	-	-
Personal Study	76	72.7	22	1.3	3.9	0

CONCLUSION

A higher prevalence of 2 separate roots with 2 canals in the mesial root (84.3) and 1 canal in the distal root (72.7) was observed in mandibular second molars (74% and 54%, respectively). In addition, a lower incidence of C-shaped canals (10.2%) and 3-rooted teeth (6.1%) was observed in the Tunisian population.

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