LUPINE PUBLISHERS

Modern Approaches in Dentistry and Oral Health Care

DOI: 10.32474/MADOHC.2021.05.000202

ISSN: 2637-4692

Research Article

Types and Dimensions of Molar Root Trunk Correlated with Molars Affected Class III Furcation Involvement in Taiwanese

Guey-Lin Hou*[1, 2]

[1]*Department of Periodontics, and Graduate Institute of Dental Science, Kaohsiung Medical University, Kaohsiung, Taiwan*

[2]*Department of Periodontal & Prosthetic Therapeutic Center & Chairman, Chang-Gung Memorial Hospital, Kaohsiung City, Taiwan*

***Corresponding author:** Guey-Lin Hou, Former Professor, Graduate Institute of Dental Science, Department of Periodontics, Kaohsiung Medical University, Taiwan

Received: October 07, 2021 **Published:** October 20, 2021

Abstract

The purpose of the present study was to investigate the correlation of the types and dimensions of molar root trunk with Class III furcation involvement (FI) with periodontal attachment loss (PAL). The extracted teeth (169) consisted of maxillary (103) and mandibular (66) first and second molars with a final diagnosis of severe advanced periodontitis (class III FI and alveolar bone loss ≧70%) were extracted and preserved in Formalin solution and used in the present study. The root trunk length (RTL) and root length were measured using the Electronic Caliper Micrometer (ECM). The assessments of the PAL of the extract molars were taken under a stereomicroscoper equipped with micrometer scale. The clinical records including patient's age, gender, degree of FIs and root trunk type (RTT), molar location, furcation site, and number of extracted molars. Collected data were analysed using the chi-square test and one-way ANOVA**.**

Results showed that significant relationships were listed as follows:

a) between the molar location and prevalence of extracted molars ($p<0.001$);

b) between RTT and molar location ($p<0.001$), and furcation sites ($p<0.05$);

c) between RTT and PAL ($f = 4.32$, $p<0.05$).

It was concluded that the prevalence of the molar extraction and PAL is associated with increasing length of root trunk affected with the Class III molar FI.

Keywords: RTT; PAL; Molar FI; RTL; ECM; PAL

Introduction

Diagnosis, treatment plan, and prognosis of molar furcation involvement (FI) are one of the most challenging problems. The primary reason is due in part to the complexity of furcation entrance dimension (FED), root divergent angle (RDA), and degree of root separation, molar root fusion. Early studies have documented that the variations in molar root morphology may be regarded as a beneficial factor favor the development of localized periodontal problems by providing an environment favorable to plaque retention [1-3]. The shape, length, and number of molar roots are generally capable of affecting the anchorage and stability of molars to a significant degree. Although, molars with long root trunk are not easily to develop FI when compared to those molars with short root trunk, periodontal problems such as more and more attachment loss and resultant molar loss which may occur when such molars with Type B as Type C root trunk developed in Class III FI [4]. Based on the earlier study on the types, dimension, distribution, and prevalence of root trunks together with a molar FI classification included assessment and correlating the relatiohship of varing degrees of root trunk with horizontal and vertical attachment loss [4]. These data of RTT and dimension and respective periodontal attachment level may be developed as an aid in diagnosing the Class III FI and respective PALs. Our earlier report also showed that different dimension of buccal root trunk (BRT), mesial root trunk (MRT), and distal root trunk (DRT) of maxillary molars as well as in BRT and lingual root trunk (LRT) of mandibular molars may be useful in assessing the diagnosis of through and

through FI. Limited information, regarding types and dimensions of root trunk correlated with the periodontal attachment loss (PAL) with Class II and III FIs, is available. The purpose of the present study was to investigate the correlation of PAL and the types and dimensions of root trunk with Class II FI.

Methods and Materials

Samples

The study samples consisted of a total 169 maxillary (103) and mandibular (66) first and second molars were extracted due to the final diagnosis of hopeless teeth with severe advanced periodontal destruction and with Class III molar furcation involved and alveolar bone loss ≧70% in a group of individuals. The subjects included males and females, 24 to 84 years of age, with a mean age of 47.8±7.2 years. The subjects were collected among individuals treated in the Kaohsiung Medical University, Department of Periodontics for periodontal therapy. The molars collected had not restored with crown or bridge or otherwise damaged so as to prevent an exact assessment of vertical dimensions of root trunk and root length. The extracted molars were washed in a tap water, and tooth type determined subsequently, the collected examples were fixed in formalin solution after hard root deposits are also removed with curettage and ultrasonic scaling.

Measurement of samples (Vertical dimension of molar root trunk)

The vertical dimensions of the root trunk and root length were measured with an ECM (NSK, Max-Caliper, Japan Micrometer, MFG Co. Ltd.) and the means and standard deviations calculated. Measurements of the maxillary molars included the vertical height of the BRT, MRT, and DRT, as well as the molars included the BRT and LRT, respectively. The type of root trunk classified according to the ratio of root trunk height to root length in Types A, B, and C, which was reported earlier [4].

Samples consisted of 169 hopeless permanent molars (103 maxillary and 66 mandibular molars) which were diagnosed as having severe advanced periodontitis, with a Class III molar FI (Figure 1) and alveolar bone loss ≧70% and with a failure of repeated periodontal therapy following radiographic examination.

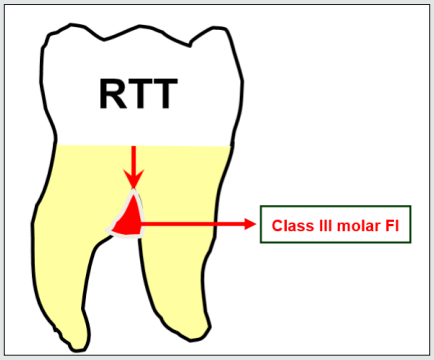

Figure 1: Indicates Root trunk type (RTT) of molars affected class III furcation involvement (FI).

The measurements of PAL

Clinical records including patient's age, gender, grades of RTT, FI, FED (defined three groups 1,2, and 3 as FED < 0.55 mm, 0.55-0.75mm, and > 0.75mm) (Figures 2, 3, 4) the PAL for the intra-furcations on the maxillary molar roots, as well as buccal, and lingual intra-furcations on the mandibular molar roots, were made after extraction. Routine periapical radiographic examinations were taken on molars to ensure the degree of FIs. The PAL of 168 isolated molars with Class III accounted for 70% as more by using the stereomicroscopic examination equipped with micrometer scale. Measurements of true attachment loss were taken by methylene blue staining after molar extraction. The classification of Root trunk types A, B, and C was employed as the three grading system which was published earlier [4].

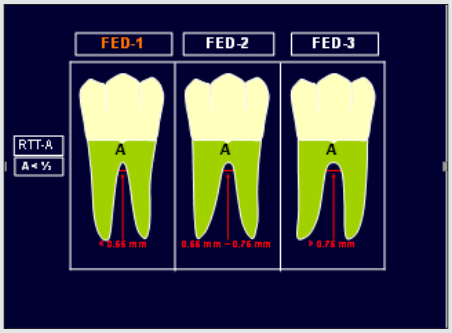

Figure 2: Illustrates the relationships between RTT- A and FED.

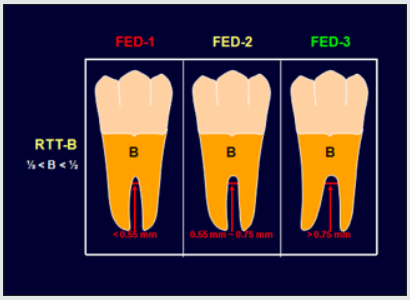

Figure 3: Indicates the relationships between RTT- B and FED.

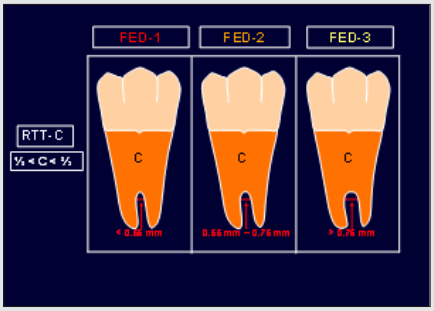

Figure 4: Indicates the relationships between RTT- C and FED.

Statistical Analysis

The relationship between the RTTs and molar location, furcation sites among maxillary and mandibular molars were analyzed using chi-square test. The mean values and standard deviations between type, dimensions of molar root trunk among maxillary and mandibular molars were also calculated. The correlation of the root trunk types with respect to the molar location, furcation site, and PAL was analyzed by one-way ANOVA.

Results

The prevalence, number and location of 169 extracted hopeless molars with Class III FI were illustrated in Table 1. Of the 169 molars examined, extracted hopeless teeth occurred most frequently in maxillary second (34.3%) and mandibular first (31.4%) molars as compared to maxillary first (26.6%) and mandibular first (7.7%) molars. The chi-squre test with equal proportions reveals a significant relationship between molar location and number of molars extracted (t = 29.0, p<0.001). Table 2 showed the prevalence and location of root trunk types A, B, and C in extracted hopeless molars with Class III FI and bone loss ≧ 70%. Among 309 maxillary molar furcations (103 molars) examined, 140 and 133 had Type C and Type B root trunks, giving a prevalence of 45.3% and 43%, respectively. While the remaining 11.7% was Type A root trunk. In the 66 mandibular molars with 132 furcations, the majority of extracted hopeless molar furcation were affected with Type C root trunk (46.9%), followed by 31.1% with Type B and 11.3% with Type A, respectively. Out of 132 molar furcations, the majority of extracted hopeless molar furcations were affected with Type C (46.2%; 61/132) and B (25%; 33/132) root trunks in the mandibular second molar. The remaining 19.7% (26/132) had lower pre- valence of Type A (12.9%; 17/132), B (6%; 8/132) and C (0.8%; 1/132) in the mandibular first molar when compared to the second molar. Result revealed that a significant relationship between the molar root trunk type and molarlocation (X_6^2 = 93.67, p<0.001, DF= 6) by using the chi-square test. (Table 2) The comparison of the prevalence in the root trunk Types A, B, and C on the furcation sites of buccal, mesial, distal, and lingual furcations was listed in Table 3. The highest prevalence of root trunk type A (53.03%) is located at the buccal furcation, follow by lingual (19.7%), distal (15.15%), and mesial (12.12%) furcation, res- pectively. In addition, the highest prevalence of root trunk types is at the buccal furcation of type A (53.03%) follow by types B (37.92%) and type C (33.83%). There exists a significant relation- ship between molar location and root trunk type (X_6^2=14.25, p<0.05) (Table 3).

Table 1: illustrated prevalence, distribution and location of extracted hopeless molar affected with Class III furcation involvement.

Molar Location	Total no.	Total %	Uniform* Distribution (%)	Chi-square test
16 & 26	45	26.6	25	
17 & 27	58	34.3	25.5	t = 29.04
36 & 46	13	7.7	25	
37 & 47	53	31.4	25	P <0.0001
Total	169	100	100	

Table 2: showed prevalence, distribution of root trunk types A, B, and C in the extracted hopeless molars affected with Class III furcation involvement.

Molar Location	Type A N (%)	Type B N (%)	Type C N (%)	Total n	Chi-square test
16 & 26	24(7.8)	74(23.9)	37(12.0)	135	
17 & 27	12(3.9)	59(19.1)	103(33.3)	174	t = 93.67
Total	36(11.7)	133	140(45.3)	309	P <0.001
36 & 46	17(12.9)	8(6.1)	1(0.8)	26	
37 & 47	12(9.1)	33(25.0)	61(46.2)	106	
Total	29(22.0)	41(31.1)	62(46.9)	132	

Table 3: indicated the relationship between the prevalence of root trunk types and furcation sites of buccal, mesial, distal, and lingual surfaces.

BF: buccal furcation; DF: distal furcation; LF: lingual furcation; MF: mesial furcation; RTT: root trunk type.

Molar Location	n	RTT Type A n (%)	RTT Type B (%)	RTT Type C (%)	Chi-square test test
BF	169	35(53.03)	66(37.92)	68(33.83)	
DF	103	10(15.15)	45(25.86)	48(23.88)	t = 14.25
LF	66	13(19.70)	25(14.37)	28(13.93)	P <0.05
MF	103	8(12.12)	38(21.84)	57(28.36)	
Total	441	66	174	201	

Table 4: demonstrated the comparisons of root trunk length (RTL) among types A, B, and C root trunks in 169 extracted hopeless molars with Class III FI.

RTL: Root Trunk Length; M: mean: SD: Standard Deviation; n: teeth numbers; *: one root trunk only

Molar Location	n	Type A RTL(M±SD)	Type B RTL (M±SD)	Type C RTL (M±SD)
16 & 26(45)	135	3.15(0.57)	4.76(0.70)	6.29(1.04)
17 & 27(58)	174	3.12(0.58)	4.55(0.82)	7.81(2.41)
36 & 46(13)	26	2.83(0.83)	4.62(1.14)	5.49*(-)
37 & 47(53)	106	3.19(0.71)	4.88(0.76)	9.22(3.13)
Total (169)	441	66	174	201

Table 4 indicates the mean values and the ranges of the types of root trunk A, B, and C relative to the vertical dimensions of the root trunk in 169 extracted hopeless molars with Class III FI. A greatest mean vertical dimensions of the root trunk were noted on the mandibular second (9.22±3.13mm), followed by the maxillary second(7.8±2.41mm), and maxillary first (6.29±1.04mm) molars of the type C root trunk; followed by Type B root trunk (4.55±4.88mm) and least in Type A root trunk types(2.83±3.19mm).

Discussion

Of the 169 hopeless extracted molars with Class III FIs, and ABL≧70%, the greatest prevalence of molars extracted most commonly observed on the maxillary second (17 & 27; 34.3%) and the mandibular second (37 & 47; 31.4%) molars, followed by the maxillary 1st molars (16 & 26; 26.6%) and least in the mandibular first molars (36 & 46; 7.7%) (Table 1). Based on the data suggests that relatively significant higher prevalence of extracted hopeless molars seems associated with the second molars as compared to the first molars (t=29.0, p< 0.0001) (Table 1). This finding appears to be consistent with those hopeless extracted molars with the long root trunk, especially molars with Type C. (Figure 4) Limited information regarding to the relationship between root trunk type, and molar location in Taiwanese is available. The present data is the first report in Taiwan. The present results also show that the majority of extracted hopeless molar furcations were affected with root trunk types C and B in both maxillary second (33.3% and 19.1%) and mandibular second (46.2% and 25.0%) molars when compared to the root trunk type A (3.9% and 9.1%, respectively). (Table 2) Statistical analysis revealed that a strongly significant relationship between molar root trunk type and molar location (X_6^2 = 93.67, p<0.001). (Table 2) It suggests that the majority of the extracted hopeless molars examined had relatively higher prevalence in the molar root trunk type C (50.8%) and B (33.9%) than the type A root trunk in the maxillary and mandibular second molars. In addition, the prevalence of type C root trunk affected more frequently in the second molar (50.8% and 30.4%) as compared to the first molar (18.4% and 0.5%).

Little or limited data about the relationship between the molar location and classification of molar root trunk for the individuals with severe advanced periodontitis is available. The result of the present study is in accordance to earlier report [4]. Little or no report regarding the relationship between the length of molar root trunk and associated PAL is reported. Most former reports do not addressed the extent and degree of molar FI associated with the dimensions and types of root trunk, especially molars with the presence of Class III. The present data for the % of the PAL associated RTL could contribute to understanding the relationship between the PAL and the RTL. It suggests that the higher length of root trunk probably correlate with more PAL when molars affected with Class III FI. The comparison of tha prevalence in the root trunk Types A, B, and C on the furcation sites of buccal, mesial, distal, and lingual furcations was listed in Table 3. There exists a significant relationship between molar location and root trunk type (X_6^2 =14.25, $p<0.05$).

Limited report regarding the prevalence of the root trunk types A, B, and C affecting the furcation sites at the buccal, mesial, distal, and lingual furcation was presented. Statistical analysis shows a significant relationship between molar root trunk types and associated with furcation sites (X_6^2 =14.25, $p<0.05$) (Table 3). The present study showed that the majority of the extracted hopeless molars with type C root trunk were more common observed buccally (33.8%) and mesially (28.4%) than distally (23.9%) and lingually (13.9%). (Table 3) In 1994, we addressed a detail morphological description and provide a grading system of molar root trunk based on the extracted molars, which was collected from adult individuals treated in local dental clinics (LDC). In contrast to the type C root trunk, type A root trunk was more commonly found on the buccal furcation (53.0%) than on the distal (15.2%), lingual (19.7%) and mesial (12.1%) furcation (Table 3). There exists a relative higher prevalence of molars affected with root trunk type C between the extracted molars collected from LDC. In the present study, a relative higher prevalence of extracted molars (maxillary and mandibular second molars: 50.8% and 30.4%, respectively) affected with type C root trunk, was found in the periodontal clinics of teaching hospital, as compared to those LDC (18.4% and 9.3%), respectively) [4]. This data suggested that the occurrence of the long root trunk probably got more potential risk for tooth loss than short root trunk when molars affected with Class III FI.

The degree of vertical attachment loss and the length of root trunks are very significant factors in the diagnosis of molar FI [4-7]. Limited or little information regarding the vertical length of root trunk is documented earlier. The root trunks were identified by the ratio of root trunk length to root length and classified into types A, B, and C as described earlier [4]. On monitoring the variation of the first and second molars with vertical length of root trunks, it is evident that the mean values of associated types A, B, and C root trunk (involving the cervical third, the cervical half, and the cervical two-thirds of root length) can be identified via the periapical radiograph. In addition, the understanding of the mean values of RTL and RL probably enable investigator to assess the relationship between the RTL and RL and associated molar FI and to contribute to realizing the approximate levels of the PAL or alveolar bone supported remaining root or remaining root in bone. Result also indicates the mean values and the ranges of the types of root trunk A, B, and C relative to the vertical dimensions of the root trunk in 169 extracted hopeless molars with Class III FI (Table 4). A greater mean vertical dimensions of the root trunks were noted in maxillary second(7.81±2.41mm) and mandibular second (9.22± 3.13mm) molars, respectively, in the Type C root trunk; followed by Type B root trunk (4.55±0.82mm) and (4.88±0.76mm) and least in Type A root trunk types(2.83±0.83mm) and (3.12±0.58mm), respectively. Based on the present data, a greater mean values of vertical dimension of type C root trunk (#37 & #47= 9.22 mm; #17& #27=7.81 mm) seems to suggest that the longer the molar root trunks; the poor prognosis the molars affected with Class III FI.

References

1. Hou GL, Tsai CC (1997) Cervical enamel projection and intermediate bifurcational ridge correlated with molar furcation involvements. J Periodontol 68(7): 687-693.
2. Hou GL, Tsai CC, Huang JS (1997) Relationship between molar root fusion and localized periodontitis. J Periodontol 68(4): 313- 319.
3. Hou GL, Tsai CC (1987) Relationship between periodontal furcation involvement and molar cervical enamel projection. J Periodontol 58(10): 715- 721.
4. Hou GL, Tsai CC (1997) Types and dimensions of root trunk correlating with diagnosis of molar furcation involvements. J Clin Periodon- tol 24(2): 129- 135.
5. Tal H (1982) Relationship between the depth of furcation defects and alveolar bone loss. J Periodontol 53: 631-634.
6. Gher MW, Dunlap RW (1985) Linear variation of root surface area of the maxillary first molar. J Periodontol 56(1): 39-43.
7. Herman DW, Gher ME, Dunpal RM, Pelleu GB (1983) The potential attachment area of the maxillary first molar. J Periodontol 54(7): 431-434.

DOI: 10.32474/MADOHC.2021.05.000202