

Biometric study of the width, length and depth of the root trunk groove of human lower second molars

Estudo biométrico da largura, comprimento e profundidade da pre-furca dos segundos molares inferiores de humanos

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One hundred human lower second molars, 51 from the left side and 49 from the right side, extracted due to their poor clinical and radiographic conditions were utilized in this study. Using a Contracer apparatus, the profiles of the buccal and lingual root surfaces of these teeth were traced on a millimeter-scaled paper. The profiles were registered from the cemento-enamel junction (CEJ), millimeter by millimeter, up to the entrance of the furcation. The width, length and depth of the root trunk groove, as well as the length of the root trunk, were studied. After statistical analysis ($p < 0.05$) it was possible to conclude that: a) the mean width of the root trunk groove on the buccal surface was 3.6 mm and, on the lingual surface, 3.3 mm; b) the mean depth of the root trunk groove on the buccal surface was 0.88 mm and, on the lingual surface, 0.77 mm; c) the mean length of the root trunk groove on the buccal surface was 2.93 mm and, on the lingual surface, 3.61 mm. The mean length of the root trunk on the buccal surface was 3.09 mm and, on the lingual surface, 3.91 mm ($p < 0.025$). There was a coincidence between the length of the root trunk and that of its groove in 90.2% of the buccal surfaces of the samples from the left side, and in 77.5% of the samples from the right side; on the lingual surface, the coincidence occurred in 77.5% of the teeth from the left side, and on 88.3% of the teeth from the right side. This work revealed that there is a concavity on the root trunk region of the lower second molar, whose depth and width were greater on the buccal surface and whose length was greater on the lingual surface. The depth of the 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.

UNITERMS: Furcation defects; Dental pulp cavity; Periodontics; Molar.

INTRODUCTION

Plaque control, which is usually a difficult procedure, is even more so in the furcation area²⁴. GHER; VERNINO¹⁰ (1980) described the anatomy of multi-rooted teeth, and other authors pointed it out as a high-risk factor for periodontal disease^{2,13,15} and therapeutic difficulties¹.

The study of the width and length of the root trunk can reveal important details related to the progression of periodontal disease, its prevention and treatment. An anatomical detail that deserves attention is the flute-shaped depression that can be observed on the buccal and lingual surfaces of human molars. EASLEY; DRENNAN⁸ (1969) and

HEINS; CANTER¹² (1968) described this anatomical characteristic as a root developmental groove on the root trunk. Other authors depicted it a concavity which belongs to the root trunk of the upper and lower first molars and extends vertically in the direction of the furcation^{7,18}. The purpose of this work is to analyze the length of the root trunk, as well as the width, depth and length of the root trunk groove, both on the buccal and lingual surfaces of human lower second molars.

MATERIALS AND METHODS

One hundred human permanent lower second molars, 49 from the right side and 51 from the left

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side, extracted due to their clinical and radiographic poor conditions (hopeless teeth) were utilized in this study. Teeth that showed sound trunks and absence of fused roots were selected. After extraction, the teeth were immersed in a 2% sodium hypochlorite solution for 3 hours in order to facilitate the removal of debris.

In order to assess the profile of the root trunk area, records of the buccal and lingual surfaces of all selected teeth were made by means of a Contracer apparatus. Measurements were carried out from the cemento-enamel junction to the furcation entrance, millimeter by millimeter.

Starting from a line tangent to the most convex points of the surface profile, the measurement of the depth of the root trunk groove was carried out. The values of the width and depth of the groove were obtained on a millimeter-scaled paper. The values were divided by 20, which corresponded to the amplification utilized in the Contracer machine.

The statistical analyses employed were the analysis of variance (F test) and Tukey's test.

RESULTS

The width, length and depth of the root trunk groove and the length of the root trunk of lower second molars are shown in Tables 1 to 3.

The analysis of variance revealed that the values of width, depth and length of the root trunk groove were statistically significant, since the calculated F values for the three measurements were greater than those of the critical F (Table 1). The

TABLE 1 - Lower second molars from the right and left sides - width, depth and length (mm) of the root trunk groove. Values of the analysis of variance (F), critical F and calculated F.

Analysis of variance	Width		Depth		Length	
	Buccal	Lingual	Buccal	Lingual	Buccal	Lingual
n	100	100	100	100	100	100
Mean	3.6	3.3	0.88	0.77	2.93	3.61
Standard deviation	0.93	0.98	0.27	0.24	0.89	0.76
Critical F	5.15		3.92		5.15	
Calculated F	12.75*		7.2*		38.45*	
	p < 0.025		p < 0.05		p < 0.025	

*Statistically significant.

TABLE 2 - Average width and depth (mm) of the root trunk groove, according to the position in relation to the cemento-enamel junction. Tukey's test for 0 x 1 x 2 x 3 x 4 x 5.

Position	Width	Depth
0	2.29	0.18
1	3.29	0.39
2	3.69	0.72
3	3.93]	1.05
4	3.31]	1.26]
5	3.71	1.33]
Tukey	0.23	0.12

p < 0.05; "]" = statistical difference.

average width of the groove on the buccal surface was 3.6 mm, and, on the lingual surface, 3.3 mm. The average length of the groove on the buccal surface was 2.93 mm and, on the lingual surface, 3.61 mm. The analysis of variance regarding the values of width demonstrated that, although the values varied from level zero to level five, the differences found were statistically significant only between levels 3 and 4 (Table 2). As for depth, statistically significant differences were found only between levels 4 and 5 (Table 2).

The values of length pertaining to the root trunk (Table 3) were statically significant since the calculated F values for the three measurements analyzed were greater than those of the critical F. The average length of the root trunk on the buccal surface was 3.09 mm and, on the lingual surface, 3.91 mm.

Table 4 shows that, on left lower second molars, the length of the root trunk and the length of the root trunk groove were coincident in 90.2% of the samples on the buccal surface, and in 77.5% of the samples on the lingual surface. Meanwhile, on the right side, there was coincidence in 77.5% of the samples on the buccal surface, and in 88.3% of the samples on the lingual surface.

DISCUSSION

We did not find in the literature any detailed or scientifically conducted description of the root trunk groove. Some studies simply mention^{10,11,18} this anatomical characteristic. In this research, the registration of data was carried out by means of the Contracer apparatus, which enables high-precision measurements of the concavities and convexities of irregular surfaces. The emplo-

TABLE 3 - Length of the root trunk (mm) of lower second molars on the buccal and lingual surfaces. Values of analysis of variance (F), critical F and calculated F.

Analysis of variance	Buccal	Lingual
n	100	100
Mean	3.09	3.91
Standard deviation	0.9	0.68
Critical F	5.15	
Calculated F	38.76*	

*Statistically significant; $p < 0.025$.

used methodology is efficient due to its precision, speed and facility of execution; therefore, we considered it advantageous in relation to the cross-section technique previously used in other studies^{7,10,11}.

Although there is no special methodology for the study of root trunk grooves, GHER; VERNINO¹¹ (1981) and SVARDSTROM; WENNSTROM¹⁸ (1988) described a concavity which deepened in the direction of the furcation, starting the measurement at the cemento-enamel junction.

GHER; DUNLAP⁹ reported that the beginning of the concavities was found at a distance of 0.7 mm from the cemento-enamel junction on the buccal surface, and at a distance of 0.3 mm from that junction, on the lingual surface. The concavities progressively deepened until they reached the furcation. However, no evaluation has been carried out on their depth and apical extension⁹. We noted that the beginning of the root trunk groove occurred on the cemento-enamel junction in 77.5% to 90.2% of the examined teeth. At the cemento-enamel junction, the average depth of the groove was 0.18 mm and the average width, 2.29 mm. Thus, in our sample, an area of trunk without groove did not exist in the majority of the analyzed teeth, differently from what was observed by the authors mentioned above⁹.

The collected data enabled us to note that, starting from the cemento-enamel junction and heading to the furcation, there was a progressive increase in the width and depth of the root trunk groove, which reached their maximum values in the last millimeter of the root trunk. Although the length of the root trunk groove showed a numerical increase, the variation was statistically significant only between levels 4 and 5. As to the width of the

TABLE 4 - Percentage of coincidence between the length of the root trunk and the length of its groove.

Surface	Side	Coincident	%	Non-coincident	%
Buccal	Left	46	90.2	5	9.82
	Right	38	77.5	11	22.44
Lingual	Left	38	77.5	11	22.44
	Right	45	88.3	6	11.76

root trunk groove, although it progressively increased until the third millimeter of the root trunk length, decreasing between the third and fourth millimeter, there was a statistically significant difference only between levels 3 and 4.

According to GHER; VERNINO¹⁰ (1980), the length of the root trunk of the lower second molar is greater and more variable than that of the lower first molar and, according to BAIMA³ (1986), the further back the position of the tooth in the dental arch, the greater the length of the root trunk. We were able to make some comparisons with the data obtained by GHER; VERNINO¹⁰ (1980). These authors affirmed that the length of the root trunk of the lower first molar on the buccal surface was 3 mm and, on the lingual surface, 4 mm. According to our results, the length of the root trunk of the lower second molar varied from 3 to 5 mm, with an average of 3.09 mm on the buccal surface and 3.91 mm on the lingual surface.

Analyzing our results, there was a statistically significant difference between the buccal and lingual surfaces of lower second molars regarding the width and depth of the trunk – those measures were greater on the buccal surface, in 95% of the cases.

The fact of the root trunk groove being shorter on the buccal surface could be significant considering the greater severity of its exposure on the buccal surface of molars, as it is reported in epidemiological surveys carried out with mandibular teeth^{19,20,21,22}, dry mandibles and crania¹⁴. As it has been discussed by several authors, this greater severity could be related to variations in radicular morphology – the root trunk groove is proportionally larger and deeper on the buccal surface.

We did not find any statistically significant differences between the values obtained for teeth from the left and right sides. Likewise, epidemiological studies carried out with dry mandibles^{20,22} did not

find any statistical differences between the left and right sides, regarding the severity of periodontal disease.

Clinical works and epidemiological surveys have shown that, when compared with other teeth, molars accumulate more plaque^{5,6}, are more prone to extraction⁴, and show worse prognosis^{13,16}. The need for special care to avoid the progression of periodontal disease in molars becomes obvious once we know that there are important predisposing anatomical factors, such as radicular concavities^{6,10,11}.

Considering that the root trunk is responsible for a large percentage of the total area of insertion of molars, and taking into account the previously described features of its groove, with regard to the difficulties of treatment and the presence of plaque-retaining recesses, our efforts should be concentrated on the radicular trunk region. We should have a preventive perspective when the periodontal disease is still restricted to the trunk

area, with its complicating factor, the root trunk groove. We can thereby prevent the disease from reaching an area of high risk, in apical direction, where the treatment and control of dental plaque by the patient is more difficult and sometimes even impossible.

CONCLUSIONS

We can conclude that the width of the root trunk groove was, approximately, 3.5 mm for lower second molars. Therefore, when we probe the root trunk groove and the periodontal pocket depth is greater than 3 mm, we are very close to the furcation entrance; however, we can rarely diagnose it.

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RIOS, C. M. de Los; PUSTIGLIONE, F. E.; ROMITO, G. A. Estudo biométrico da largura, comprimento e profundidade da pré-furca dos segundos molares inferiores de humanos. **Pesqui Odontol Bras**, v. 16, n. 1, p. 26-30, jan./mar. 2002.

Foram obtidos 100 dentes, segundos molares inferiores (51 esquerdos e 49 direitos) extraídos de humanos quando diagnosticados como condenados (extração indicada). Por meio de um aparelho Contracer foram traçados, em papel milimetrado, os perfis das faces vestibulares e linguais dos 100 dentes em estudo. Estes perfis foram registrados a partir do limite amelocementário, de milímetro em milímetro, até que atingíssemos a entrada da furca. Foram realizadas medidas da largura, comprimento e profundidade da região da pré-furca, assim como o comprimento do tronco radicular. Após a análise estatística ($p < 0,05$), conclui-se que: a) a largura da pré-furca, na face vestibular, é de 3,6 mm e na face lingual 3,3 mm; b) a profundidade da pré-furca foi de 0,88 mm na face vestibular e 0,77 mm na face lingual; c) o comprimento da pré-furca na face vestibular foi de 2,93 mm e de 3,61 mm na face lingual. O comprimento do tronco radicular foi de 3,09 mm na face vestibular e de 3,91 mm na face lingual ($p < 0,025$). Houve uma coincidência do comprimento do tronco radicular e da pré-furca em 90,2% da amostra para a face vestibular no lado esquerdo e 77,5% no lado direito; para a face lingual, a coincidência ocorreu em 77,5 % dos casos no lado esquerdo e 88,3% no lado direito.

UNITERMOS: Defeitos da furca; Cavidade da polpa dentária; Periodontia; Molar.

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