ISSN: 2581 - 3633

International Journal of Medical Science and Advanced Clinical Research (IJMACR)

Available Online at: www.ijmacr.com

Volume – 2, Issue – 2, March - April - 2019, Page No. : 41 - 45

Osteometric Assessment of the Mastoids for Gender Determination - A Retrospective CBCT Study

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Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Aim: The aim of the study is to characterize the mastoid process in terms of its size and to assess the reliability of the mastoid's, morphometric parameters in determining the gender of the subject.

Materials and Method: This retrospective study consists of 100 Adult CBCT (CONE BEAM COMPUTED TOMOGRAPHY) images of 25 males and 25 females, who were listed for Implant retained Prosthesis. Radiographic measurements of the length, width and height of left and right mastoids were accurately characterized using customized software. Age group of 15-60 years were included and Images with gross artifacts; Images that did not show anatomic details of the base or the lateral sides of the mastoid were excluded.

Result: This study showed significant difference between mastoid process of males and females. Statistics revealed highly significant value for mastoid length, width and height ($p<0.01$)**.** This study revealed that the mastoid process could be used a reliable indicator for gender determination**.**

Keywords: Mastoid Process, Mastoid Length, Mastoid Width, Mastoid Height, Sexual Dimorphism, Gender Identification

Introduction

Gender determination of an individual using the remains of human skeleton had been an interest among the anthropologists. Osteometric studies using individual bones exhibiting sexual dimorphism has been reported among different ethnic groups [(1)].One of the pivotal features considered in anthropological analysis for identification of an individual is the Gender [(2)]. The studies for sex determination are based on the dimorphism between the gender that is present in the majority of human bones[(3)].In cases of mutilated body, it is difficult to identify the bones[(4)] .Pelvis and skull are the reliable structures for osteometric assessment[(2,5)] . Sex is best assessed from the pelvis but it is very often damaged [(6)].Skull is required more frequently for gender interpretation in medico legal cases [(7,8)] . In such scenario mastoid plays a vital role in determining the gender of an individual.It is the most dimorphic part of the skull. next to the pelvic bone mastoid bone is the second best region of the skeleton for this purpose. Due to its compact nature

and its protected position in the skull, the petrous bone makes itself the second bone next to pelvis to identify gender which remains intact even in old age [9]. Mastoid process is conical and the prominence projects from the under surface of mastoid portion of temporal bone, located just behind the external acoustic meatus and is lateral to the styloid process [10]. It has been reported that morphological characters of mastoid process are valuable in recognizing a gender [11, 12, 13] .As Hoshi had already suggested when skulls were placed on flat surface, the male skulls rest on the mastoid processes, while the female skulls rest on the occipital condyles or other portions of the skull [3, 14].Radiography usage in mass disaster identification is of supreme importance as it was described in the Noronic fire [12]

Aim and Objectives

The present study aims to assess the measurement of mastoid process as it has maximum sex discriminatory power among all skull variables and to determine the gender from the CBCT images among Indian population. The variables measured are:

1. Mastoid Length.
2. Mastoid Width
3. Mastoid Height

Method

This retrospective study consists of 50 Adult CBCT images(100 Mastoid Process) of 25 males and 25 females which included left and right mastoid process.This study was done using PLANMECA MID PROMAX 3D MACHINE and images were analyzed using Planmeca Romexis software.

Radiographic measurements of the Length,Width & Height of Left and Right mastoids were accurately measured using customized software.

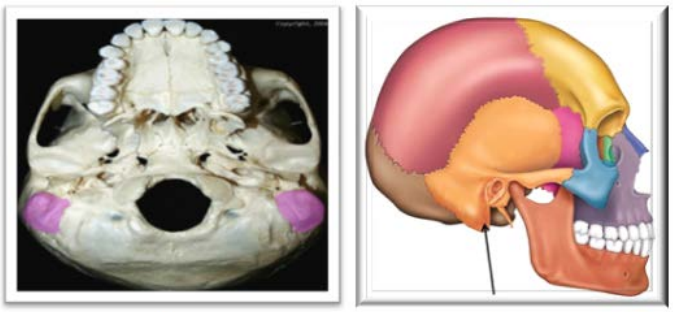
Inclusion Criteria

- Age Group Of 15-60years
- Both Males And Females

Exclusion Criteria

- Images with gross artifacts
- Images that did not show any anatomic details of the base or the lateral sides of the mastoid

Mastoid Process



A B

1. **Length:** Length is measured from the posterior end of mastoidea to the mastoidale (Fig 1)
2. **Height:** Height is measured by drawing a perpendicular line from the centric point of length to the tip of the mastoid process. (Fig 2)
3. **Width:** Width is measured from the most prominent point on the lateral and medial aspect of the mastoid(Fig 3)

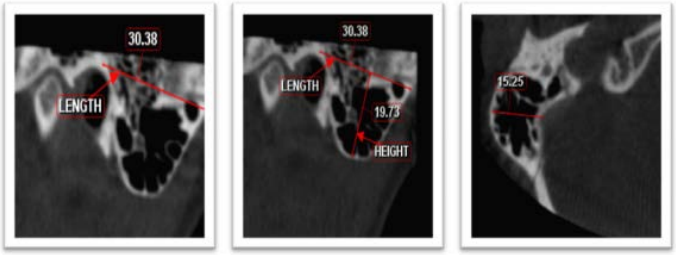
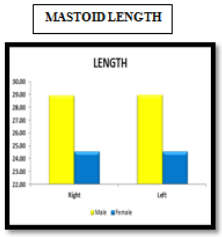


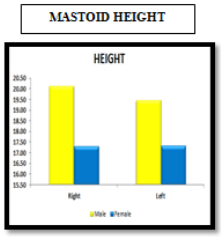
Fig 1 (Sagittal View) Fig 2(Sagittal View) Fig 3(Axial View)

Results

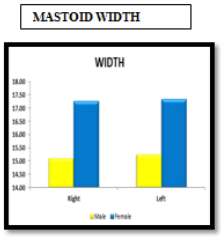
The collected data were analysed with IBM.SPSS statistics software 23.0 Version. The mean & S.D were used for continuous variables. To find the significant difference between the bivariate samples in Independent groups the unpaired sample t-test was used. In the above statistical tool the probability value of .01 was considered as significant.



Graph 1



Graph 2



Graph 3

Table.1: T – Test

Gender		N	Mean	Std. Deviation	Std. Error Mean
RIGHT L	Male	25	28.9560	1.07224	.21445
	Female	25	24.5556	.98375	.19675
LEFT L	Male	25	28.9672	1.11498	.22300
	Female	25	24.5880	.95861	.19172
RIGHT H	Male	25	20.1300	.93132	.18626
	Female	25	17.3008	.69045	.13809
LEFT H	Male	25	19.4668	3.73303	.74661
	Female	25	17.3392	.65800	.13160
RIGHT W	Male	25	15.1224	.59597	.11919
	Female	25	17.2712	.56125	.11225
LEFT W	Male	25	15.2576	.55490	.11098
	Female	25	17.3580	.55627	.11125

Males: The mean mastoid length of males (right-28.95mm,left-28.96mm) (**GRAPH-1**);height of males(right-20.13mm,left-19.46mm) (**GRAPH-2**); width of males(right-15.12mm,left-15.25mm) (**GRAPH-3**).

Females: The mean mastoid length of females (right-24.55mm, left-24.58mm) (**GRAPH-1**); height of females (right-17.30mm, left-17.33 mm) (**GRAPH-2**); width of females (right-17.27mm, left-17.35mm) (**GRAPH-3**).

Discussion

From the present study the statistical analysis of P value is highly significant and it can be concluded that, the Mastoid Length,Height And Width is a reliable indicator for sexual dimorphism. All other studies conducted on mastoid for gender determination were done on dry skull obtained from cadavers of known gender and the osteometric measurements were carried out using vernier calliper and 3D RECONSTRUCTED SKULL MODEL and this was the first study done on CBCT imaging. Sex classification is more precise in pelvic remains than the skull complete pelvic bone is not available for analysis. Perhaps skull is the second prime region of the skeleton to determine gender. During a mass disaster or breakout of war, where gender determination of a massive population is backbreaking and lingering, sex determination using mastoid process could be reliable and alacritous. In the skull, the robust and tough mastoid bone makes it resistant to physical damage.for two reasons, the mastoid region is favorable for sex determination, the compact structure of the petrous portion and its protected position at the base of the skull. So it remains intact in skeletons of very old age. Even though skull is fragmented, the mastoid stays intact. From the size of mastoid, sex can be identified i.e. a larger mastoid suggests male sex and a smaller mastoid suggests female sex[4]. The mastoid process is most resistant to damage, due to its anatomic position at the base of skull has made the mastoids a focus of researchers interest and encouraged them considering this bone as a prime morphometric trait in their studies of gender identification of human skeletal remains. The results obtained in this study proves that all the measures taken for male subjects were higher than the measurements taken for females, indicating that sex determination can be made by cranial measurements, as described by Günay &Altinkök and Kemkes & Gobel[2,15,16] . Mastoid length and height are greater in males compared to females, whereas mastoid width is greater in females compared to males. Sumati and Patnaik (2010) [17] has worked on mastoid process of North Indian skulls and this happens to be the second study on South Indian population next to das (2012)and the present study was the first study to be attempted on CBCT mode of imaging[5].In this study(table.1) The mean mastoid length of males (right-28.95mm,left-28.96mm);height of males(right-20.13mm,left-19.46mm);width of males(right-15.12mm,left-15.25mm) The mean mastoid length of females (right-24.55mm,left-

24.58mm);height of females(right-17.30mm,left-17.33mm); width of females(right-17.27mm,left-17.35mm).

According to the study conducted by Amin et al-3D reconstructed CBCT, Male mastoid length was 30.96mm, Male mastoid height was 21.60mm, Male mastoid width was 15.97 mm and Female mastoid length was 24.59mm, Female mastoid height was 17.30mm, Female mastoid width was 17.27mm which was in accordance with our study.

According to the study conducted by verma et al on dry skull, , Male mastoid length was 28.62mm, Male mastoid height was 21.60mm, Male mastoid width was 15.39mm and Female mastoid length was 23.92mm, Female mastoid height was 17.79mm, Female mastoid width was 17.36mm which was in accordance with our study.

Conclusion

Present study proved statistically that the mastoid length and height is less in females when compared to males and mastoid width is greater in females compared to males. Based on the success in this practical implementation, in future, we aim to determine the volumetric analysis of mastoid process for gender from the human skull imaging (CBCT 3D IMAGE) for the forensic science applications.

References

1. Jigyasa Passey, Suniti R Mishra, Rahul Singh, K Sushobhana, Shailendra Singh, Priyanka Sinha.Sex Determination Using Mastoid Process.Asian Journal Of Medical Sciences | Nov-Dec 2015 | Vol 6 | Issue 6.
2. Osvaldo, Fortes De Oliveira1; Rachel, Lima Ribeiro Tinoco1; Eduardo, Daruge Júnior1; Andrea Sayuri, Silveira Dias Terada2; Ricardo Henrique, Alves Da Silva2; Luiz Renato, Paranhos3.Sexual Dimorphism In Brazilian Human Skulls: Discriminant Function Analysis. Journal Of Forensic Odontostomatology. December 2012, Vol.30, No.2 Pg 26-33.
3. Paiva La, And Segre M: Sexing The Human Skulls Through The Mastoid Process.Rev. Hosp. Clin. Fac. Med.2003 Jan-Feb;58(1):15-20 .
4. Swati Shah,Pratik Patel.Sexing The Human Skull Using The Mastoid Process..Nhl Journal Of Medical Sciences/July 2013/Vol.2/Issue 2.
5. A. Das Gupta, Arindom Banerjee, Anil Kumar Etal. Discriminant Function Analysis Of Mastoid Measurements In Sex Determination. J Life Sci, 4(1): 1-5 (2012)
6. Janaki Sivakumar Et Al. Multi Variant Analysis And Validation Study On Mastoid Triangle Process For Sex Determination. International Journal Of Innovative Technology And Research. Volume No. 1, Issue No. 2, February - March 2013, 187 – 190
7. Dr. Sunil Poonia , Dr Seema Gupta, Dr. Pooja Choudhary And Dr. Manoj Verma.Sex Determination Using Mastoid Process Measurements Of Dry Skull Bone: A Descriptive Analysis. International Multispecialty Journal Of Health (Imjh) Issn: 2395-6291.Vol-2, Issue-10, October- 2016.
8. Phenice Tw. A Newly Developed Visual Method Of Sexing The Os Pubis. American Journal Of Physical Anthropology 1969; 30: 297-301.
9. Virupaxi Et.Al.: Sexual Dimorphism Of Mastoid Process In Dried Skulls Of North Karnataka Population. Int J Cur Res Rev | Vol 8 • Issue 4 • February 2016
10. Verma S, Babu. “Sex Determination By Mastoid Process In Western U. P. Populations”. Journal Of Research In Human Anatomy And Embryology 2015; Vol. 1, Issue 1, July-December 2015; Page: 1-5.
11. Amin W, Saleh M-W, Othman D, Salhab D, And Thunaibat H., “Osteometric Assessment Of The

Mastoids For Gender Determination In Jordanians By Discriminant Function Analysis." American Journal Of Medical And Biological Research, Vol. 3, No. 4 (2015): 117-123. Doi: 10.12691/Ajmbr-3-4-7.

12. Krogman Wm. The Human Skeleton In Forensic Medicine. Springfield. Illinois, Usa. Charles C. Thomas Pub Ltd, 1962; 114-22
13. Biggerstaff Rh.Craniofacial Characteristics As Determination Of Age Sex & Race In Forensic Dentistry. Dent Clin North Am. 1977; 21(1): 85-97.
14. Hoshi .H Et Al.Sex Difference In The Shape Of The Mastoid Process In Norma Occipitalis And Its Importance To Sex Determination Of The Human Skull. Okajimas Folia Anat Jpn. 1962 Oct;38:309-13.
15. Günay Y, Altinkök M. The Value Of The Size Of Foramen Magnum In Sex Determination. J Clin Forensic Med 2000; 7:147-9.
16. Kemkes A, Gobel T. Metric Assessment Of The "Mastoid Triangle" For Sex Determination: A Validation Study. J Forensic Sci 2006; 51:985-9.
17. Sumati,Patnaik. Determination of Sex from Mastoid Process by Discriminant Functional Analysis. Journal Of Anatomical Society of India.59(2).222-228(2010)