Research Article
J Nepal Soc Perio Oral Implantol. 2024 Jan-Jun;8(15):38-43.

Submitted: Apr 19, 2024
Accepted: Jun 14, 2024
Published: Jun 21, 2024

Assessment of Root Trunk Morphology of Molar Teeth in Patients Visiting a Tertiary Care Hospital

Dr. Bhagabat Bhattarai,[1] Dr. Preeti Singh,[2] Dr. Sujaya Gupta,[1] Dr. Usha Sapkota,[1] Dr. Anuja Pandey,[1] Dr. Anuja Gautam[1]

[1]*Department of Periodontics and Oral Implantology, Dental Programme, Kathmandu Medical College, Duwakot, Bhaktapur, Nepal;*
[2]*Department Oral Pathology and Microbiology, Dental Programme, Kathmandu Medical College, Duwakot, Bhaktapur, Nepal.*

ABSTRACT

Introduction: Molar root morphology influences diagnosis, prognosis, and treatment of periodontal disease. Root trunk length (RTL) is considered a key factor that influences periodontal prognosis. Knowledge of anatomy of RTL ensures clinician to assess the extent of periodontal destruction and thereby plan appropriate management.

Objective: To assess the RTL and types of root trunk of mandibular and maxillary molars.

Methods: This descriptive cross-sectional study was done on extracted mandibular and maxillary molar teeth with intact roots from 2022 March to 2023 September at Department of Periodontics and Oral Implantology, Kathmandu Medical College. Ethical approval was taken before data collection. Convenience sampling was done. Hou and Tasi (1997) classification was used for root trunk type. For analysis, SPSS v.20 software was used. Descriptive statistics, mean, standard deviation, and median was calculated for quantitative data.

Results: Among 304 samples, 75 (24.7%) were maxillary molars and 229 (75.3%) were mandibular molars. The RTL of maxillary first molars were 4.32±1.05, 3.68±1.06, and 4.08±1.22 millimetres (mm) for mesial, buccal, and distal aspect respectively. The RTL of maxillary second molars were 6.13±1.89, 4.93±1.53, and 4.94±1.43 mm for mesial, buccal, and distal aspect respectively. The RTL of mandibular first molars were 3.72±1.78 and 4.07±1.89 mm for buccal and lingual aspect respectively. The RTL of mandibular second molars were 3.77±1.99 and 3.95±1.98 mm for buccal and lingual aspect respectively. Among 683 furcations, 277 (40.5%) were type A and 406 (59.4%) were type B.

Conclusions: The knowledge of variation in RTL and type may help in diagnosis, treatment and prognosis of furcation involved tooth.

Keywords: Furcation; root anatomy; root trunk length; root trunk types.

INTRODUCTION

Molar root morphology influences the diagnosis, prognosis, and treatment of periodontal disease. Its knowledge helps clinician to assess the extent of periodontal destruction and thereby management and prognosis. Multirooted tooth with bone loss have an increased risk of additional bone loss with an impaired long-term prognosis. Multiple factors influence the prognosis of furcation-involved teeth, including (i) tooth-related factors such as furcation involvement (FI); (ii) factors related to the dentition such as the number of molars left (Dannewitz et al. 2006),[1] and (iii) patient-related factors such as smoking habits, and applied treatment modality.[2,3]

Cervical enamel projection, bifurcational ridge, root proximity, length of root fusion, furcation entrance dimension, root fusion, and enamel pearls lead to unpredictable results of periodontal therapy.[4] Furcation morphology of multirooted teeth has been addressed extensively in the literature. There are some anatomical variations that contribute to the aetiology and the compromised prognosis of furcation involved teeth.[3] Furcation areas present some of the greatest challenges of the success of periodontal therapy.[5] Inaccessibility of furcation areas leads to a lack of proper access for instrumentation and consequently, a persistence of pathogenic microbial flora.[6] Thus, this study aimed to assess the length and types of root trunk of molar teeth.

Correspondence
Dr. Bhagabat Bhattarai
Email: bhagabat912@gmail.com

Citation
Bhattarai B, Singh P, Gupta S, Sapkota U, Pandey A, Gautam A. Assessment of Root Trunk Morphology of Molar Teeth in Patients visiting a Tertiary Care Hospital. J Nepal Soc Perio Oral Implantol. 2024 Jan-Jun;8(15):38-43.

METHODS

The present descriptive cross-sectional study was conducted in the Department of Periodontics and Oral Implantology, Kathmandu Medical College. The samples were collected between 2022 March to 2023 September. Ethical clearance was obtained from the Institutional Review Committee (Ref. 0311202002) before starting the data collection. Convenience sampling method was used to select the study samples. Sample size of 162 was calculated using formula $n = Z^2 pq/e^2$; where n = sample size; Z = 1.96 at 95% confidence; p = prevalence = 0.119 (11.9%);[4] q = 1-p; e = permissible error = 0.05 (5%). So, $n = (1.96)^2 \times 0.119 \times 88.1/(0.05)^2 = 161.1 \approx 162$. Though calculated sample size was less, the authors were able to collect 316 extracted molar teeth and after cleaning data, analysis was done in 304 molar teeth. Extracted mandibular and maxillary molar teeth with intact root, accessibility of furcation area, unaltered morphological teeth, and preserved cementoenamel junction (CEJ) were taken as sample and analysed for root trunk length and types. They were collected from the hospital, rinsed under running water, and preserved in 10% formalin. During analysis, they were cleaned by washing with normal saline.

Teeth with caries involving CEJ, teeth having fused root and developmental anomalies were excluded criteria. For each tooth, the vertical dimensions of the root trunk and root length were assessed with a digital micrometre caliper (Figure 1). Pretesting was done in 10% of the study sample and was not included in the final sample. Debris was removed by using hand scalers. Allocation of reference point and CEJ were done by fine pencil on the specimen. Measurements of maxillary molars include the vertical height of the buccal root trunk (BRT), mesial root trunk (MRT), and distal root trunk (DRT). Measurements of mandibular molars include the vertical height of the buccal root trunk (BRT) and lingual root trunk (LRT). The types of root trunk were classified according to Hou and Tasi (1997).[4] The types of root trunk were classified –according to the ratio of root trunk height to root length into types A, B, and C. Types A, B, and C are defined as root trunks involving the cervical third or less, the cervical third to one half and the cervical two-thirds or greater of the root length, respectively.[4]

Figure 1: Measurement of the trunk length using digital micrometre caliper.

Collected data were entered in and analysed in IBM SPSS Statistics for Windows, version 20 (IBM Corp., Armonk, N.Y., USA). For descriptive statistics, mean, standard deviation, and median was calculated for quantitative data.

RESULTS

Out of total 316 samples, after filtering only 304 were taken for analysis. There were total 75 maxillary teeth and 229 mandibular teeth. The root trunk length of maxillary first molars were 4.32±1.05 mm, 3.68±1.06 mm, and 4.08±1.22 mm for mesial, buccal, and distal aspect respectively. The root trunk length of maxillary second molars were 6.13±1.89 mm, 4.93±1.53 mm, and 4.94±1.43 mm for mesial, buccal, and distal aspect respectively. The root trunk length of mandibular first molars were 3.72±1.78 mm and 4.07±1.89 mm for buccal and lingual aspect respectively. The root trunk length of mandibular second molars were 3.77±1.99 mm and 3.95±1.98 mm for buccal and lingual aspect respectively.

Only Type A and Type B root trunks were found. Among 683 furcations, 277 (40.5%) were type A and 406 (59.4%) were type B. Majority of furcation were type B (Table 4). For maxillary molars 76 (33.8%) in all three sides (76/225 for three sides of 75 maxillary molars) were type A and 149 (66.2%) in all three

Table 1: Individual mean root trunk lengths and related parameters in maxillary arch.

Tooth and its numbering	Descriptive Parameters	Region/ Area of root trunk			Total
		Mesial aspect	Buccal aspect	Distal aspect	
Maxillary right first molar (16)	Mean±S.D.	4.45±1.18	3.68±1.18	4.09±1.32	22
	Median	4.8	3.31	3.64	
	Minimum	2.06	2.48	1.13	
	Maximum	5.79	5.95	6.78	
	S.E.M	0.25	0.25	0.28	
Maxillary left first molar (26)	Mean±S.D.	4.14±0.83	3.69±0.89	4.05±1.09	16
	Median	4.06	3.61	4.34	
	Minimum	3.09	2.50	1.97	
	Maximum	5.74	5.18	5.43	
	S.E.M	0.21	0.22	0.27	
Maxillary right second molar (17)	Mean±S.D.	6.24±0.86	5.85±2.14	7.07±0.76	5
	Median	6.37	6.21	6.91	
	Minimum	5.38	3.62	5.96	
	Maximum	7.33	7.89	7.78	
	S.E.M	0.38	0.95	0.34	
Maxillary left second molar (27)	Mean±S.D.	6.12±2.02	4.79±1.40	4.61±1.21	32
	Median	5.93	4.45	4.20	
	Minimum	1.80	2.04	2.26	
	Maximum	11.02	7.65	7.67	
	S.E.M	0.36	0.25	0.21	
Total					75

S.D. = standard deviation; S.E.M. = standard error of mean.

Table 2: Individual mean root trunk lengths and related parameters in mandibular arch.

Tooth and its numbering	Descriptive Parameters	Region/ Area of root trunk		Total
		Lingual aspect	Buccal aspect	
Mandibular left first molar (36)	Mean±S.D.	4.02±2.17	3.67±2.03	47
	Median	3.82	3.50	
	Minimum	0.81	0.95	
	Maximum	11.15	8.96	
	S.E.M	0.32	0.29	
Mandibular right first molar (46)	Mean±S.D.	4.12±1.65	3.77±1.57	57
	Median	4.11	3.88	
	Minimum	1.17	0.90	
	Maximum	8.27	9.26	
	S.E.M	0.22	0.21	
Mandibular left second molar (37)	Mean±S.D.	4.01±2.24	3.85±2.04	62
	Median	3.81	3.52	
	Minimum	0.95	0.70	
	Maximum	11.09	9.49	
	S.E.M	0.28	0.26	
Mandibular right second molar (47)	Mean±S.D.	3.89±1.71	3.69±1.95	63
	Median	3.95	3.68	
	Minimum	0.95	1.02	
	Maximum	8.90	11.09	
	S.E.M	0.22	0.25	
				229

sides (149/225 for three sides of 75 maxillary molars) were type B (Table 5). For mandibular molars 201 (43.9%) in all two sides (201/458 for two sides of 229 mandibular molars) were type A and 257 (56.1%) in all two sides (201/458 for two sides of 229 mandibular molars) were type B (Table 5). Among mandibular molars, in 11 (4.8%) there was difference in type of root trunk, in rest of mandibular teeth both sides had similar type.

Table 3: Root trunk lengths in first and second molars.

Tooth and its numbering	Descriptive Parameters	Region/ Area of root trunk (mm)			Total
		Mesial aspect	Buccal aspect	Distal aspect	
Maxillary first molars (16 and 26)	Mean±S.D.	4.32±1.05	3.68±1.06	4.08±1.22	38
	S.E.M	0.17	0.17	0.19	
Maxillary second molars (17 and 27)	Mean±S.D.	6.13±1.89	4.93±1.53	4.94±1.43	37
	S.E.M	0.31	0.25	0.24	
					75
			Buccal aspect	Lingual aspect	
Mandibular first molars (36 and 46)	Mean±S.D.	-	3.72±1.78	4.07±1.89	104
	S.E.M	-	0.17	0.19	
Mandibular second molars (37 and 47)	Mean±S.D.	-	3.77±1.99	3.95±1.98	125
	S.E.M	-	0.18	0.18	
					229
Total					304

Table 4: Root trunk type according to arch.

Region/ Area of root trunk		Type A n (%)	Type B n (%)
Maxillary (N = 75)	Mesial aspect	20 (26.7)	55 (73.3)
	Buccal aspect	26 (34.7)	49 (65.3)
	Distal aspect	30 (40.0)	45 (60.0)
Mandibular (N = 229)	Buccal aspect	95 (41.5)	134 (58.5)
	Lingual aspect	106 (46.3)	123 (53.7)

Table 5: Type of root trunks in first and second molars.

Tooth and its number	Root trunk type	Region/ Area of root trunk, n (%)			Total
		Mesial aspect	Buccal aspect	Distal aspect	
Maxillary first molars (16 and 26)	A	13 (34.2)	17 (44.7)	19 (50.0)	38
	B	25 (65.8)	21 (55.3)	19 (50.0)	
Maxillary second molars (17 and 27)	A	7 (18.9)	9 (24.3)	11 (29.7)	37
	B	30 (81.1)	28 (75.7)	26 (70.3)	
					75
	Root trunk type	Lingual aspect	Buccal aspect		Total
Mandibular first molars (36 and 46)	A	54 (51.9)	50 (48.1)		104
	B	50 (48.1)	54 (51.9)		
Mandibular second molars (37 and 47)	A	52 (41.6)	45 (36.0)		125
	B	73 (58.4)	80 (64.0)		
					229

DISCUSSION

The distance from the CEJ to the entrance of the furcation can vary extensively.[7] Treatment of furcation involved teeth are still based largely on basic clinical and radiographic techniques, such as conventional assessment of attachment and bone loss, which have limitations. To achieve better clinical practice, Knowledge of the anatomical and morphological features of roots is necessary.

Handling of extracted teeth requires heat sterilisation prior to use for educational or research purposes according to infection control recommendations.[8] It was stated that autoclaving teeth does not appear to alter their physical properties or dimensions.[9] For infection control purposes, collected teeth were immersed in 10% formalin followed by washing with normal saline. Debris was removal by using hand scalers. Allocation of references point and CEJ was done by fine pencil. Minimum root trunk length measured was 0.81 mm and maximum of 11.15 mm was noted in mandibular first molars (Tables 1, 2).

As a general rule, the first molar has a shorter root trunk than the second molar which is consistent in this study with maxillary molar and not with mandibular molars. This may due to asymmetrical sample between maxillary and mandibular molars. In the first molar the mesial furcation entrance is located about 3 mm from the CEJ, while the buccal is 3.5 mm and the distal entrance about 5 mm apical of CEJ.[10] In this study mesial furcation is located at 4.32 mm, while buccal is located at 3.68 mm and distal is located at 4.08 mm.

The furcation entrances of the mandibular first molar, similar to those of the maxillary first molar, are located at different distances from the CEJ. Thus, the lingual entrance is frequently found more apical of CEJ (>4 mm) than the buccal entrance (>3 mm).[10] Similarly, in this study, buccal furcation is located at 3.75 mm and lingual at 4 mm.

Similar study has shown mean mesial trunk length of 4.98 mm, distal of 4.31 mm and buccal of 3.97 mm in maxillary molars and for mandibular molars, 3.75 mm buccal and 4.31 mm lingual trunk.[11]

The maximum height of root trunk for mandibular and maxillary molars was the 6.6 mm, and 7.8 mm respectively.[11] Dunlap and Gher (1985)[12] found no tooth had a root trunk longer than 6.0 mm on maxillary first molars. Maximum root trunk length was 11.02 mm for maxillary and 11.15 for mandibular molars.[13] Long root trunk have negative influence on the success of periodontal therapy.

This study showed no root trunk with type C. Similar finding in mandibular molar has been found in other study.[11] For maxillary molars, type C was found in 3.3% and types A and B accounted for 34.9% and 61.8% of maxillary molars; 62.5% and 37.5% of mandibular molars.[11]

Mean root trunk length is found to be lower in buccal aspect compared to mesial and distal aspect in case maxillary molar and mean buccal root trunk length is less than mean lingual root trunk which is similar to study done by Dababneh et al. (2011).[11] Greater percentage of root trunk type C which comprises 11.9% in maxillary first molar and 1% in mandibular first molars was present.[4] But in this study 277 (40.5%) were type A and 406 (59.4%) were type B (Tables 4, 5). For maxillary molars 76 (33.8%) in all three sides (76/225 for three sides of 75 maxillary molars) were type A and 149 (66.2%) in all three sides (149/225 for three sides of 75 maxillary molars) were type B. For mandibular molars 201 (43.9%) in all two sides (201/458 for two sides of 229 mandibular molars) were type A and 257 (56.1%) in all two sides (201/458 for two sides of 229 mandibular molars) were type B. Among mandibular molars molars, in 11 (4.8%) there is difference of type of trunk. A furcation-involved molar with a long root trunk and short roots may not be a candidate for root resection, since these teeth lose more periodontal support with furcation involvement.[3] The limitations of this study were intraexaminer variability could have occured and it was a single centre study.

CONCLUSIONS

The slight variation in root trunk length has been found in current study population as compared to other study may help treatment and prognosis of furcation involved tooth. The distance from the cementoenamel junction to the entrance of the furcation can vary extensively.

ACKNOWLEDGEMENTS

The authors would like to thank the interns of Kathmandu Medical College, Dental Programme and patients whose teeth were utilised for this study.

Conflict of interest: None.

REFERENCES

1. Dannewitz B, Krieger JK, Hu¨sing J, Eickholz P. Loss of molars in periodontally treated patients: a retrospective analysis five years or more after active periodontal treatment. J Clin Periodontol. 2006;33:53-61.
2. Hirschfeld L, Wasserman B. A long-term survey of tooth loss in 600 treated periodontal patients. J Periodontol. 1978;49(5):225-37.
3. Al-Shammari KF, Kazor CE, Wang HL. Molar root anatomy and management of furcation defects. J Clin Periodontol. 2001;28(8):730-40.
4. Hou GL, Tsai CC. Types and dimensions of root trunk correlating with diagnosis of molar furcation involvements. J Clin Periodontol. 1997;24(2):129-35.
5. Kerns DG, Greenwell H, Wittwer JW, Drisko C, Williams JN, Kerns LL. Root trunk dimensions of five different tooth types. Int J Periodont Restor Dent. 1999;19(1):82-91.
6. Cobb CM. Non-surgical pocket therapy: Mechanical. Ann Periodontol. 1996;1(1):443-90
7. Newmann and Carranza, Clinical Periodontology 13th edition, Philadelphia, PA 19103-2899, Elsevier, 2015.
8. Kohn WG, Collins AS, Cleveland JL, et al. Guidelines for infection control in dental healthcare setting-2003. MMWR Recomm Rep. 2003;52(RR-17):1-61.
9. Parsell DE, Stewart BM, Barker JR, Nick TG, Karns L, Johnson RB. The effect of steam sterilisation on the physical properties and perceived cutting characteristics of extracted teeth. J Dent Educ. 1998;62:60-3.
10. Lindhe J. Clinical Periodontology and Implant Dentistry 4th edition, 9600 Garsington Road, Oxford OX4 2DQ, UK, Blackwell Publishing Ltd, 2003,706.
11. Dababneh R, Samara R, Abul-Ghanam MA, Obeidat L, Shudifat N. Root trunk: Types and dimension and their influence on the diagnosis and treatment of periodontally involved first molars. Journal of The Royal Medical Services. 2011;18(1):45-51.
12. Dunlap RM, Gher ME. Root surface measurements of the mandibular first molar. J Periodontol. 1985;56(4):234-8.
13. Horwitz J, Machtei EE, Reitmeir P, Holle R, Kim TS, Eickholz P. Radiographic parameters as prognostic indicators for healing of class II furcation defects. J Clin Periodontol. 2004;31(2):105-11.