Original Research

Evaluation Of The Location And Anatomy Of The Posterior Superior Alveolar Artery (PSAA) And Its Related Factors By CBCT In The Radiology Department Of The School Of Dentistry And Private Clinics Of Tehran

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Abstract:

Objective: this study aims to investigate the location and anatomy of the PSAA and maxillary sinus by CBCT in Islamic Azad University and private clinics in Tehran in 2017.

Methods: The study was performed on 299 CBCTs and the images were examined for the prevalence of arterial observation. In this study, the diameter and distance from the floor and medial wall as well as the degree of symmetry and their relationship with age, gender and position of the tooth were investigated. SPSS software, t-test and ANOVA were used for statistical analysis of data.

Results: PSAA was observed in 76.2% of subjects. In examining the dental status of individuals and observing PSAA, the artery was observed more in people with teeth in the posterior maxillary. There was symmetry in 99 patients, of which 39.4% were seen in molar teeth, 20.2% in premolars and 27.3% in both molars and premolar teeth. There was no significant relationship between arterial symmetry and age and dental status, but the degree of symmetry was measured in men 1.9 times that of women. The highest frequency in terms of PSAA position was related to placement within the bone (53.5%). The results of the present study showed that symmetry had a significant relationship with gender and also there was a significant relationship between the prevalence of arteries with dental status and the distance of arteries with dental type.

Conclusion: According to the results of the present study, more care should be taken during surgery in the area of the molar teeth due to the shorter distance from the sinus floor.

Keywords: Cone beam computed tomography, Dental implants, Maxillary sinus

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Introduction

Bleeding of the posterior superior alveolar artery is one of the problems that complicates the surgeon's ability during implant surgery, which makes implant placement difficult. Preventing hemorrhagic problems from this artery during surgery, while agglomerating the conversion sinus, is very important to increase the vertical height of the bone and the success of implants (1-3). Therefore, understanding the anatomy and vascular condition of the area helps the surgeon to prevent area bone necrosis and further improve the area due to better vascularization of blood vessels (4-6). The blood supply to both lateral walls of the sinus is from the posterior superior alveolar and infraorbital arteries, which are branches of the maxillary artery. It is clinically important to know the location of the posterior superior artery to prevent rupture during surgery (7-9). Surgeries performed on the lateral wall of the buccal sinus include open sinus lift, caldwell-Luc operation, Lefort 1, and osteotomy. Osteosynthesis for the treatment of maxillary fractures may also involve these arterial branches and cause hemorrhage. Although bleeding from this vessel is not a life-threatening problem, it can reduce vision during surgery and increase pain, inflammation, and infection after surgery (10–13).

The existence of this artery was first mentioned by Strong in 1934. Then in 1980, Boyne James discussed sinus surgery and its problems, and then Tatum reviewed sinus lift surgery (14,15). Imaging such as CBCT, CT, MRI, Panoramic, Waters, and Caldwell can be used to examine the sinuses (16,17). Nowadays, plain films are not used as the primary imaging method because they show only an overview of the anatomy and pathology of the sinuses and provide a 2D image from the 3D areas. MRI and CT have the ability to show anatomical details, but the effective dose with a standard MDCT protocol is up to 1.5 to 12.5 times higher than a CBCT with a medium field (17–19). Radiography is currently the only alternative method for examining this artery, and CBCT is used as a routine method for preoperative evaluation of common alveolar and maxillary sinus surgery in patients receiving posterior maxillary implants (15, 17-19). Therefore, the current study aimed at evaluating the location and anatomy of the posterior superior alveolar artery and maxillary sinus by CBCT.

Materials and methods:

The cross-sectional study was conducted on 300 CBCTs taken from patients in radiology and private clinics in Tehran. All of these patients were referred by clinicians for CBCT radiography in order to implant treatment and surgery. Patient information including age and gender were taken from the patient file. The patient's dental status was divided into teeth in the posterior maxillary or toothless according to radiography. Inclusion criteria included CBCT scans showing the maxilla completely, high-quality, artifact-free images, no history of any previous surgery, and no sclerotic walls of the maxillary sinus (1,2,6,9). Each scan was taken by Villa and Newtom with the largest available field and the shortest exposure time of 85 kvp and 7-5 mA in the Frankfurt-plan according to the reference points. Patient information was stored in dicom format and axial, coronal and sagittal images were reformatted with Simplant software. CBCT cross-sectional images were taken with a slice thickness of 1 mm and an interval of 0.1 mm. The arterial path in the area was divided into 8 parts including the first premolar region (right and left), the second premolar region (right and left), the first molar region (right and left) and the second molar region (right and left). If the artery was observed in cross-sectional images, its diameter was measured and its placement was divided into 3 categories: interosseous, transmembrane, and the outer cortex of lateral wall. Two horizontal parallel lines were drawn from the most coronal part of the buccal crest and the floor of the sinus to

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represent the alveolar crest of the maxillary sinus floor, and the distance of the PSA artery to these points was measured.

Statistical analysis

Data were analyzed by SPSS software and t-test and ANOVA (1-3,12,13). The frequency of arterial location and its size were determined in the samples and its true amount was estimated with 95% confidence in the population as well as the role of age, gender and dental status with each of these indicators was evaluated by chi-square test.

Results

1- Demographic characteristics

In this section, we examine the demographic characteristics of patients, including gender, age, dental status and symmetry of the samples.

Examination of the studied samples by gender

Out of the 299 CT scans examined, 169 (56.5%) were men and 130 (43.5%) were women.

Examine the samples by age

The mean age of patients participating in the study was 43.3 ± 15.08, ranging from a minimum of 14 years to a maximum of 80 years.

Examination of the samples by dental condition

Out of 299 CBCT examined, 276 cases (92.3%) were related to patients with teeth and only 23 cases (7.7%) were related to patients without teeth.

2- Prevalence of PSAA and its relationship with age, gender and dental status

Prevalence of PSAA in samples

Of the 299 CBCT examined, the PSAA was observed in 228 cases (76.2%) and not in 71 samples (23.7%).

Evaluation of the relationship between the prevalence of PSAA with age and gender

The mean age was 43.33 ± 15.06 and 43.2 ± 15.3 years in subjects with and without PSAA, respectively. Out of the 228 samples in which the PSAA was observed, 129 (56.6%) were male and 99 (43.4%) were female. Of the 71 patients with no PSAA, 40 (56.3%) were male and 31 (43.7%) were female. The result of Mann-Whitney test showed that there was no statistically significant difference in terms of age between the two groups (P-value = 0.99). Therefore, the hypothesis of a relationship between age and gender with observation of the PSAA was rejected.

Relationship between the prevalence of PSAA and dental status

Of the 228 samples in which the PSAA was observed, 221 (96.9%) had teeth and 7 (3.1%) had no teeth. Of the 71 patients with no PSAA, 55 (77.5%) had teeth and 16 (22.5%) had no teeth. The results of chi-square test showed a statistically significant difference in terms of dental status between the two groups (P-value <0.001). Therefore, the hypothesis of a relationship between dental status and observation of the PSAA was confirmed.

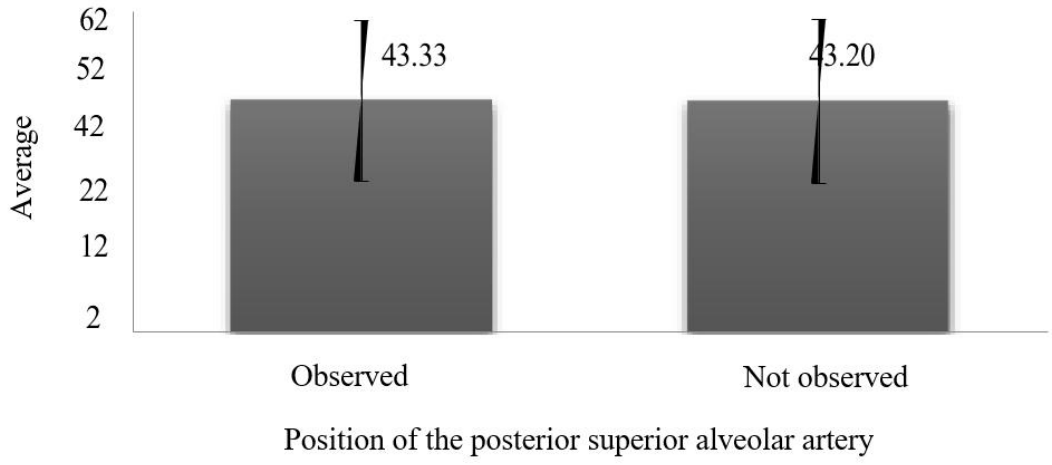

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Figure 1. Association of the prevalence of posterior superior alveolar artery with age

3- Examination of the studied samples by symmetry

Of the 228 samples in which the PSAA was observed, tooth symmetry was present in 99 patients (43.4%) and there was no in 129 patients (56.6%). Of the 99 samples in which symmetry was observed, 39 samples (39.4%) were found in molar teeth, 20 samples (20.2%) were seen in premolars, and 27 samples (27.3%) were symmetric in both molar and premolar teeth. In 13 samples (13.1%) the symmetry of the tooth type was not seen.

Evaluation of the relationship between PSAA symmetry with age and dental status

The mean age was 41.62 ± 16.79 and 44.64 ± 13.50 years in the subjects with symmetry and in the subjects without symmetry, respectively. Of the 99 samples in which the PSAA was symmetrical, 94 (94.9%) had teeth and 5 (5.1%) had no teeth. Of the 129 patients in whom the PSAA was not symmetrical, 127 (98.4%) had teeth and 2 (1.6%) had no teeth. The results of Mann-Whitney test and Chi-square test showed that there was no statistically significant difference in terms of age and dental status between the two groups.

Relationship between PSAA symmetry with gender

Out of the 99 samples in which the PSAA was symmetrical, 65 (65.7%) were male and 34 (34.3%) were female. Of the 129 patients in whom the PSAA was not symmetrical, 64 (49.6%) were male and 65 (50.4%) were female. The result of chi-square test showed a statistically significant difference in terms of gender between the two groups (P-value = 0.01). The symmetry of the PSAA was about 1.9 times greater in men than in women.

4- Evaluation of the horizontal diameter factor of the PSAA and its relationship with age, gender, dental status and position

The mean horizontal diameter of the PSAA in the samples was 0.21 ± 0.7 mm, which varied from a minimum of 0.19 to a maximum of 1.8 mm.

Relationship between horizontal diameter of PSAA with tooth position, tooth type, age, gender and dental status

The mean horizontal diameter of the PSAA in the right teeth was 0.69 ± 0.20 mm, which varied from a minimum of 0.19 to a maximum of 1.23 mm. This factor was 0.70 ± 0.21 mm in the left teeth. The mean horizontal diameter of the PSAA was 0.69 ± 0.19 mm in premolar teeth. This amount was 0.70 ± 0.22 mm in molar teeth. The mean horizontal diameter of the PSAA was 0.70 ± 0.20 mm in men and 0.69 ± 0.21 mm in women. The mean horizontal diameter of the PSAA was 0.70 ± 0.20 mm in subjects with teeth and 0.73 ± 0.28 mm in edentulous subjects. The result of Mann-Whitney test showed that there was no statistically significant difference in terms of horizontal diameter of the artery between the two sides and the type of tooth, age, gender and dental status. Therefore, the hypothesis of a relationship between the horizontal diameter of the PSAA with the position and the type of tooth, age, gender and dental status was rejected.

5- Vertical diameter of the PSAA and its relationship with age, gender, dental position

The mean vertical diameter of the PSAA was 0.89 ± 0.20 mm in the samples, which varied from a minimum of 0.21 to a maximum of 1.88 mm. The vertical diameter of the PSAA is presented in the below table and diagram.

Relationship between vertical diameter of PSAA with tooth position and type, age, gender and dental status

The mean vertical diameter of the PSAA was 0.89 ± 0.21 mm and 0.89 ± 0.19 mm in the right and left teeth, respectively. The mean vertical diameter of the PSAA was 0.89 ± 0.21 and 0.89 ± 0.20 mm in premolars and molar teeth, respectively. The mean vertical diameter of the PSAA was 0.89 ± 0.18 and 0.89 ± 0.23 mm in men and women, respectively. The mean vertical diameter of the PSAA was 0.86

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± 0.24 mm in subjects with teeth and this factor was 0.89 ± 0.20 mm in those without teeth. The result of Mann-Whitney test showed that there was no statistically significant difference in terms of vertical diameter of the artery between the two sides and the type of tooth, age, gender and dental status. Therefore, the hypothesis of a relationship between the vertical diameter of the PSAA with the position and the type of tooth, age, gender and dental status was rejected.

6- Distance of PSAA from crest and its relationship with age, gender, and dental status

The mean distance of the PSAA from the crest in the samples was 20.88 ± 3.79 mm, which varied from a minimum of 9.21 to a maximum of 31.51 mm. The distance of the PSAA from the apex of the crest is shown in the below table and diagram.

Relationship between the distance of the PSAA from the apex of the crest with the position and type of tooth, age, gender and dental status

The mean distance of the PSAA from the crest was 20.83 ± 3.91 mm in the right teeth and it was 20.93 ± 3.67 mm in the left teeth. The mean distance of the PSAA from the apex of the crest in premolar teeth was 22.08 ± 3.67 mm and this amount was 20.04 ± 3.64 mm in molars. The mean distance of the PSAA from the crest was 21.12 ± 3.67 mm in men and 20.58 ± 3.92 mm in women. The mean distance of the PSAA from the apex of the crest was 20.9 ± 3.8 mm in subjects with teeth and 19.14 ± 3.22 mm in edentulous subjects. The result of Mann-Whitney test showed that there was no statistically significant difference in terms of artery position between the two sides and type of tooth, age, gender, and dental status. Therefore, the hypothesis of a relationship between the distance of the PSAA with the position and the type of tooth, age, gender, and dental status was rejected.

7- Distance of PSAA from sinus floor and its relationship with age, gender, and dental status

The mean distance of the PSAA from the sinus floor in the samples was 9.12 ± 3.21 mm, which varied from a minimum of 1.13 to a maximum of 19.1 mm. The distance of the PSAA from the floor of the sinus are examined in the below table and diagram.

Relationship between PSAA distance from sinus floor with age, gender and dental status

The mean distance of the PSAA from the sinus floor in the right teeth was 9.10 ± 3.22 mm and this value was 9.14 ± 3.21 mm in the left teeth. The mean distance of the PSAA from the sinus floor in men and women was 9.22 ± 3.29 and 8.98 ± 3.10 mm, respectively. The mean distance of the upper posterior alveolar artery from the sinus floor in teeth with and without teeth was 3.18 ± 9.09 and 4.35 ± 10.45 mm, respectively. The mean distance of the PSAA from the sinus floor in subjects with teeth and edentulous was 9.09 ± 3.18 and 10.45 ± 4.35 mm, respectively. The result of Mann-Whitney test showed that there was no statistically significant difference in the position of the artery between the two sides, age, gender, and dental status. Therefore, the hypothesis of a relationship between the distance of the PSAA from the sinus floor with the position of the tooth, age, gender, and dental status was rejected. The result of Mann-Whitney test showed a statistically significant difference in the position of arteries between molars and premolar teeth (P-value <0.001). This means that the distance of the PSAA from the sinus floor in premolar teeth was significantly greater than the molars.

8- Distance of the PSAA from the medial wall of the sinus and its relationship with age, gender, and dental status

The mean distance of the PSAA from the medial wall of the sinus in the samples was 11.19 ± 5.7 mm, which varied from a minimum of 1.12 to a maximum of 20.42 mm. In the following table and diagram, we examine the distance of the PSAA from the

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medial wall of the sinus in the samples.

Relationship between distance of PSAA from medial sinus wall with age, gender, and dental status

The mean distance between PSAA and medial wall of the sinus in the right teeth and in the left teeth was 11.07 ± 5.67 and 11.3 ± 5.73 mm, respectively. The mean distance of PSAA from medial sinus wall in men and women was 11.18 ± 5.76 and 11.19 ± 5.60 mm, respectively. The mean distance of the PSAA from the medial wall of the sinus in subjects with teeth and without teeth was 11.16 ± 5.72 and 12.30 ± 3.76 mm, respectively. The result of Mann-Whitney test showed that there was no statistically significant difference in the position of the artery between the two sides, age, gender and dental status. Therefore, the hypothesis of a relationship between the distance of the PSAA from the medial wall with age, gender and dental status was rejected. The result of Mann-Whitney test showed a statistically significant difference in the position of arteries between molars and premolar teeth (P-value <0.001). This means that the distance between PSAA and medial sinus wall in the molar teeth was significantly greater than this factor in premolar teeth.

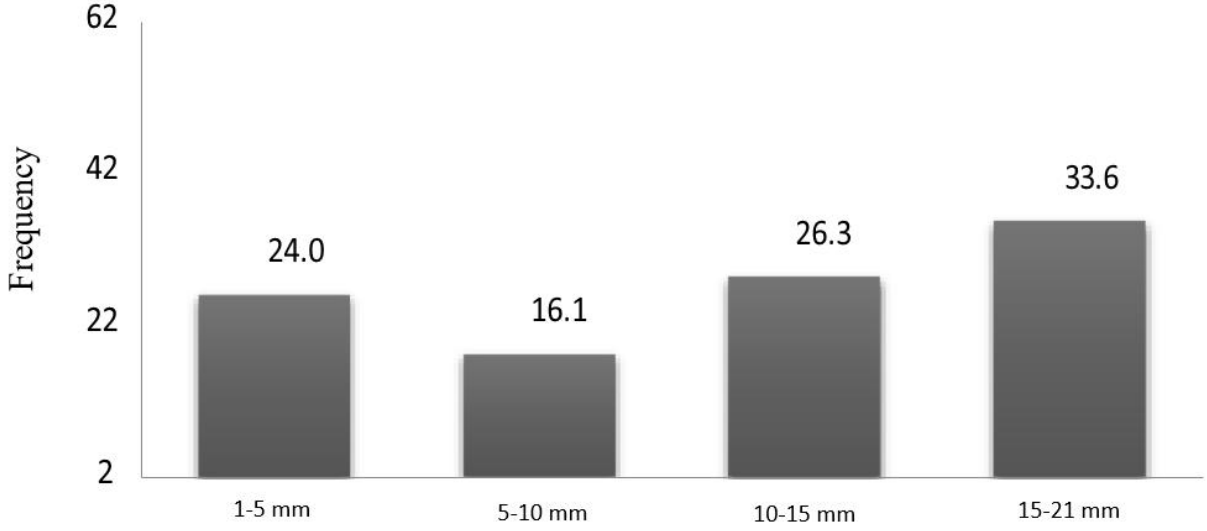

Figure 2. Distance distribution of the posterior superior artery from medial wall of the sinus

9- The position of PSAA and its relationship with age, gender, dental status and position

Among the 608 samples studied, the position of PSAA was completely internal in 325 samples (53.5%), partially in bone for 221 samples (36.3%) and completely in the soft tissue for 62 samples (10.2%). The position of PSAA is shown in the below table and diagram.

Investigation of the relationship between the position of the PSAA with the position and type of tooth, age, gender, and dental status

The result of Chi-square test showed that there was no statistically significant difference in terms of artery position between the two sides, age, gender, and dental status (P-value = 0.09). Therefore, the hypothesis of a relationship between the position of the PSAA with the position of the tooth, age, gender, and dental position was rejected. The result of Chi-square test showed a statistically significant difference in the position of the artery between the molar and the premolar (P-value <0.001). In premolars, most teeth were completely in the bone, and in molar teeth, most teeth were bony, semi-bony, or completely in soft tissue.

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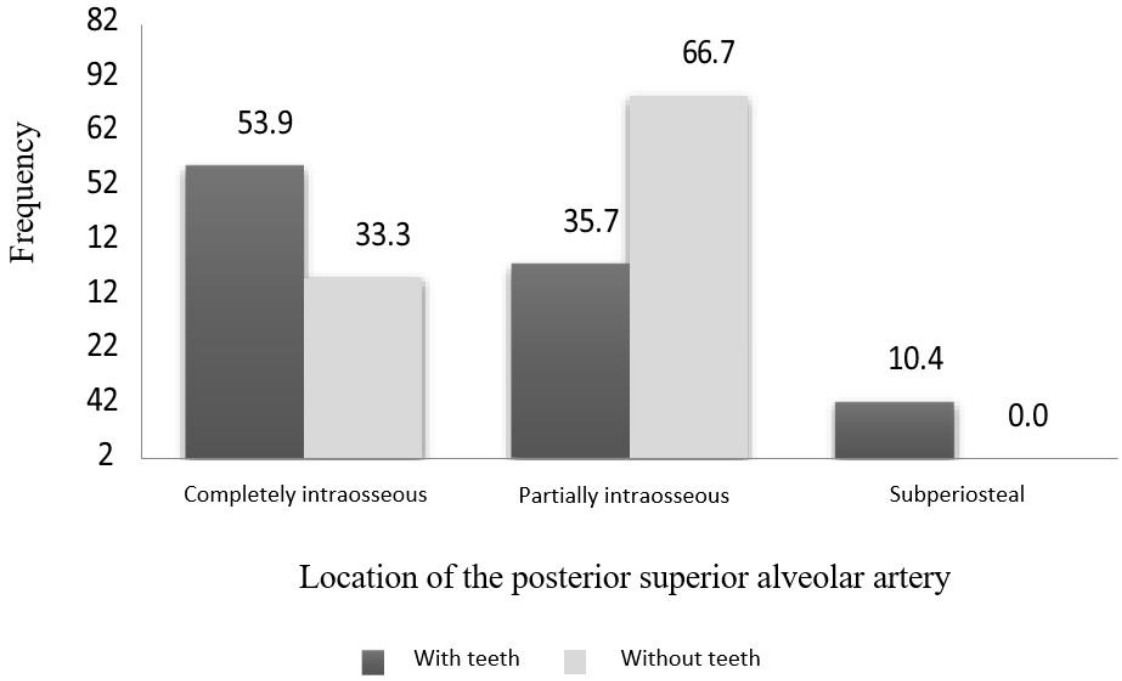

Figure 3 - Relationship between the location of the artery and dental status

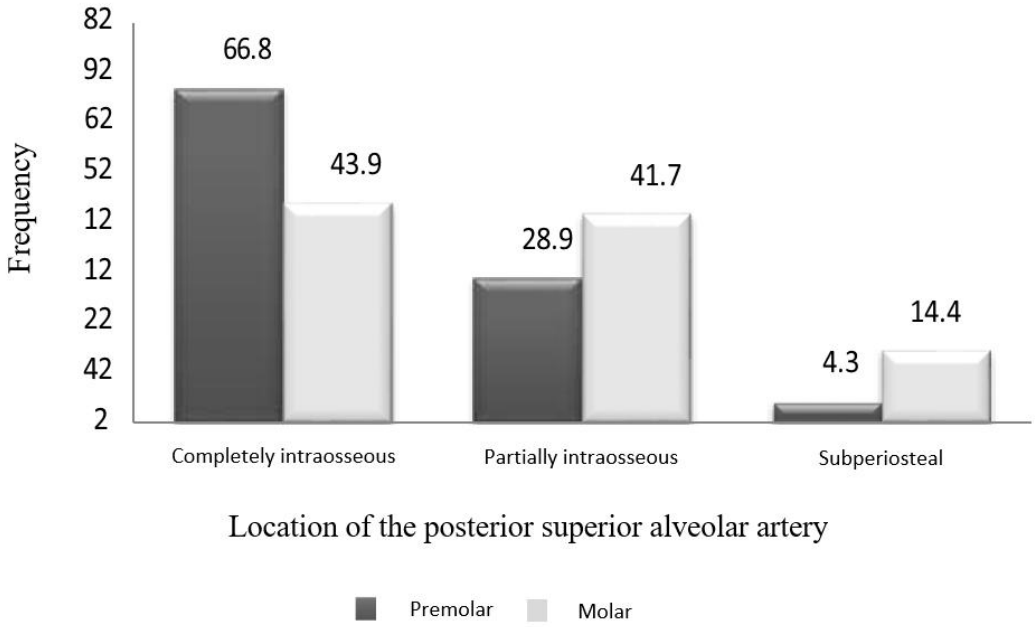

Figure 4 - Relationship between the location of the posterior superior artery and dental status

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Discussion

Localization of the PSAA artery by CBCT is important in sinus lift and posterior maxillary implant surgery which should be considered before this surgery. This artery creates complications during sinus lift surgery of the maxillary lateral wall, and its bleeding reduces the surgeon's vision and interferes with the repair of the area and bone graft (11-13). In this study, we examined a total of 299 scans (598 sinuses), of which 338 (56.5%) were for men and 260 (43.5%) were for women. The mean age of the subjects was 43.3 ± 15.08 and ranged between 14-80 years old. In a study by Kurt (1) on 146 patients, the prevalence of arterial observation was reported to be 78%. The highest and lowest prevalence were observed in the second premolar (45.2%) and in the first premolar (13%), respectively.

Shahidi (30) studied 198 patients and did not see arteries in only 7%. In the study by pandharbale (10), investigation of 50 CT scans showed arteries in 36 cases. Tehranchi (9) observed this artery in 87% of cases. In 12.5% of males and 13.5% of females no arteries were observed. Arterial observation was higher in complete edentulous individuals (25.7%) while in partial edentulous individuals it was 6.1%. Haghanifar (13) reported the prevalence of artery in 80.63% of cases on the right and in 81.25% of cases on the left, with the lowest and highest prevalence in the first premolar and in molars 1 and 2, respectively.

In our study, the PSAA was observed in 228 samples (76.2%) and not in 71 samples (23.7%). The result of Mann-Whitney test showed that there was no statistically significant difference between age and arterial prevalence (P-value = 0.98). The result of Chi-square test showed that there was no statistically significant difference between the gender and the prevalence of arterial observation (P-value = 0.54). Contrary to Tehranchi (9) research in our study, the prevalence in subjects with teeth was 96.9%, which may be related to the small number of edentulous samples in our study. Consistent with the results of the present study, other studies also reported similar result, which indicates a high probability of arterial tracing in CBCT images. In the study of chitsaz (6), the artery diameter in 30.2% of subjects was less than 1 mm, in 59.1% was between 1–2 mm, in 10.5% was more than 2 mm, and the range of artery diameter was between 0.7–2 mm. In a study by haghanifar (13), the mean diameter of the artery was 0.31 ± 0.19 mm and ranged from 0.4 to 2.2 mm, which in 69.81% was <1 mm, in 0.7% was greater than 2 mm, and at 29.49% was between 1–2mm. The diameter increased from both the first premolar to the third molar (P <0.001). Artery diameter was larger in men (20.1 ± 0.32) than in women (28.0 ± 0.25, P <0.001).

In the Pandharbale study (10), the mean diameter was 36.0 ± 0.38 and the comparison between left and right was not statistically significant (P <0.001). Tehranchi (9) stated that the mean diameters in men and women were 83.1 ± 0.25 and 2.1 ± 0.37, respectively, but the t-test showed no significant relationship between diameter and gender at P <0.05. In their study, 74.8% of subjects had arterial diameters between 1-2 mm and in 20.7% of samples the diameter was less than 1 mm. The mean horizontal diameter of the PSAA in the present study was 0.70 ± 0.21 mm, of which 74.8 was between 0.5–1 mm, 18.9 less than 0.5 mm, and 6.3 greater than 1 mm. The mean vertical diameter of the PSAA in the samples was 0.89 ± 0.20 mm, of which 77.1 was between 0.5–1.0 mm, 21.2 was between 1–2 mm, and 1.7 was less than 0.5 mm. The mean horizontal diameter of the PSAA in the right teeth was 0.69 ± 0.20 mm and this factor was 0.70 ± 0.21 mm in the left teeth. Statistical analysis of Mann-Whitney test revealed the there was no relationship between the horizontal diameter of the PSAA and the position of the tooth (P-value = 0.85), which was similar to the Pandharbale (10) results (P <0.008). The mean horizontal diameter of the PSAA in premolars was 0.69 ± 0.19 mm and this factor was 0.70 ± 0.22 mm, in molar teeth, which was consistent with the Haghanifar (13) study. The mean horizontal diameter of the PSAA in men and women was 0.7 ± 0.2 mm and 0.69 ± 0.21 mm, respectively. The result of Mann-Whitney test showed that there was no statistically significant difference in terms of horizontal diameter of arteries between men and women (P-value = 0.20). This result was in contrast to the Tehranchi (9) result which found a significant relationship between diameter and gender. The mean vertical diameter of the PSAA in the right and left teeth was 0.89 ± 0.21 mm and 0.89 ± 0.19 mm, respectively. The mean vertical diameter of the PSAA in premolars and molars teeth was 0.89 ± 0.21

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mm and 0.89 ± 0.20 mm, respectively. The mean vertical diameter of PSAA in men and women was 0.89 ± 0.18 mm and 0.89 ± 0.23 mm, respectively, which in contrast to the Tehranchi (9) study showed no relationship between gender and artery diameter.

In Haghanifar study (13), the distance between the arteries and the sinus floor in men and women was 64.8 ± 4.44 and 44.6 ± 3.42, respectively, which was a significant increase in men (P <0.001). The distance of the artery from the sinus floor in this study was not related to age. In the Pandharbale study (10), this distance was at its lowest in the area of the second molar tooth (9.49 mm). In Kurt study (1), the shortest distance was in the area of the second molar with an average of 10.9 mm on the right and 12.9 mm on the left. The mean distance of the PSAA from the apex of the crest in the samples was 20.88 ± 3.79 mm. In the present study, the mean distance of the PSAA from the sinus floor was 9.12 ± 3.21 mm, which varied from a minimum of 1.13 to a maximum of 19.1 mm. The mean distance between artery and the sinus floor in the right and left teeth was 9.1 ± 3.22 mm and 9.14 ± 3.21 mm, respectively. The mean distance of the PSAA from the sinus floor in premolars and molars teeth was 10.73 ± 3.37 mm and 7.94 ± 2.48 mm, respectively (P-value <0.001). This finding was contrary to Haghanifar's (13) conclusion, which may be related to differences in the number of samples. The mean distance of PSAA from the sinus floor in men and women was 9.22 ± 3.29 mm and 8.98 ± 3.1 mm, respectively (P = 0.55). In line with the present study, others reported similar results.

In the study of the distance between the artery and the alveolar crest in the Pandharbale (10) study, no significant difference was observed between the left and right and the first and second molars, which were similar to our research. In Kurt (1) study, this distance was the lowest (19.5 mm) on both sides in the area of the second molar, and the highest (28.4 mm) in the first premolar, which was a significant difference in the type of tooth. These results may be inconsistent with the results of the present study due to differences in the method of calculation and the lines drawn in the scan. In the study of Chitsaz (6) this distance was 16.17 ± 1.63 with a range of 14.3–22.3. In the present study, the mean distance of the PSAA from the crest was 20.88 ± 3.97 mm (9.21 ± 31.51 mm). This discrepancy is probably related to the difference in the number of samples and the CT scan. In the Haghanifar study (13), the mean distance to the crest was 31.81 ± 14.03, which was reported to be 27.81 ± 4.12 and 17.61 ± 3.88 for men and women, respectively. The smallest distance was observed in the first and second molars. This increase in distance in the premolar and molar area was significant in men. In this case, no correlation was found with age, which was similar to our study. In the present study, the mean distance of the PSAA from the crest was 21.12 ± 3.67 mm and 20.58 ± 3.92 mm in men and women, respectively. Mann-Whitney test showed no statistically significant difference in arterial position between men and women (P-value = 0.56). This was contrary to the Haghanifar (13) results. The mean distance of the PSAA from the apex of the crest in the premolars and molars was 22.08 ± 3.68 mm and 20.04 ± 3.64 mm, respectively. The result of Mann-Whitney test showed that there was no statistically significant difference in terms of artery placement between molars and premolars (P-value = 0.32). But as Haghanifar (13) stated, the lowest was seen in the area of the molar teeth.

The distance of the artery from the medial wall of the sinus in the study of Chitsaz (6) was in the range between 9.2- 10.3. In the Haghanifar study (13), this distance from the first premolar to the second molar was increasing (P <0.001), but there was no significant relationship between this distance with gender and position. This reduction in distance from the medial wall based on age

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showed a significant decreasing trend in the first premolars and the first and second molar teeth. In shahidi study (30), the minimum and maximum distances from the medial were 10.60 mm and 37.5 mm on the right and 13.20 mm and 36.60 mm on the left. In the present study, the mean distance of the PSAA from the medial sinus wall was 11.19 ± 5.70 mm. The mean distance of the PSAA from the sinus floor in premolars and molar teeth was 10.73 ± 3.37 mm and 7.94 ± 2.48 mm (1.13-18.14 mm), respectively. According to Mann-Whitney test, the distance of the PSAA from the sinus floor in premolars was significantly greater than that of molar teeth (P <0.001). The range of variations of this parameter is consistent with the Pandharbale study (10).

The position of the artery in a study by Tehranchi (9) was 47% partially in bone, 47% completely internal and 6% in soft tissue. The result of Mann-Whitney test showed a significant relationship between this position and gender. 48.9% were completely internal in men and 48% were partially in bone for women (P <0.05). In Shahidi study (30), 65.7% was related to bone and 13.5% to soft tissue. In the study of Chitsaz (6), 73.2% were completely internal, 21.7% were partially in bone, and 4.9% were in the soft-tissue. In Haghanifar study (13), the placement in the molar region was more semi-bony and in soft tissue, but in the premolar region was more intraosseous. In our study, the arteries were located (53.5%) completely inside the bone, (36.3%) half-bone, and (10.2%) completely in the soft tissue. In premolars, most teeth were completely in bone, and in molar teeth, most teeth were semi-bony or in soft tissue (P-value <0.001). These findings are similar to the results of other studies. The result of chi-square test showed that there was no statistical difference in the position of the artery between the two groups of men and women (P-value = 0.11) , which was inconsistent with the result of Tehranchi (9) and the reason can be attributed to the difference in the scans examined and the diagnosis of the location of the artery.

One of the strengths of our research has been the comprehensive study of arterial symmetry, which has not been done in any study so far. Only one study reported that arterial placement was unilateral in 48 cases and bilateral in 66 cases, with a rate of 65% for the right and 58.2% for the left. In our study, out of 228 samples in which the PSAA was observed, tooth symmetry was present in 99 patients (43.4%) and absent in 129 patients (56.6%). Among the subjects in which symmetry was observed, 39.4% were observed in molar teeth, 20.2% in premolars and 27.3% in both molars and premolar teeth. There was no relationship between symmetry and age and dental status, but in terms of gender, arterial symmetry was about 1.9 times higher in men than women (P-value = 0.01). According to these results, it is recommended to include this symmetry in the patient's file to give the surgeon more open vision in cases of surgery and to reduce the complications of arterial bleeding.

Conclusion

The findings of this study showed that the highest frequency in terms of the location of the PSAA was related to its location inside the bone (53.5%). Symmetry was significantly related to gender, as well as prevalence of arteries with dental status, and arteries distance with dental type, however none of the other variables had statistically significant relationship.

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