American Journal of Oral Medicine and Radiology

ISSN - 2394-7721

www.mcmed.us/journal/ajomr

Research Article

SEXUAL DIMORPHISM BY LOCATING THE MANDIBULAR CANAL IN DIFFERENT POSITION USING IMAGES FROM CONE-BEAM COMPUTED TOMOGRAPHY

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ABSTRACT

The aim of this study was to evaluate sexual dimorphism in anthropometric measurements on mandibular images obtained by cone beam computed tomography. This retrospective study consists of 50 CBCT images (25 Male and 25 Female) from MAHER (Meenakshi Ammal Higher Education & Research institute, Chennai.) and the age ranges from 20 to 60 years. In the CBCT images 8 measurements were performed: 1.distance from the mandibular foramen to the most anterior part of the mandibular ramus; 2. distance from the mandibular foramen to the most posterior part of the ramus; 3. distance from the superior aspect of IAC to the occlusal plane of mandibular 1st molar; 4. distance from the inferior aspect of IAC to the bottom of the mandibular canal; 5. distance from the IAC to the mandibular alveolar ridge (lingual); 6. distance from the IAC to the mandibular alveolar ridge (buccal); 7. distance from the mental foramen to the crest of the alveolar ridge; and 8. distance from the mental foramen to the base of the mandible. The values obtained was statistically analysed with SPSS software. The mean values with standard deviation was obtained and found to be significant for 5 mandibular measurements: AMaF, PMaF, SIAC, IIAC, and BIAC with a p value of <0.5%.

Key words:- Forensic science, Sexual dimorphism, Forensic dentistry, Forensic anthropology, Mandible, Cone beam computed tomography.

Access this article online	
Home page: http://www.mcmed.us/journal/ajomr DOI: http://dx.doi.org/10.21276/ajomr.2017.4.2.1	**Quick Response code**

Received:25.02.17	**Revised**:12.03.17	**Accepted**:15.03.17

INTRODUCTION

Cone-beam computed tomography (CBCT) is a relatively new imaging modality. The introduction of dentomaxillofacial CBCT scanners in the late 1990s has led to an explosion of interest in these devices in the field of dentistry. It has the obvious advantage of relatively intensifier radiation detector. CBCT imaging is performed using a rotating platform to which the X-ray source and detector are fixed. As the X-ray source and detector rotate around the object, it produces multiple, sequential, and multiplaner images that are mathematically reconstructed into a volumetric data set. A single rotational sequence would capture enough data for volumetric image construction. The radiation exposure is low because the target region is scanned in a single rotation.[1] CBCT may be very useful in some forensic procedures, offering several advantages for pre-mortem forensic and post-mortem forensic imaging including good resolution for skeletal imaging, relatively low cost, portability, and simplicity.

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The study of identity is a form of individualizing human beings by the sum of their individual characteristics. The method used by researchers to reach this goal is the identification process. Among several techniques used in identification, we focus on the study of criminal identification, which may include studies of living or dead persons. Because of the difficulty in identification, many bodies remain unidentified and new methods to facilitate identification are necessary.

MATERIALS AND METHOD

This retrospective study consists of 50 CBCT images (25 Male and 25 Female) from MAHER (Meenakshi Ammal Higer Education & Research institute, Chennai.) and the age ranges from 20 to 60 years. In the CBCT images 8 measurements were performed

1. distance from the mandibular foramen to the most anterior part of the mandibular ramus;
2. distance from the mandibular foramen to the most posterior part of the ramus;
3. distance from the superior ascpect of IAC to the occlusal plane of mandibular 1st molar;
4. distance from the inferior aspect of IAC to the bottom of the mandibular canal;
5. distance from the IAC to the mandibular alveolar ridge (lingual);
6. distance from the IAC to the mandibular alveolar ridge (buccal);
7. distance from the mental foramen to the crest of the alveolar ridge; and
8. distance from the mental foramen to the base of the mandible.

Inclusion criteria includes, no history of previous head and neck trauma, Individuals above the age of 20, should have mandibular 1st molar free of caries and restoration. Exclusion criteria includes History of Surgery /neoplasm / deficiency of mandible due to syndromes.

AMaF- distance from the mandibular foramen to the most anterior part of the mandibular ramus; PMaF- distance from the mandibular foramen to the most posterior part of the ramus;

SIAC- distance from the superior ascpect of IAC to the occlusal aspect of mandiblular 1st molar

IIAC- distance from the inferior aspect of IAC to the bottom of the mandibular canal;

LIAC- distance from the IAC to the mandibular alveolar ridge (lingual);

BIAC- distance from the IAC to the mandibular alveolar ridge (buccal);

SMeF- distance from the mental foramen to the crest of the alveolar ridge; and

IMeF-distance from the mental foramen to the base of the mandible.

RESULTS

The values obtained was statistically analysed with SPSS software. The mean values with standard deviation were calculated. Analysis of variance compared the mean values and standard deviation for mandibular measurements in men and women. Screening tests for logistic regression were used as a form of sexual differentiation and 5 mandibular measurements met the final prediction: AMaF, PMaF, SIAC, IIAC, and BIAC which was statistically significant with the p value of <0.5%. When likelihood analysis was applied to the 5 variables selected stepwise within the logistic regression the following logistic function was obtained which was in accordance to the previous study done by Thiago de Oliveira Gamba.

Logit=21.70-(0.34xAMaF)-(0.20xPMaF)-(0.35xSIAC)-(0.50xIIAC)-(0.5003xBIAC).

Figure 1. Demonstrate the distance from the mandibular foramen to the most anterior part of the mandibular ramus and distance from the mandibular foramen to the most posterior part of the ramus

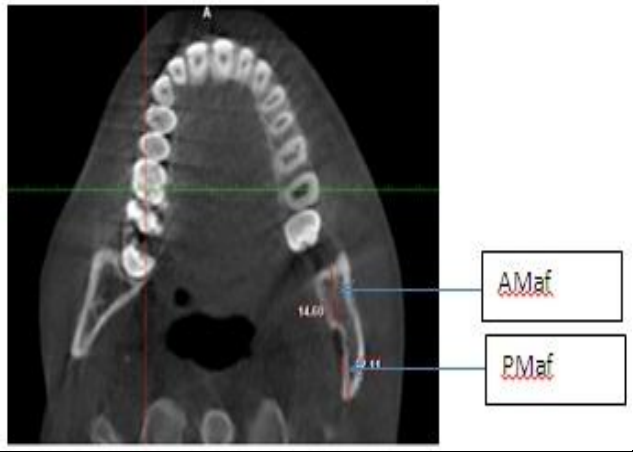

Figure 2. Demonstrate all the distances from superior, inferior, buccal and lingual.

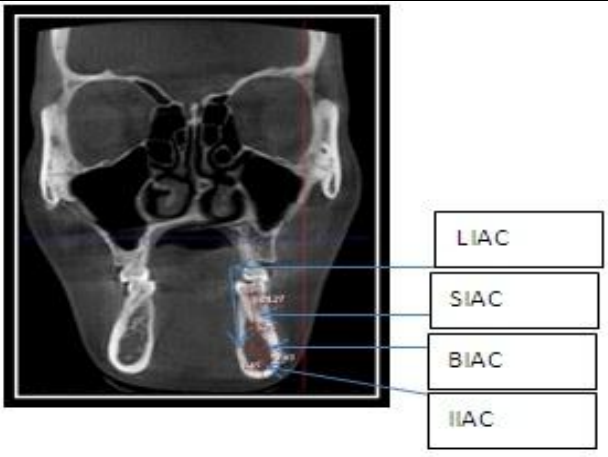

Figure 3. Demonstrate the distance form mental foramen to the crest of the alveolar ridge and from the mental foramen to the base of the mandible.

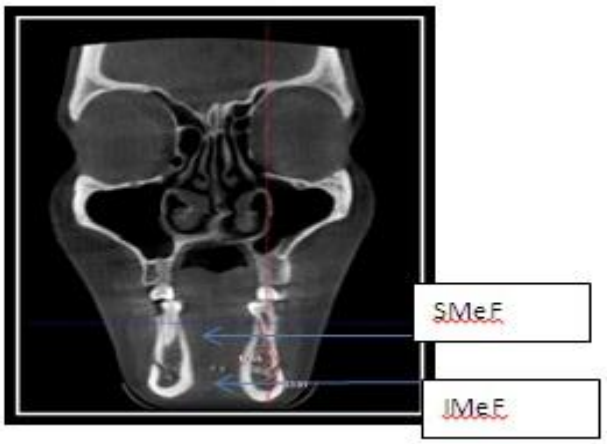

Chart 1. Inference – it shows there was significant variation between gender with AMaF, PMaF, SIAC, IIAC, and BIAC values.

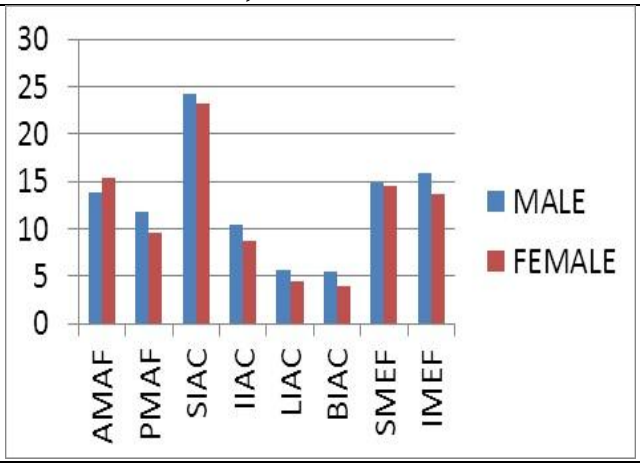

Table 1. shows the mean values and the standard deviation of all the measurements

Variable	Male		Female	
	MEAN	SD	MEAN	SD
AMaF	13.82	1.15	15.46	1.85
PMaF	11.85	1.68	9.51	1.36
SIAC	24.27	1.43	23.21	1.66
IIAC	10.41	1.80	8.66	1.98
LIAC	5.61	1.87	4.42	1.57
BIAC	5.43	1.05	3.88	1.22
SMeF	14.87	1.56	14.56	1.96
IMeF	15.92	1.68	13.62	1.29

DISCUSSION

For many years, many studies have been conducted to estimate the sex of unknown individuals. The main advantage of CBCT over MDCT is that it is associated with considerably fewer metal artefacts and is thus able to localize metallic foreign objects. However, it is not a specific examination for soft tissue. Thus, we can conclude that as well as accuracy and reliability, CBCT provides better image quality when metallic objects are present in the oral cavity[2,3].

Similarly, CT studies from Taiwan have indicated that there are significant sex differences in the positions of both the mandibular and mental foramina[4,5].

It has been reported that the accuracy rate of sex determination is 100% from a skeleton, 98% from both the pelvis and the skull, 95% from the pelvis only or the pelvis and the long bones, 90–95% from both the skull and the long bones and 80–90% from the long bones only. [6]

Next to the pelvis, the skull is the most easily sexed portion of the skeleton. Though, the determination of sex from the skull is not reliable until after puberty, [7] the craniofacial structures have the advantage of being composed largely of hard tissue, which is relatively indestructible. [8]

It has been reported in previous studies that the maxillary sinuses are significantly larger in males than in females. [9]

This study was conducted on a south indian population, and based on the results of the measurements, the analysis of variance for the measurement from the inferior alveolar canal to the buccal portion of the mandible showed no statistically significant difference between the sexes.

In CT study from the United States, Levine et al. [10] reported that older patients and white patients on average have less distance between the buccal aspect of the inferior alveolar canal and the buccal mandibular border. These results show the importance of studies in different populations; the same measurements in people from different regions may have distinct values[11].

Similarly, CT studies from Taiwan have indicated that there are significant sex differences in the positions of both the mandibular and mental foramina.[12]

The results from our study show a statistically significant difference between the sexes; as well as the mental foramen, measurement differences were found in the position of the mandibular foramen.

CONCLUSION

Often, dental professionals and forensic doctors are called to provide clarification to the court of justice for forensic identification. As crimes have become increasingly sophisticated, new forensic investigation techniques need to be improved and developed following the emergence of new technological resources. CBCT imaging can provide the much-needed 3-D perspective in certain cases that require more information than can be obtained from traditional methods. The use of this technology is yet limited and there is a need for dental professionals or forensic doctors to understand the role of this imaging modality. CBCT in future will prove to be a great tool for forensic dentistry. Of the variables assessed, AMaF, PMaF, SIAC, IIAC and BIAC showed better sex estimation parameters. The formula developed with this study can thus be used for sexual dimorphism in forensic dentistry.

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Cite this article:
Saraswathi Gopal, Shanmuga sundaram. Sexual Dimorphism By Locating The Mandibular Canal In Different Position Using Images From Cone-Beam Computed Tomography. *American Journal of Oral Medicine and Radiology*, 4(2), 2017, 43-46. DOI: http://dx.doi.org/10.21276/ajomr.2017.4.2.1