

## COMPARISON BETWEEN CT SCAN AND MANUAL METHOD OF AREA MEASUREMENT OF MASTOID PROCESS IN SEX DETERMINATION OF SOUTH INDIAN POPULATION

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### ABSTRACT

**Aim:** The purpose of this study was to evaluate the significance for sex determination of the measurement of the area formed by projection of 3 craniometric points related to the mastoid process (the porion, asterion, and mastoidale points) of 3D reconstructed computed tomography (CT) of skull and the result is compare the result of manual measurement of the area formed by projection of 3 craniometric points related to the mastoid process.

**Method:** 3D reconstructed CT of 40 males and 40 females were analysed. The three craniometric points were located and marked on both side of the 3D skull and the measurement was done by advanced post processing techniques. In manual measurement 40 males and 40 female skull were analyzed by digital caliper (0.01mm). The area of mastoid triangle was calculated by means of the Heron's formula. The result of CT reading and Manual reading is analyzed for the sex determination and the both result is compared. **Result:** From this study the areas of the male CT measurement of Mastoid is  $828.53 \pm 118.54 \text{ mm}^2$  which is greater than female Mastoid which is  $578.24 \pm 71.53 \text{ mm}^2$  (T test value 9.901 and P Value 001). Area of the male Mastoid which is measured by manual  $805.87 \pm 90.99 \text{ mm}^2$  which is greater than female Mastoid which is  $620.56 \pm 90.63 \text{ mm}^2$  (T test value 10.202 and P Value 001). **Conclusion:** The area of the mastoid triangle measured by manual and 3D reconstructed CT skull are used to determine the sex of the skull and there is no significant deference between CT scan and Manual method of area measurement of mastoid process in sex determination of south Indian population .

### KEY WORDS

3D reconstructed computer tomography, Sex determination, Mastoid process

### INTRODUCTION

In the skull, the temporal bone is highly resistant to physical damage; thus it is commonly found as

remainder in skeletons that are very old; of this, the petrous portion has been described as important for sex determination (Kalmey &

Rathbun, 1996). Paiva & Segre (2003) introduced an easy technique for sex determination starting from the temporal bone, with a small observational error and with a high predictability degree. The technique is based on the triangular area calculation obtained between the point's porion, mastoidale, and asterion, measured from xerographic copy of skulls. They found significant differences in the area between the right and left mastoid triangle when comparing male and female skulls, but owing to the asymmetries present in the skulls, it is recommended to observe the value of the total area (adding right and left sides), which was also significant, so that when it is higher than or equal to 1447.40 mm<sup>2</sup>, the skull is diagnosed as male skull, and a value near to 1260.36 mm<sup>2</sup> or less is indicative of female skull (De Paiva & Segre). The present study is aimed at describing radiological methods identification sex of skull by 3D computer tomography image.

## OBJECTIVE

The purpose of this study was to evaluate the significance for sex determination of the measurement of the area formed by projection of 3 craniometric points related to the mastoid process (the porion, asterion, and mastoidale points) of 3D reconstructed computed tomography (CT) of skull and the result is compare the result of manual measurement of the area formed by projection of 3 craniometric points related to the mastoid process.

## METHOD

3D reconstructed CT of 40 males and 40 females were analysed. The three craniometric points were located and marked on both side of the 3D skull and the measurement was done by

advanced post processing techniques. In manual measurement 40 males and 40 females skull were analyzed by digital caliper (0.01mm). The area of mastoid triangle was calculated by means of the Heron's formula. The result of CT reading and Manual reading is analyzed for the sex determination and the both result is compared.

## RESULT

From this study the areas of the male CT measurement of Mastoid is 828.53±118.54 mm<sup>2</sup> which is greater than female Mastoid which is 578.24±71.53 mm<sup>2</sup> (T test value 9.901 and P Value 001). Areas of the male Mastoid which is measured by manual 805.87±90.99 mm<sup>2</sup> which is greater than female Mastoid which is 620.56±90.63 mm<sup>2</sup> (T test value 10.202 and P Value 001) and there is no significant deference between CT scan and Manual method of area measurement of mastoid process in sex determination of south Indian population **Table – 1:-** The areas of male and female mastoid measured using manual and 3D computer Tomography imaging. (About here)

## DISCUSSION

The analysis of the mastoid process characteristics is important in the determination of sex for forensic purposes. The mastoid region used in this study, being a part of the temporal bone, is recognized as being the most protected and resistant to damage, due to its anatomical position at the base of the skull. This has been demonstrated by Kloiber (1953), Wells (1960), Schäefer (1961), Gejval (1963), and Spence (1967), as cited by Wahl and Henke<sup>10</sup> (1980) According to Paiva & Segre (2003), When it is higher than or equal to 1447.40 mm<sup>2</sup> single side, the skull is recognized as male skull and When

the total area was lower than or equal to 1260.36 mm<sup>2</sup> single side, the skull is recognized as female skull. In our present study The areas of the male right and left side From our study the areas of the male CT measurement of Mastoid is 828.53±118.54 mm<sup>2</sup> which is greater than female Mastoid which is 578.24±71.53 mm<sup>2</sup> for single side (T test value 9.901 and P Value .001). Areas of the male Mastoid which is measured by manual is 805.87±90.99 mm<sup>2</sup> for single side which is greater than female Mastoid which is 620.56±90.63 mm<sup>2</sup> for single side (T test value 10.202 and P Value .001).

### CONCLUSION

The area of the mastoid triangle measured by manual and 3D reconstructed CT skull are used to determine the sex of the skull and there is no significant difference between CT scan and Manual method of area measurement of mastoid process in sex determination of south Indian population .

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### REFERENCES

1. Kalmey, J. K. & Rathbun, T. A. Sex determination by discriminant function analysis of the petrous portion of the temporal bone. *J. Forensic Sci.*, 41:865-7, 1996

2. De Paiva, L. A. & Segre, M. sexing the human skull through the mastoid process. *Rev. Hosp. Clin. Fac. Med. São Paulo*, 58:15-20, 2003.
3. Standring S, ed. *Gray's Anatomy*. 40th Ed., Philadelphia, Elsevier, Churchill Livingstone. 2005.
4. Kemkes, A. & Gobel, T. Metric assessment of the "mastoid triangle" for sex determination: a validation study. *J. Forensic Sci.*, 51:985-9, 2006
5. Walsh M, Reeves P, Scott S. When disaster strikes; the role of the forensic radiographer. *Radiography* 2004; 10:33-43.
6. Al Ekriş AA, Ekram M. A comparative study of the accuracy and reliability of multidetector computed tomography and cone beam computed tomography in the assessment of dental implant site dimensions. *Dental Maxillofacial Radiol* 2011; 40:67-75.
7. SUAZO, G. I. C.; ZAVANDO, M. D. A. & SMITH, R. L. Sex determination using mastoid process measurements in Brazilian skulls. *Int. J. Morphol.*, 26(4):941-944, 2008

**Table – 1:- The areas of male and female mastoid measured using manual and 3D computer Tomography imaging.**

CT scan Vs. Manual Measurement	gender	N	Mean	Std. Deviation	T test	P Value
CT scan Measurement	male	40	828.53	118.54	9.901	<0.001
	female	40	578.24	71.53		
Manual Measurement	male	40	805.87	90.99	10.220	<0.001
	female	40	620.56	90.63		



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