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Study of Anatomical Relationship between Posterior Teeth and Maxillary Sinus Floor in a Subpopulation of the Brazilian Central Region Using Cone-Beam Computed Tomography – Part 2

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This study evaluated the anatomical relationship between posterior teeth root apices and maxillary sinus floor (MSF) on 202 cone beam computed tomography (CBCT) exams. The distance between the root apices and the MSF, as well as the MSF thickness of the cortical bone closest to root apices and furcation regions were measured. The vertical and horizontal relationships of the MSF with the molar roots were classified into categories adapted from the criteria proposed by Kwak et al. (14). The shortest distances between MSF and the root apices were observed in the mesiobuccal root of the second molar (0.36±1.17 mm) and the palatal root of the first molar (0.45±1.10 mm) and the widest in buccal roots of the first premolars (5.47±4.43 mm). Significant differences were observed between the distance of MSF to the root apices of single-rooted first and second premolars. The cortical thickness ranged from 0.65±0.41 mm over the mesiobuccal root of the second molar to 1.28±0.42 mm over the buccal root of the first premolar. The most observed vertical and horizontal relationships were type II and 2H, respectively. The maxillary molar roots showed greater proximity to the MSF. The thickness of the MSF cortical bone closest to the apices and furcation regions was found to be similar only for premolars.

Key Words: anatomy, maxillary sinus floor, maxillary sinusitis, periapical lesion, cone beam computed tomography.

Introduction

Infection of the root canal system may spread through the periapical tissues and reach important anatomical structures resulting in several complications. The anatomical proximity of the root apices of the maxillary posterior teeth to the maxillary sinus floor (MSF) may favor the development of inflammatory, infectious and/or traumatic alterations in the maxillary sinus (MS) (1-4). In addition, operative procedural errors during root canal therapy (overinstrumentation, overirrigation and overfilling) and aggressive surgical procedures represent potential risk factors for introduction of foreign material into the MS (5).

The diagnosis of sinus disease of odontogenic origin is not simple, confounding both patient and the medical and dental professionals (6). The most common causes of odontogenic sinus disease are dental abscesses and periodontal disease that perforated the Schneiderian membrane, and irritation and secondary infection promoted by intra-antral foreign bodies and sinus perforation during tooth extraction (7).

Conventional radiographic exams are commonly used in the study of the anatomical relationship between maxillary posterior teeth and the MS. However, these exams have limitations that may jeopardize this analysis (1-3,8,9). Periapical radiographs were unable to determine the risk of perforation of the maxillary sinus floor (MSF) during periapical surgery (8). The limitation resulting from the two-dimensional images prevents the correct interpretation of the periapical lesions relationship with the MSF (9). Periapical and panoramic radiographs offer little accuracy to the morphometric analysis of the relationship of bone structures with teeth (10). The clinical application of cone beam computed tomography (CBCT) as an aid in the diagnosis and planning has contributed to establish effective therapeutic protocols (11-13). The importance of CBCT scans in the analysis of the morphological characteristics of the MS and its relationship with the roots of the maxillary posterior teeth has been shown (10,14-19).

The biological constitution of different populations has a variety of genetic characters, which can determine distinct anatomical and topographical relationships. The anatomical knowledge of the structures that compose the middle and lower thirds of the face, especially the MS and its relation with posterior teeth, is of utmost importance not only for the accurate diagnosis of inflammatory alterations that may be established in both the MS and periapical region, but also for the correct establishment of therapeutic, surgical and rehabilitation plans. Thus, the aim of this study was to evaluate the anatomical relationship between maxillary posterior teeth root apices and the MSF in a subpopulation of the Brazilian central region by CBCT images.

Material and Methods

Study Sample

The present study was performed as a retrospective analysis of CBCT exams selected from the database of a private radiologic center (TCO, Goiânia, GO, Brazil). The inclusion criteria were CBCT exams of the maxilla presenting fully erupted first and second premolars and first and second molars with fully formed apices. Excluded from the study sample were exams presenting image of a device or apparatus of orthodontic retention and presence of external resorption of the root apex, apical periodontitis, bone changes associated with systemic diseases and benign and/or malignant tumors in the posterior area of the maxilla and/or MS.

Two hundred and two CBCT exams met the inclusion criteria and were included in this study. Among the selected participants, 128 were females (63.37%) and 74 were males (36.63%), with a mean age of 40.7 years (range: 15-80 years). One thousand and two-hundred maxillary posterior teeth were evaluated (300 first premolars, 300 second premolars, 300 first molars and 300 second molars). Two hundred and sixty-six premolars were single-rooted and 334 were bi-rooted. All molars were tri-rooted teeth.

The protocol for the study was approved by the Research Ethical Committee of the Federal University of Goiás (Process number 391.886).

CBCT Image Acquisition and Analysis

All CBCT images were acquired using the I-CAT Cone Beam 3D imaging system (Imaging Sciences International, Hatfield, PA, USA) using a 16 cm x 6 cm field of view (FOV). Image volume was reconstructed with isotropic-isometric 0.25 x 0.25 x 0.25 mm voxels. The tube voltage was 120 KVp, tube current was 3.8 mA, and an exposure time of 40 s was used. The images in DICOM format were processed, interpreted and measured by the proprietary software of the CBCT machine (Xoran version 3.1.62; Xoran Technologies, Ann Arbor, MI, USA). The PC workstation used Windows® 7 professional 32-bit with XP Mode operating system (Microsoft Corporation, Redmond, WA, USA) with 2nd Generation Intel® Core™ i5-2400, 3.1 GHz up to 3.4 GHz with Intel Turbo Boost 2.0, 4 Threads 6 MB Cache (Intel Corporation, USA), card video nVidia GeForce GT610 1 GB, 64-bit (NVIDIA Corporation, USA) and Dell monitor E2211H 21.5 inches – Widescreen resolution of 1920 x 1080 pixels (Dell Corporation, Round Rock, Texas, USA).

The anatomical relationship between MSF and maxillary posterior teeth was evaluated by measuring the distances between the inferior wall of the MSF and the root apices of the posterior teeth and the MSF cortical thickness in the region closest to the root apices and in the furcation areas. For the measurements, a specific tool of the I-CAT program was used, and the measurements were performed on the cross-sectional images with slice thickness of 1 mm.

For the premolars, the following items were measured: SR: the distance between the apex of single-rooted teeth and the inferior wall of the MSF; BR: the distance between the apex of the buccal root and the inferior wall of the MSF; PR: the distance between the apex of the palatal root and the inferior wall of the MSF; CTSR: the cortical thickness of the inferior wall of the MSF nearest to the apex of single-rooted tooth; CTBR: the cortical thickness of the inferior wall of the MSF closest to the apex of the buccal root; CTPR: the cortical thickness of the inferior wall of the MSF nearest to the apex of the palatal root; CTF: the cortical thickness of the inferior wall of the MSF closest to the furcation area (Figs. 1A and 1B).

For the molars, the following items were measured: MBR: the distance between the apex of the mesiobuccal root and the inferior wall of the MSF; DBR: the distance between the apex of the distobuccal root and the inferior wall of the MSF; PR: the distance between the apex of the palatal root and the inferior wall of the MSF; CTMBR: the cortical thickness of the inferior wall of the MSF nearest to the apex of the mesiobuccal root; CTDBR: the cortical thickness of the inferior wall of the MSF closest to the apex of the distobuccal root; CTPR: the cortical thickness of the inferior wall of the MSF nearest to the apex of the palatal root; CTF - the cortical thickness of the inferior wall of the MSF closest to the furcation area (Figs. 1C-E).

The vertical relationship between the MSF and the roots of the maxillary molars was evaluated on the CBCT cross-sectional images and classified into five categories according to the criteria described by Kwak et al. (14): Type I: the MSF was located above the level connecting the buccal and palatal root apices; Type II: the MSF was located below the level connecting the buccal and palatal root apices, without an apical protrusion over the MSF; Type III: an apical protrusion of the buccal root apex was observed over the MSF; Type IV: an apical protrusion of the palatal root apex was observed over the MSF; Type V: apical protrusions of the buccal and palatal root apices were observed over the MSF (Figs. 2A-E).

The horizontal relationship between the MSF and the roots of the maxillary molars was evaluated on the CBCT cross-sectional images and classified into five categories adapted from the criteria proposed by Kwak et al. (14): Type 1H: the alveolar recess of the MSF was located more towards the buccal side than towards the buccal root; Type 2H: the alveolar recess of the MSF was located between the buccal

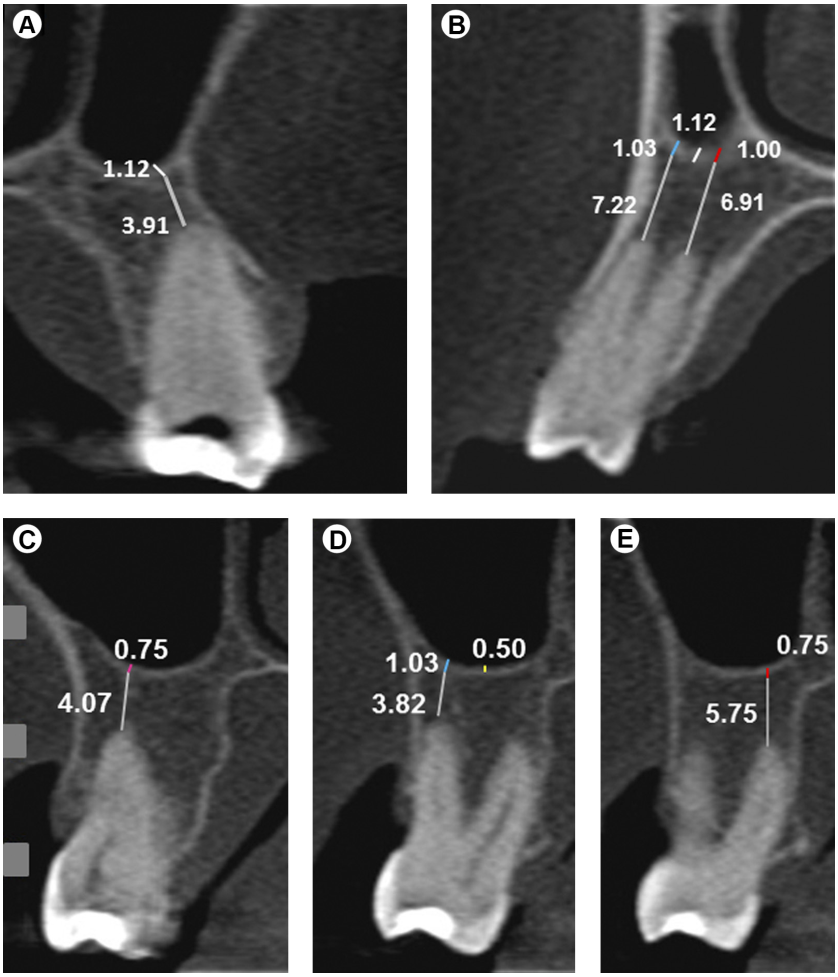

Figure 1. A,B: CBCT cross-sections of maxillary premolars with measurements (mm) of the distance between the maxillary sinus floor and the root apices and the maxillary sinus floor cortical thickness in the region closest to the root apices and in the furcation. A: SR and CTSR in single-rooted; B: BR, PR, CTBR, CTPR and CTF bi-rooted. C-E: CBCT cross-sections of maxillary molars with measurements (mm) of the distance between the maxillary sinus floor and the root apices and the maxillary sinus floor cortical thickness in the region closest to the root apices and in the furcation. C: MBR and CTMBR; D: DBR, CTDBR and CTF; E: PR and CTPR.

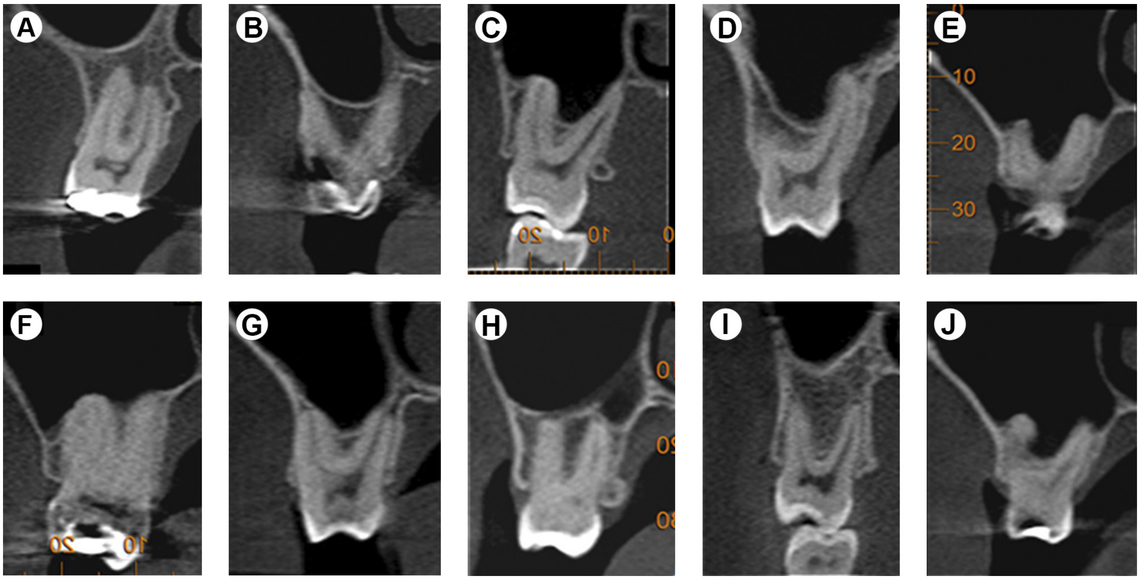

Figure 2. CBCT images. Vertical relationship. A: Type I; B: Type II; C: Type III; D: Type IV; E: Type V. Horizontal relationship. F: Type 1H, G: Type 2H, H: Type 3H, I: Type 4H, J: Type 5H. Adapted from Kwak et al. 2004 (14).

and palatal roots; Type 3H: the alveolar recess of the MSF was located more towards the palatal side than towards the palatal root; Type 4H: the alveolar recess of the MSF passes over the roots without establishing relationship with them; Type 5H: the alveolar recess of the MSF is located towards the buccal side and towards the palatal side, and may or may not also extend between the roots (Figs. 2F-J).

All measurements and analyzes were performed by two oral and maxillofacial radiologists, with experience in interpreting CBCT exams. The examiners were trained and calibrated using 10% of the sample in a pilot study. In absence of consensus, a third examiner, with the same qualification (oral and maxillofacial radiologist), was called for a final decision.

Statistical Analysis

The mean and standard deviation of the distances between the root apices and the MSF; and the thickness of the MS cortical bone were obtained. The differences between the distances, as well as between the thicknesses were evaluated by Kruskal-Wallis test. The statistical differences between the types of vertical and horizontal relationships were evaluated by Chi-square test. All statistical analyses were carried out with the Statistical Package for Social Sciences (IBM SPSS 20, IBM Co., New York, NY, USA).

Results

The mean and standard deviation values (mm) of the distances between the root apices of the maxillary premolars and molars and MSF are shown in Tables 1 and 2. CBCT analysis revealed that the mean value of the distance from the root apices to the MSF ranged from 0.36±1.17 mm for the mesiobuccal root of the second molar to 5.47±4.43 mm for the buccal root of the first premolar. A statistically significant difference was obtained between the distance of root apices to the MSF of single-rooted first and second premolars ($p<0.05$). The shortest distance was observed for single-rooted second premolar (1.71±2.81 mm) (Table 1). No significant difference was observed between the distance of MSF to the buccal and palatal root apices of bi-rooted first and second premolars ($p>0.05$). With regards to the molars, the greatest proximity was observed in the mesiobuccal root of the second left (0.36±1.17 mm) and second right (0.44±1.07 mm) molars and the palatal root of the first left molar (0.45±1.10 mm) (Table 2).

The mean and standard deviation values (mm) of the MSF cortical thickness in the region of the root apices and the furcation area of the maxillary premolars and molars are shown in Tables 3 and 4. The cortical thickness of the MSF inferior wall nearest to the root apices ranged from 0.65±0.41 mm over the mesiobuccal root of the second molar to 1.28±0.42 mm over the buccal root of the first premolar. A statistically significant difference was observed between the cortical thickness of the MSF inferior wall and the root apices of single-rooted first and second premolars. Considering individually each premolar, no statistically significant difference was observed in the mean value of the cortical thickness of the inferior wall of the MSF nearest to the root apex (single, buccal and palatal roots) and the furcation area in all premolars (Table 3). With regards to the molars, significant differences were observed regarding only the cortical bone thickness over the mesiobuccal and distobuccal roots ($p>0.05$). Considering each molar individually, statistically significant differences were observed in the mean value of the cortical thickness of the MSF inferior wall nearest to the root apex (mesiobuccal, distobuccal and palatal) and the furcation area in all molars (Table 4).

The frequency distributions of the vertical and horizontal relationships between MSF and roots of maxillary molars are shown in Tables 5 and 6. The most frequent vertical and horizontal relationships were types II and 2H, respectively ($p<0.05$).

Table 1. The mean distances and standard deviation values in mm between the maxillary premolar root apices and MSF

Tooth	N	SR (X ± SD)	BR (X ± SD)	PR (X ± SD)
14	150	$4.25 \pm 4.52^{A, b}$	$5.12 \pm 4.14^{A, b}$	$4.89 \pm 4.45^{A, b}$
15	150	$1.80 \pm 2.86^{A, a}$	$3.19 \pm 3.68^{A, a}$	$2.20 \pm 2.90^{A, a}$
24	150	$4.98 \pm 4.97^{A, b}$	$5.47 \pm 4.43^{A, b}$	$4.39 \pm 4.59^{A, ab}$
25	150	$1.71 \pm 2.81^{A, a}$	$3.31 \pm 4.90^{A, a}$	$2.65 \pm 4.36^{A, ab}$

n = number of teeth; X = mean; *SD* = standard deviation. Different capital letters indicate significant differences in horizontal lines and different lowercase letters indicate significant differences in the vertical lines; p <0.05 (*Kruskal-Wallis); SR: single root, BR: buccal root, PR: palatal root.

Table 2. The mean distances values in mm (*SD*) between the maxillary molar root apices and MSF

Tooth	n	MBR (X ± SD)	DBR (X ± SD)	PR (X ± SD)
16	150	$0.96 \pm 1.79^{A, b}$	$0.97 \pm 1.87^{A, a}$	$0.79 \pm 1.58^{A, ab}$
17	150	$0.44 \pm 1.07^{A, a}$	$0.74 \pm 1.52^{AB, a}$	$1.00 \pm 1.72^{B, b}$
26	150	$0.75 \pm 1.43^{A, ab}$	$0.66 \pm 1.21^{AB, a}$	$0.45 \pm 1.10^{B, a}$
27	150	$0.36 \pm 1.17^{A, a}$	$0.62 \pm 1.53^{AB, a}$	$0.73 \pm 1.63^{B, ab}$

n = number of teeth; X = mean; *SD* = standard deviation. Different capital letters indicate significant differences in horizontal lines and different lowercase letters indicate significant differences in the vertical lines; p <0.05 (*Kruskal-Wallis); MBR: mesiobuccal root, DBR: distobuccal root, PR: palatal root.

Table 3. The mean cortical thickness values in mm (*SD*) of the maxillary sinus floor in the region of root apices and the furcation area of the maxillary premolars

Tooth	CTSR (X ± SD)	CTBR (X ± SD)	CTPR (X ± SD)	CTF (X ± SD)
14	$1.26 \pm 0.37^{A,b}$	$1.28 \pm 0.42^{A,b}$	$1.15 \pm 0.47^{A,b}$	$1.18 \pm 0.33^{A,b}$
15	$0.92 \pm 0.47^{A,a}$	$1.01 \pm 0.52^{A,a}$	$0.92 \pm 0.53^{A,ab}$	$1.00 \pm 0.52^{A,ab}$
24	$1.17 \pm 0.51^{A,b}$	$1.14 \pm 0.34^{A,ab}$	$1.13 \pm 0.47^{A,b}$	$1.13 \pm 0.31^{A,b}$
25	$0.96 \pm 0.49^{A,a}$	$0.94 \pm 0.41^{A,a}$	$0.77 \pm 0.49^{A,a}$	$0.88 \pm 0.35^{A,a}$

n = number of teeth; X = mean; SD = standard deviation. Different capital letters indicate significant differences in horizontal lines and different lowercase letters indicate significant differences in the vertical lines; $p < 0.05$ (*Kruskal-Wallis); CTSR: cortical thickness single root, CTBR: cortical thickness buccal root, CTPR: cortical thickness palatal root, CTF: cortical thickness furcation.

Table 4. The mean cortical thickness values in mm (*SD*) of the maxillary sinus floor in the region of root apices and the furcation area of the maxillary molars

Tooth	CTMBR (X ± SD)	CTDBR (X ± SD)	CTPR (X ± SD)	CTF (X ± SD)
16	$0.88 \pm 0.45^{AB, b}$	$0.85 \pm 0.45^{AB, b}$	$0.78 \pm 0.43^{A, a}$	$0.96 \pm 0.22^{B, a}$
17	$0.71 \pm 0.42^{A, a}$	$0.76 \pm 0.42^{AB, ab}$	$0.81 \pm 0.38^{B, a}$	$0.98 \pm 0.27^{C, a}$
26	$0.85 \pm 0.48^{A, b}$	$0.75 \pm 0.39^{AB, ab}$	$0.72 \pm 0.43^{B, a}$	$0.95 \pm 0.24^{AC, a}$
27	$0.65 \pm 0.41^{A, a}$	$0.72 \pm 0.45^{AB, a}$	$0.77 \pm 0.46^{B, a}$	$0.95 \pm 0.25^{C, a}$

n = number of teeth; X = mean; *SD* = standard deviation. Different capital letters indicate significant differences in horizontal lines and different lowercase letters indicate significant differences in the vertical lines. $p < 0.05$ (*Kruskal-Wallis). CTMBR: cortical thickness mesiobuccal root, CTDBR: cortical thickness distobuccal root, CTPR: cortical thickness palatal root, CTF: cortical thickness furcation.

Table 5. The vertical relationship between maxillary molar roots and maxillary sinus floor

Tooth	n	Type I	Type II	Type III	Type IV	Type V
16	150	39 (26.00%)	67 (44.67%)	12 (8.00%)	25 (16.57%)	7 (4.67%)
17	150	47 (31.33%)	43 (28.67%)	41 (27.33%)	12 (8.00%)	7 (4.67%)
26	150	27 (18.00%)	82 (54.67%)	10 (6.67%)	23 (15.33%)	8 (5.33%)
27	150	38 (25.33%)	52 (34.67%)	37 (24.67%)	15 (10.00%)	8 (5.33%)
Total	600	151 (25.16%)	244 (40.67%)	100 (16.67%)	75 (12.50%)	30 (5.00%)

n = number of teeth; Chi-square test ($p = 0.05$).

Table 6. The horizontal relationship between maxillary molar roots and MSF

Tooth	n	Type 1H	Type 2H	Type 3H	Type 4H	Type 5H
16	150	7 (4.67%)	93 (62.00%)	9 (6.00%)	39 (26.00%)	2 (1.33%)
17	150	20 (13.33%)	78 (52.00%)	7 (4.67%)	44 (29.33%)	1 (0.67%)
26	150	7 (4.67%)	106 (70.67%)	8 (5.33%)	29 (19.33%)	0 (0.00%)
27	150	30 (20.00%)	78 (52.00%)	5 (3.33%)	36 (24.00%)	1 (0.67%)
Total	600	64 (10.67%)	355 (59.17%)	29 (4.83%)	148 (24.67%)	4 (0.67%)

n = number of teeth; Chi-square test ($p = 0.00$).

Discussion

Molar roots compared to the premolars showed a closer relationship with the MSF. The shortest distance between the root apex and the MSF was observed for the mesiobuccal root of the second left molar.

The results of the present study are in agreement with those from previous studies that have used computed tomography (CT) (10,14) and CBCT images (20-22). Eberhardt et al. (10) measured the distance between the root apices of posterior teeth and the MS using CT in 38 patients (12 specimens) and obtained results similar to the present study. Jung & Cho (23) analyzed the relationship of the maxillary molars and adjacent structures by CBCT. The authors performed measurements on a sample of 83 patients/332 molars and found that the shortest distance between the root apex and the MS was in the MB root of the second molar. Pagin et al. (22) evaluated qualitatively the close relationship between the MSF and the root apices of the posterior teeth in a Brazilian population by CBCT images. Their sample was composed by 100 MS, 315 teeth, and 601 root apices. Close proximity was observed in 216 roots. Among them, 130 presented root apices in close contact with the MSF with no root protrusion within the MS and no elevation in the sinus floor trajectory. The opposite was observed in 86 roots. The mesiobuccal root of the second molar was frequently found in close proximity to the MSF. With regards to the largest distances, the results of the present study showed that the root apices of first premolars are frequently far away from the MSF, which agrees with the study conducted by Kilic et al. (21).

Other studies (14,20,21) showed different results from those observed in this study. Kwak et al. (14) analyzed the clinical and morphological features of the MS in a Korean population using CT. The shortest distance between the root apex and the MSF was observed in the distobuccal root of the second molar. Kilic et al. (21) also found a shorter distance between the root apex of distobuccal root of the second molar and the MS, after analyzing 87 right and 89 left MS of

92 patients using CBCT. Yoshimine et al. (20) analyzed the anatomical characteristics of premolars, molars and MS for planning of dental implant treatment in 30 patients (120 teeth). The shortest distance was found for the palatal root of the first molar. The present results showed that after the mesiobuccal root of the second molar, the root with greater proximity to the MS was the palatal root of the first molar ($p>0.05$). These results highlight the care that is required in case of periapical surgery involving this area. Maillet et al. (24) noted that odontogenic sinus disease is frequent in patients presenting apical periodontitis in the palatal root of first molar and mesiobuccal root of second molar.

Some of the studies that analyzed the relationship of the roots of the maxillary posterior teeth with the MS used as reference the presence of protrusion of the roots in MS and assigned negative values for the distance between the apex and MSF, considering the lower portion of the alveolar recess adjacent to the protrusion (21,23). In this study, it was considered that even with the protrusion of the roots into the MS the presence of cortical bone and the mucosa overlying the MSF must be investigated. So, this measure was considered as 0.00 mm when the apex had contact with the floor and also when there was a root protrusion into the MS. For further research, was measured the thickness of the cortical bone of the sinus floor in the region closest to the apex and in the furcation area. Kwak et al. (14) also made measurements of the MSF cortical bone thickness in nearby regions of the root apex and furcation area and pointed out that the thickness of the MSF cortical bone and its relationship to the adjacent teeth is important in determining the prognosis of the orthodontic tooth movement. According to these authors, this information can provide a more appropriate basis for controlling orthodontic tooth movement and forecasting the degree of tooth movement during orthodontic procedures. Yoshmine et al. (20), in a study of the topography of the upper posterior teeth and the MS using CBCT, considered important to know the thickness of the MS cortical bone, in the closest region to the buccal root apex of the posterior teeth. This knowledge helps in the planning of dental implants and obtaining successful aesthetic treatment. In this study, the greatest cortical thickness of the MS floor was found in the region of the first premolar (1.13 ± 0.62 mm) and the smallest in the region of the first molars (0.82 ± 0.28 mm). A similar result was obtained in the present study in which the greatest thickness of the cortical bone of the MS floor was observed in the region of the first premolar apex (1.28 ± 0.42 mm) and the smallest in the region of the second molars apex (0.65 ± 0.41 mm). Although there was no statistically significant difference for these results in this study, it is interesting to note that the region of greatest distance between the apex and the MSF coincided with the region of the greatest cortical thickness closer to the apex (first premolars), and the region of shortest distance between the apex and the MSF coincided with the lowest cortical thickness closer to the apex (second molars). This could be an indication of a greater chance of spreading infections of dental origin to the MS in the second molars region. Further studies with specific criteria for sample selection are likely to corroborate this hypothesis.

All first and second molars (600 teeth) had classified their vertical and horizontal relationship with the MSF. The vertical relationship Type II (MSF located below the level connecting the buccal and palatal root apices without an apical protrusion over the MSF) was the most common. However, contrary to the present results, the vertical relationship most observed in the studies developed by Kwak et al. (14) (Korea) and Kilic et al. (21) (Turkey) were type I (MSF located above the level connecting the buccal and palatal root apices). The difference between these studies may be attributed not only to methodological differences, but also to the characteristics of ethnicity, since the analyzed populations were diverse. A common feature to the I and II types is the absence of protrusion of the roots into the sinus floor. The absence of projection of the roots into the sinus was also observed with high prevalence in other studies (10,15,22). However, Jung and Cho (23) projection of the roots into the MS was the most commonly observed vertical relationship.

The type 2H horizontal relationship (alveolar recess of the MSF located between the buccal and palatal roots) was the most frequent. These results are in agreement with the of previous studies (14,23). The Type 1H (alveolar recess of the MSF located towards the buccal side rather than towards the buccal root), showed a higher frequency in the second molars than first molars, agreeing with Jung and Cho (23), and contrasting the results of Kwak et al. (14).

The presence of vertical Type II and horizontal Type 2H relationships may contribute to a rapid dissemination of odontogenic infectious processes to the MS and still provide the alveolar extension post extraction, which may jeopardize future rehabilitation by dental implants. Considering the spread of infections originating from maxillary teeth, Obayashi et al. (4) observed that 65.7% of the analyzed cases showed alterations in alveolar cortical bone involving these teeth, the buccal cortical bone being the most affected. Despite these changes being most evident in the anterior teeth, 59% of the analyzed first molars and 42% of second molars showed infection spreading to these cortical plates. Thus, depending on the type of the horizontal relationship, a greater possibility of MS alterations could be present in cases of extensions towards the buccal and palatal sides (Types 1H, 3H, 5H), due to the spread of odontogenic infection.

Rational application of CBCT for the evaluation of different aspects involved in an infectious process between the posterior teeth and the MS, and analysis of periapical lesions has favored a better treatment plan, accurate diagnosis compared to conventional radiography and consequently a better therapeutic option (9,13,25). All relationships between teeth and adjacent anatomical structures that may serve to ease spreading an infection should be well studied, especially considering the different features between populations. It was verified (25) that maxillary posterior teeth with periapical radiolucent lesions had the highest frequency of sinus changes. A close spatial relationship between periapical lesion and sinus resulted most frequently in sinus abnormalities.

In conclusion, the roots of the maxillary molars showed greater proximity with the MS when compared with premolars; the thickness of the cortical bone of the MS floor in the region closest to the apex and furcation area was found to be similar only for premolars.

Resumo

Avaliou-se a relação anatômica entre dentes posteriores e o soalho do seio maxilar (SSM) por meio da tomografia computadorizada de feixe cônico (TCFC) em 202 exames. A distância entre os ápices radiculares e o SSM, bem como a espessura do osso cortical do SSM próximo dos ápices radiculares e áreas de bifurcação foram medidas. As relações verticais e horizontais do SSM com as raízes dos molares foram classificados em categorias adaptadas a partir dos critérios propostos pelo Kwak et al. (14). A menor distância entre o SSM e os ápices dentários foi observada na raiz mesiovestibular do segundo molar (0,36±1,17 mm) e na raiz palatina do primeiro molar (0,45±1,10 mm), e a maior na raiz vestibular do primeiro pré-molar (5,47±4.43 mm). Diferenças significantes foram observadas entre a distância do SSM e os ápices dentários de primeiros e segundos pré-molares unirradiculares. A espessura da cortical óssea variou de 0,65±0,41 mm na região da raiz mesiovestibular do segundo molar a 1,28±0,42 na raiz vestibular do primeiro pré-molar. As relações vertical e horizontal mais prevalentes foram do tipo II e 2H, respectivamente. As raízes dos molares superiores apresentaram maior proximidade com o SSM. A espessura da cortical óssea do SSM nas regiões mais próximas dos ápices e área de furca foi similar apenas para os pré-molares.

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