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Root trunk height of maxillary and mandibular permanent first molars in Iraqis (a pilot study)

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Abstract

Although the Root Trunk Height (RTH) as a variable in different racial groups was extensively studied, but its relation to the presence and absence of other anatomical abnormalities as Cervical Enamel Projection (CEP) never been tested. On the other hand, data focused on this variable in our community are not available. So the aim of this pilot study is to provide a base line data on this important anatomical variable (RTH) in our community and to calculate its possible correlation to the presence of (CEP). In this study (242) extracted permanent molars (126 maxillary first molar and 116 mandibular first molar) were collected from the dental clinics of Al-Mustansiriya teaching hospital /college of dentistry. RTH for each tooth was measured and presence of CEP was recorded. Results of this research showed that that mean values of RTH of permanent first molars in Iraqis were comparable with that found in other countries. On the other hand, there is a highly significant relation between the RTH and presence of CEP on buccal and mesial aspects of maxillary first molar and buccal aspect of mandibular first molar, while this relation is not significant on distal aspect of maxillary first molar and lingual aspect of mandibular first molar.

Key words: root trunk, furcation involvement, enamel projections.

Introduction

A thorough knowledge of tooth anatomy including root form and root anatomy with the understanding of the potential for variations from the norm is essential for the successful outcome of the dental and periodontal treatment procedures [(1)]. Root complex as it defined in the literature is the portion of a tooth that is located apical of the cemento-enamel junction (CEJ), i.e. the portion that normally is covered with a root cementum. The root complex may be divided into two parts: the root trunk and the root cone(s). The root trunk represents the undivided region of the root. The height of this root trunk is defined as the distance between the CEJ and the separation line (furcation) between two root cones (roots). Depending on the position of the separation line the height of the root trunk may vary from one surface to another in one given molar or some times premolar [(2)] .So that teeth may have very short root trunks, moderate length trunks and very long trunk in which the roots may be fused to a point near the apex [(3)].

In 1988, Hou et al developed a classification scheme that takes into

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account the length of root trunk compared to total root length. Type **A** has the shortest root trunks, involving a third, or less, of cervical area of the root. Type **B** root trunks include up to half of the length of the root, while in type **C** the furcation entrance is in the cervical two-thirds. This system can give a more realistic prognosis for the tooth, as it takes into consideration the vertical as well as the horizontal component of the attachment loss[4].

The combination of root trunk length with the number and configuration of the roots affects both the ease and success of therapy in cases of furcation involvement [5 - 7]. The shorter the root trunk, the less attachment has to be lost before the furcation is involved. On the other hand, once the furcation is exposed, teeth with short root trunks may be more accessible to maintenance procedures and the short root trunks may facilitate some surgical procedures. Alternatively teeth with unusually long root trunks or fused roots may not be appropriate candidates for treatment [8].

Large number of researches was carried out to study these important anatomical variables and to explore out their significance in relation to various aspects of periodontal therapy. As an example, in a study of mandibular first and second molars, the researcher reported that the mean root trunk length was 3.14 mm on the buccal aspect, and 4.17 mm on the lingual aspect [9]. In another study they found that the root trunk surface area for mandibular and maxillary molars averages 31% and 32% of the total root surface area respectively [10, 11]. Therefore, horizontal attachment loss leading to furcation invasion compromises the root trunk resulting in the loss of one third of the total periodontal support of the tooth [12, 13].

Anatomical landmarks associated with the root trunk as the cervical enamel projections CEP, the root trunk irregularities and grooves were also investigated and their relation to the outcome of periodontal treatment was also explored [14 - 17]. As an example De Los et al studied the concavity on the root trunk region (root trunk groove) of the lower second molar and they found that its depth and width were greater on the buccal surface and its length was greater on the lingual surface. The also found that the depth of that root trunk groove increased in the apical direction, with maximum depth in the last millimeter of the root trunk. The root trunk was longer on the lingual surface than it was on the buccal surface [18].

Although the RTH and cervical morphology as variables in different racial groups was also studied [19 - 21], but their relation to the presence and absence of other anatomical abnormalities as CEP never been tested. On the other hand, data focused on this variable in our community are not available. So the aim of this pilot study is to provide a base line data on this important anatomical variable (RTH) in our community and to calculate its possible correlation to the presence and absence of (CEP).

Materials and methods

The material of the study consisted of (242) extracted permanent molars (126 maxillary first molar and 116 mandibular first molar). The sample was collected from the dental clinics of Al-Mustansiriya teaching hospital / college of dentistry.

The soft tissues and debris were removed from the teeth by boiling them in water for 30 minutes and then they were soaked in 6% solution of sodium hypochlorite for 48 hours. Then they were stored in a solution of

equal parts of glycerin and 3% hydrogen peroxide. Before examination and recording the parameters, the teeth were brushed with a soft tooth brush to remove any residual debris and then left to dry.

Reference points and demarcations were determined on the entrance of the buccal, mesial and distal furcations for the maxillary first molars and the same procedure was applied for buccal and lingual furcations on the mandibular first molars. A high magnifying lens was used for a good visualization during examination and measurement. Presence and absence of cervical enamel projections (**CEP**) were assigned for each tooth and an orthodontic vernier was used to measure the distance between the reference points (which represent the entrance of the furcation areas) and the closer points of cemento-enamel junction; this distance (in millimeters) represents the height of the root trunk (**RTH**). Data then analyzed using SPSS system installed on Fujitsu Siemens laptop.

Results

In general, results of this research showed that the mean values of RTH for the permanent maxillary first molars were: 3.614 mm, 4.646 mm and 4.252 mm on buccal, mesial and distal aspects respectively. While for the permanent mandibular first molars these means were: 3.130 mm and 3.980 mm on buccal and lingual aspects respectively Table (1).

For the permanent maxillary first molars, the results showed that the smallest means of RTH were recorded on the buccal aspect (3.322 mm with CEP & 3.896 mm without CEP) and largest mean values were recorded on the mesial aspect (4.50 mm with CEP & 4.785 mm without CEP) while the values of this mean on the distal aspect was intermediate between these two values (4.28 mm with CEP & 4.23 mm without CEP) Table (2).

On each individual aspect, the results showed that the means of RTH on both buccal and mesial aspects were smaller when associated with the presence of CEP than without. This difference was highly significant according to (2 tailed t-significant test). On distal aspect there are no significant differences in RTH means associated with the presence of CEP. Table (3)

For the permanent mandibular first molars, the results showed that smaller means of RTH were recorded on the buccal aspect (3.054 mm with CEP & 3.272 mm without CEP) than means that were recorded on the lingual aspect (3.972 mm with CEP & 4.00 mm without CEP) Table (4).

On each individual aspect, the results showed that the means of RTH on buccal aspects were smaller when associated with the presence of CEP than without. And again this difference was highly significant according to (2 tailed t-significant test). On lingual aspect there are no significant differences in RTH means associated with the presence of CEP Table (5).

Discussion

Importance of this study can be summarized by two points; 1) It was the first study in its subject in our community, so it provided the base line data about RTH in Iraq. 2) It may be the first or one of the first few worldwide researches that study the correlation between the RTH and the CEP.

Results of this study revealed that mean values of RTH of permanent first molars in Iraqis were comparable with that found in other countries [5, 9]. However more studies are required to document these findings or to study the

possible relations between the RTH and the other anatomical abnormalities that may relate to the furcation area as inter radicular ridges or even the abnormal morphology of furcation area itself.

Formation of CEP during tooth development may tend to stretch the extremities of the root trunk area. This hypothesis may provide a good explanation for the shorter RTH that associate with the presence of CEP. The highly significant relation between the presence of CEP and the shorter RTH on buccal and mesial aspects of maxillary first molars and buccal aspect of mandibular first molar can be explained by the more frequent occurrence of CEP on these surfaces compared by the distal aspects of maxillary first molars and lingual aspects of mandibular first molars where the relation was not significant.

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Table (1) Distribution of RTH means by tooth types and surfaces

Tooth	Surface	Means in mm
Maxillary first molar	Buccal	3.614
	Mesial	4.646
	Distal	4.252
Mandibular first molar	Buccal	3.130
	Lingual	3.980

Table (2) Paired Samples Statistics for permanent maxillary first molar

Tooth surface	Mean	Number	Std. deviation	Std. Error Mean
Buccal*	3.3226	62	.21985	.02792
Buccal	3.8968	62	.30243	.03841
Mesial*	4.5065	62	.43977	.05585
Mesial	4.7855	62	.46548	.05912
Distal*	4.2806	62	.33527	.04258
Distal	4.2306	62	.26771	.03400

(*) indicate the presence of CEP

Table (3) Paired Samples test for permanent maxillary first molar

Tooth surfaces	Mean	Std. Deviation	Std. Error Mean	t	df	Sig(2-tailed)
Buccal* - Buccal	-.57419	.40849	.05188	-11.068	61	.000 (HS)
Mesial* - Mesial	-.27903	.62125	.07890	-3.537	61	.001 (HS)
Distal* - Distal	.05000	.41833	.05313	.941	61	.350 (NS)

(*) indicate the presence of CEP. HS = highly significant. NS = not significant

Table (4) Paired Samples Statistics for permanent mandibular first molar

Tooth Surfaces	Mean	N	Std. Deviation	Std. Error Mean
Buccal *	3.0545	44	.22147	.03339
Buccal	3.2727	44	.33713	.05082
Lingual *	3.9727	44	.39730	.05989
Lingual	4.0045	44	.22094	.03331

(*) indicate the presence of CEP

Table (5) Paired Samples t-test for permanent mandibular first molar

Tooth Surfaces	Mean	Std. Deviation	Std. Error Mean	t	df	Sig(2-tailed)
Buccal* - buccal	-.21818	.36870	.05558	-3.925	43	.000 (HS)
Lingual* - lingual	-.03182	.43604	.06573	-.484	43	.631 (NS)

(*) indicate the presence of CEP. HS = highly significant. NS = not significant.