ORIGINAL RESEARCH ARTICLE

SEXUAL DIMORPHISM IN THE LOCATION OF MAXILLARY SINUS AND MANDIBULAR CANAL

Authors:

Shahin KA [1]
LaxmikanthChatra [2]
PrashanthShenai [3]
Veena KM [3]
Prasanna Kumar Rao [4]
Rachana V Prabhu [5]

[1] Senior Lecturer, Department of Oral Medicine and Radiology, Yenepoya Dental College, Yenepoya University, Mangalore, Karnataka, India.

[2] Senior professor and Head, Department of Oral Medicine and Radiology, Yenepoya Dental College, Yenepoya University, Mangalore, Karnataka, India

[3] Professor, Department of Oral Medicine and Radiology, Yenepoya Dental College, Yenepoya University, Mangalore, Karnataka, India.

[4] Associate Professor, Department of Oral Medicine and Radiology, Yenepoya Dental College, Yenepoya University, Mangalore, Karnataka, India.

[5] Reader, Department of Oral Medicine and Radiology, Yenepoya Dental College, Yenepoya University, Mangalore, Karnataka, India.

ABSTRACT

Back ground: It is important to evaluate the bone thickness, bone density, location of vital anatomic structures and also height and width of the jaws in many dental clinical situations especially in implant placement and forensic applications. Further, sexual dimorphisms differ widely and thus the quality and quantity of the bone and anatomic location also vary and will have an impact on various dental surgical procedures.

Objectives: The purpose of this study was to assess the sexual dimorphism in the anatomic location of the vital structures like maxillary sinus and mandibular canal in the jaws by using linear tomography.

Methods and methodology: The mean location of the maxillary sinus and the mandibular canal from the alveolar crest of posterior teeth was done on 90 healthy dentulous patients divided in the two equally divided groups (males=45 and females=45) by using cross sectional linear tomograms.

Results: The results showed the mean distance of the location of maxillary sinus and the mandibular canal with respect to the alveolar crest in males and females.

Conclusion: This study proved that there was a high significance in the location of the mandibular canal in relation to the alveolar crest between males and females though there was no significance in the location of the maxillary sinus.

Key words: Maxillary sinus, mandibular canal, alveolar crest, cross sectional radiograph, implant planning.

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INTRODUCTION

It is a well-known fact that the human species display tremendous sexual dimorphism in size, shape, and behaviours and males have larger and more robust physical features, along with greater muscularity and strength. The jaw of male is robust, and presents marked ridges in the area of insertion of the masseter and medial pterygoid muscles, exhibit gonial eversion and a flexure in the posterior edge of the mandibular ramus at the height of occlusal plane and mandibular heads more voluminous than females.[1]

Various Imaging Techniques including conventional radiography and computed tomography, are proposed to localize the mandibular canal [2]. Preoperative bone height was evaluated from the top of the alveolar crest to the superior border of the mandibular canal on a standard panoramic radiograph and it was concluded that panoramic examination can be considered a safe preoperative evaluation procedure for routine posterior mandibular implant placement. However American Academy of Oral and Maxillofacial Radiology has acclaimed that cross sectional imaging be used for implant cases & that conventional cross-sectional tomography is optimal for acquiring the information needed for implants patients.[3]

The aim of the present study was to assess any sexual dimorphic changes in the location of the maxillary sinus and the mandibular canal in the jaws.

Materials and methods;

Ninety healthy dentulous individuals between 16 and 45 years, consisting of equally divided males and females were chosen with their informed consent. Patients included had intact posterior teeth from premolars to molars and were devoid of any developmental defects After obtaining the approval from the ethical committee panel of our institution, linear tomographic radiographs were taken in the standardized position for the left maxillary and mandibular jaw along with proper radiation protective measures.[figure 1 &2] Film was then developed in the automatic processor. Then the distance between the buccal alveolar crest and lingual alveolar crest up to the anatomical structures (the lowest position of maxillary sinus and the superior position of mandibular canal) with respect to maxillary and mandib-

Figure 1
Linear tomographic radiographs in the standardized position for the left maxillary jaw

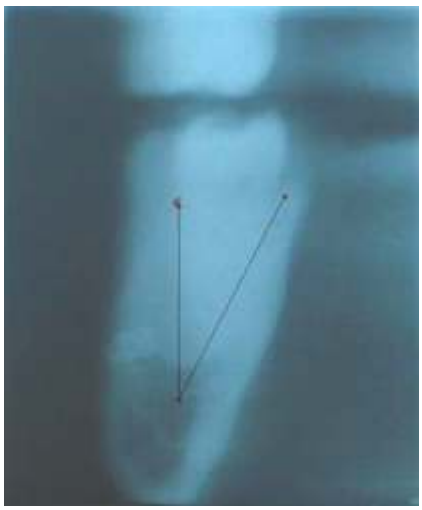

Figure 2
Linear tomographic radiographs in the standardized position for the left mandibular jaw

ular posterior teeth was measured using Adobe Photoshop 7. Then the average of the distance between the buccal and lingual alveolar crests up to the anatomical structures was calculated. Then the derivatives were calibrated with the 1 cm scale measurements in the same radiograph. The magnification factor for the tomographic radiograph in promaxplanmeca that is 1.5 was also considered and calculated before arriving at the final values. Unpaired't' test was used for statistical analysis.

RESULT

In the maxillary posterior region from the first premolar to second molar there was no gender wise statistical significance in the location of the maxillary sinus from the alveolar crest. [Table1, Chart 1] In case of mandible there was a very high statistical significance with respect to the alveolar crest of first premolars to the mandibular canal between males and females as the distance showed 19.4mm and 17.18mm respectively. At second premolars also there was high significance as the distance was 18.56mm and 16.66 mm in males and females respectively. In case of mandibular first molars it was 17.7mm and 16.01mm and in mandibular second molars it was 16.86mm and 15.28mm in males and females respectively showing that the statistical significance was high. [Table 2, Chart 2] Thus gender wise a very high statistical significance was seen in the location of the mandibular canal with respect to first premolar and high statistical significance in the posterior part of the jaws at the region of mandibular 2nd premolar, 1st molar and 2nd molar. There was about 1.9+/- 0.3mm difference in the mean location of the mandibular canal with respect to the alveolar crest between the two genders.

DISCUSSION

The mean location of lower border of the maxillary sinus and the superior border of the mandibular canal from the alveolar crest in 90 equally divided male and female patients are obtained in Indian population. Similar studies have been conducted in various populations like Japanese[4], Berne[5],Turkish[6].

In turkish population the maxillary vertical height in dentate group had no statistical significance between the genders, whereas in mandible, the vertical height showed high statistical significance in the anterior part and statistical significance in the posteriors[6]. This difference in the maxillary and mandibular vertical height between the alveolar crest and anatomic location was also noted in our study.

Yet another study in turkish population found that the lower border of the maxillary sinus to alveolar crest in edentulous molar region was 6.58+/-3.53mm in females and 6.14+/-3.97mm in males.[7] And, superior border of the mandibular canal in molar edentulous region upto alveolar crest was 9.24+/-3.81mm in females and 11.44+/-5.43mm in males. [7] This study also showed that there was high statistical significant difference between the two genders in mandibular molar region and no statistical significance in upper maxillary jaws.[7]

In the Berne population the average measured bone height from the mandibular canal to the alveolar crest in the panoramic radiograph was 13.9+/-2.66mm and the average boneheight in linear tomography was 14.87+/-3.3mm.[6] In Japanese population[5] the distance from the alveolar crest of the mandibular molar region to the superior wall of the mandibular canal was 9.1+/-5.54mm on the right side and was 9.9+/-5.05mm on the left side of the edentulous jaws.

In our study, an attempt was done to correlate the sexual dimorphic differences present in the location of the maxillary sinus and the mandibular canal in this study population. In maxillary region there was no statistical significance seen, whereas in mandible there was a very high statistical significance between males and females as the distance between

Chart 1: Genderwise compariason of location of maxillary sinus

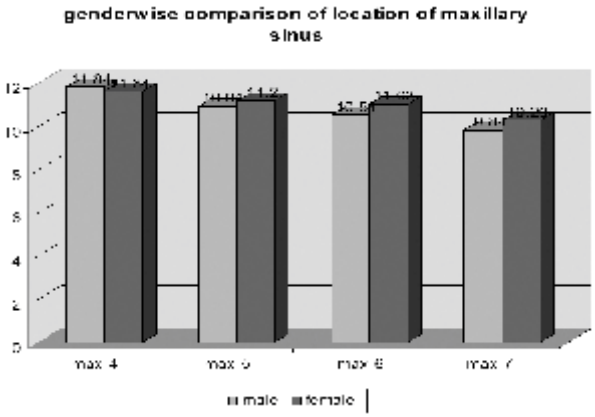

Table 1; Gender wise comparison of location of maxillary sinus

Gender		N	Mean	Std deviation	T
Max 4	male female	45 45	11.8439 11.6447	2.9454 2.3191	.35600 p=.722ns
Max 5	male female	45 45	10.9434 11.2035	2.3003 1.9406	.58000 p=.564ns
Max 6	male female	45 45	10.5449 11.0295	2.4575 2.2473	.97600 p=.332ns
Max 7	male female	45 45	9.8393 10.2885	2.3609 2.3234	.91000 p=.365

Chart 2: Genderwise compariason of location of mandibular canal

Table 2; Gender wise comparison of location of mandibular canal

Gender		N	Mean	Std deviation	T
Max 4	male female	45 45	19.4027 17.1840	2.9379 2.5256	3.84200 p=.001vhsns
Max 5	male female	45 45	18.5613 16.6632	3.1839 2.2761	3.25300 p=.002hs
Max 6	male female	45 45	17.7019 16.0134	2.9994 2.5203	2.89100 p=.005hs
Max 7	male female	45 45	16.8602 15.2803	2.9115 2.6955	2.67100 p=.009hs

the alveolar crest to the mandibular canal in males showed 19.4mm and in females it was 17.18mm in case of first premolars. The gender wise difference was also statistically highly significant in case of second premolars, first molars and second molars. The mean distance between the alveolar crest and the mandibular canal was decreasing as it was moving posterior in both the genders suggesting that mental foramen was more inferiorly placed than mandibular foramen.

In the maxilla there was no statistical significance, may be due to the variable degree of pneumatisation in different individuals. But in case of mandible, the statistical significant is due to the sexual dimorphism, [8] which may be due to the relative development of the musculoskeletal system, particularly the masticatory muscles, which are attached to the mandible. Therefore, the size and shape of the mandible is influenced by variable lifestyles, division of labour and activity by sex, chewing habits, and also ethnic groups. Moreover, there are different growth rates and developmental stages of male and female mandibles. Since females reach puberty earlier than males, development of their mandible and skull appear to either stop or slow down earlier than that in maturing males. [8]

Literature review suggests most of the studies are done on edentulous jaws for implant planning. Our study with reference to implant placement helps to assess the preoperative jaw height in the males and female patient of this population, but keeping in mind the apicocoronal changes occurring post extraction. It can also be used to estimate the average location of the mandibular canal before any minor dental surgical procedures like extractions, impactions and periapical surgeries. Further it can also be used in forensics in mass destruction cases for gender identification.

This study was on ninety healthy dentulous patients of a local area and therfore represents only for this population. For a more accurate assessment ,this study should be further conducted for a larger sample residing in various parts of the world.

CONCLUSION:

This study has been conducted keeping in view, broad aspects of variability of anatomic position of vital structures in males and females, the minute variation of which can impede with the effective dental treatment outcome. The mean distance between the alveolar crest and the maxillary sinus and the mandibular canal was decreasing as it was moving posterior in both the genders. A very high statistical significance was observed in the mean distance of the mandibular first premolar region with a p value of 0.001 and a high significance was seen with respect to mandibular second premolar, first molar and second molar. This study gives an approximate idea about the location of the mandibular canal in this population and the sexual dimorphism between the genders. This information can help one to assess and apply before any minor dental and surgical procedures There is still a need for further research in assessing the location of anatomical structures like the inferior dental canal, incisive canals of the mandible, maxillary sinus and the incisive canal and foramen of the maxilla in various large study samples and thus to possess an accurate assessment value of the distances.

REFERENCES

1. Galdames ICS, MatamalaDAZ , Smith RL; Evaluating Accuracy and Precision in Morphologic Traits for Sexual Dimorphism in Malnutrition Human Skull: a Comparative Study. Int. J. Morphol 2008; 26:877-81.
2. Saulacic N, Belser U, Bernard JP. Efficacy of panoramic radiographs in the preoperative planning of posterior mandibular implants: a prospective clinical study of 1527 consecutively treated patients.Clin Oral Implants Res. 2008;19: 81-5.

3. American Academy of Oral and Maxillofacial Radiology, Tyndall DA, Brooks SL. Hill C, Arbor A, Mich. Selection criteria for dental implant site imaging: a position paper of the American Academy of Oral and Maxillofacial radiology. Oral Surg Oral Med Oral Pathol Oral RadiolEndod 2000; 89: 630-7

4. Katsutoshi H. Study of the Maxillary Sinus Floor and the Mandibular Canal as Seen in Panoramic Radiographs of Edentulous Jaws [in Japanese].The Journal of the Kyushu Dental Society. 1996;5 :1-12 .

5. Frei C, Buser D, Dula K. Study on the necessity for crosssection imaging of the posterior mandible for treatment planning of standard cases in implant dentistry. Clin. Oral Impl. Res. 2004; 15:490–97

6. Saglam AA. The vertical heights of maxillary and mandibular bones in panoramic radiographs of dentate and edentulous subjects. Quintessence Int. 2002 Jun;33(6):433-8

7. Güler AU, Sumer M, Sumer P, Biçer I. The evaluation of vertical heights of maxillary and mandibular bones and the location of anatomic landmarks in panoramic radiographs of edentulous patients for implant dentistry. J Oral Rehabil. 2005 ; 32:741-6

8. Ongkana N, Sudwan P. Gender difference in Thai mandibles using metric analysis. Chiang Mai Med J. 2009; 48:43-8.