ROLE OF DIMENSION OF MASTOID PROCESS AND NASAL PROCESS IN GENDER DETERMINATION

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ABSTRACT

BACKGROUND: The determination of gender from human skeletal is the fundamental importance of any forensic investigation. The accurateness of the sex estimation from skeletal varies according to bones and the fragmentary condition and the maximum accuracy can be obtained once the whole skeleton is available. In the event of lacking of any soft tissues, skeletal material is typically analysed to construct the individual's biological profile, which includes information about genetic ancestry, sex and stature. In general, mastoid process indicates good reliability in gender identification over its triangular dimensions

AIM: To determine the dimensions of mastoid process and nasal process in gender determination.

MATERIALS AND METHODS: Material for the study consisted of 20 adult human skulls obtained from the Anatomy and Forensic department of Saveetha dental College. Mastoid measurements and nasal process (Length, Breadth) were taken in millimeters with the help of sliding Vernier Caliper and the dimensions of the mastoid process and nasal process were calculated.The measurements were tabulated and analysed using spss software.

RESULTS: The results of the present study revealed that the marked sexual dimorphism in the dimensions of the mastoid and nasal region, are establishing its value as a gender indicator.

CONCLUSION: The result of the present study showed that the nasal process and mastoid process shows the evidence of anatomic variability between the genders as a good indicator of sex when all the parameters are considered.

Keywords: eco friendly, innovative method,mastoid process,nasal process

INTRODUCTION:

Identification means “determination of individuality.” In numerous civil and criminal concerns, identification of the individual, either living or dead, are essential. Anatomical and medical features are the two major aspects to establish the identification(1). The establishment of recognition is required from fresh intact corpses, decomposed corpses, mutilated and dismembered corpses, or skeletalized material. Sex determination of humans or human skeletal corpse as a vital step in identification and is vital for further analysis (2).Studies on human skeletal remains for sex determination remain the topic of interest among researchers.

Human skulls are remnants to physical damage and have several complex structures. Different craniofacial components have different caliber in Gender identification. Skull and pelvis presume to have great importance in establishing sex of an individual(3) In oral cavity, teeth may be used for gender determination with the aid of odontometric analysis were mandibular canines presented the greatest di-morphism amongst all the teeth. Hence skull remains a better sex determinant of which we have chosen, mastoid process that shows good reliability in gender identification through its triangular dimensions and field of view. Mastoid process demonstrates greater dimorphic trait with females having smaller mastoid. In the skull, the mastoid bones are robust and tough composing it resistant to physical damage(4). The mastoid region is complimentary for sex determination for two reasons – the compact structure of the petrous portion and its protected position at the base of the skull. Hence, it is usually found intact in skeletons of very old age. Even though the skull is fragmented, the mastoid resides integral.

Fortitude of gender is done through various body parts, the skull, the pelvis, the long bones with an epiphysis and a metaphysis in skeletons, the mastoid process, the foramen magnum and the paranasal sinuses (5).The medial nasal process on the inner side of each nasal pit combine into the intermaxillary segment and form the upper lip, crest, and tip of the nose. The medial nasal processes unite with the maxillary prominences. The lateral nasal process from each side joins to form the alae of the nose. Sexual dimorphism refers to the systemic difference in the form either in shape or size between individuals of different sexes in the same species(5,6) .Maxillary sinuses are two spaces that are filled with air, located in the maxillary bone and can be in various sizes and shapes. Their walls are thin. The apex of the sinuses can extend into the zygomatic process and can occupy the zygomatic bone. The floor shaped by the alveolar process, the first, the second and the third molars and the roots of the canines could exalt the sinuses or might perforate their floor.(7) Maxillary sinuses of various species are known to exhibit sexual dimorphism . The maxillary sinuses in males are larger than in females in contemporary human populations.This is achieved by various methods. Previously our department has published extensive research on various aspects which inspired us to do this study(8,9)(10)(11)(12). The aim of the study was to determine the dimensions of mastoid process and nasal process in gender determination.

MATERIALS & METHODS: Material for the study consisted of 20 adult human skulls obtained from the Anatomy and Forensic department of Saveetha dental College. Mastoid measurements and nasal process (Length, Breadth) were taken in millimeters with the help of sliding Vernier Caliper and the dimensions of the mastoid process and nasal process were calculated.The measurements were tabulated and analysed using spss software.

RESULTS: 2 Skulls of height 17-23, 7 Skulls of height 23-32 and 9 Skulls of height 32-38 are the ranges of heights of skulls for Mastoid Process. 3 skulls of width 18-21, 10 Skulls of width 21-23 and 7 Skulls of 23-27 are width of Skulls for mastoid process,

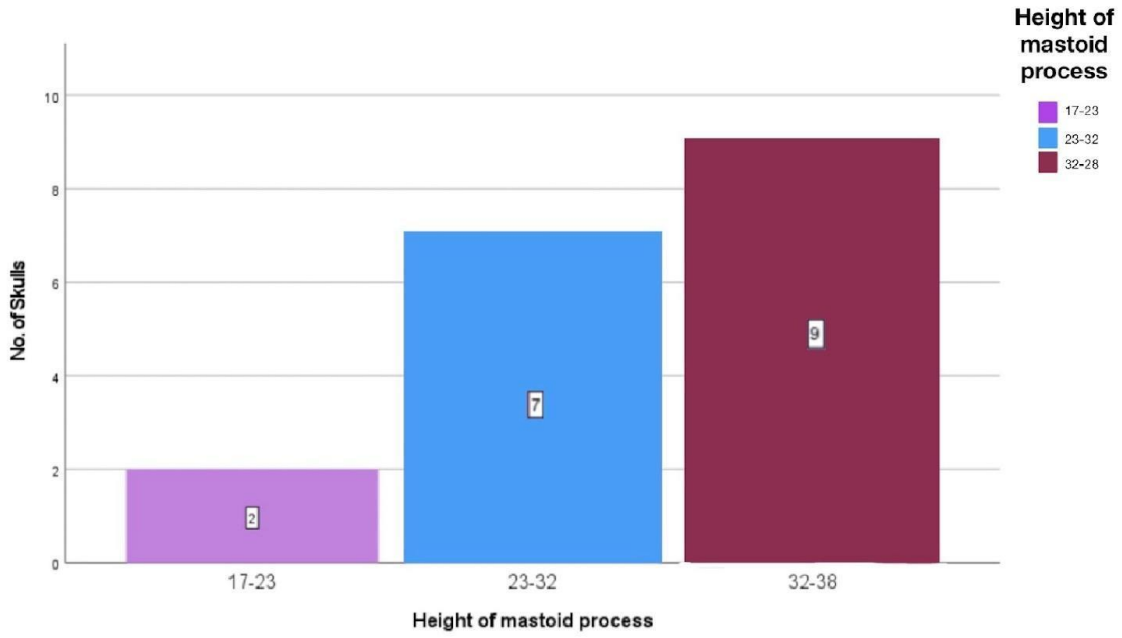

Figure 1: The bar graph represents the distribution showing responses to the height of the mastoid process . X axis represents the height of the mastoid process and Y axis represents the number of skulls. 2 skulls,7 skulls and 9 skulls range between 17-23,23-32,32-28 height respectively.

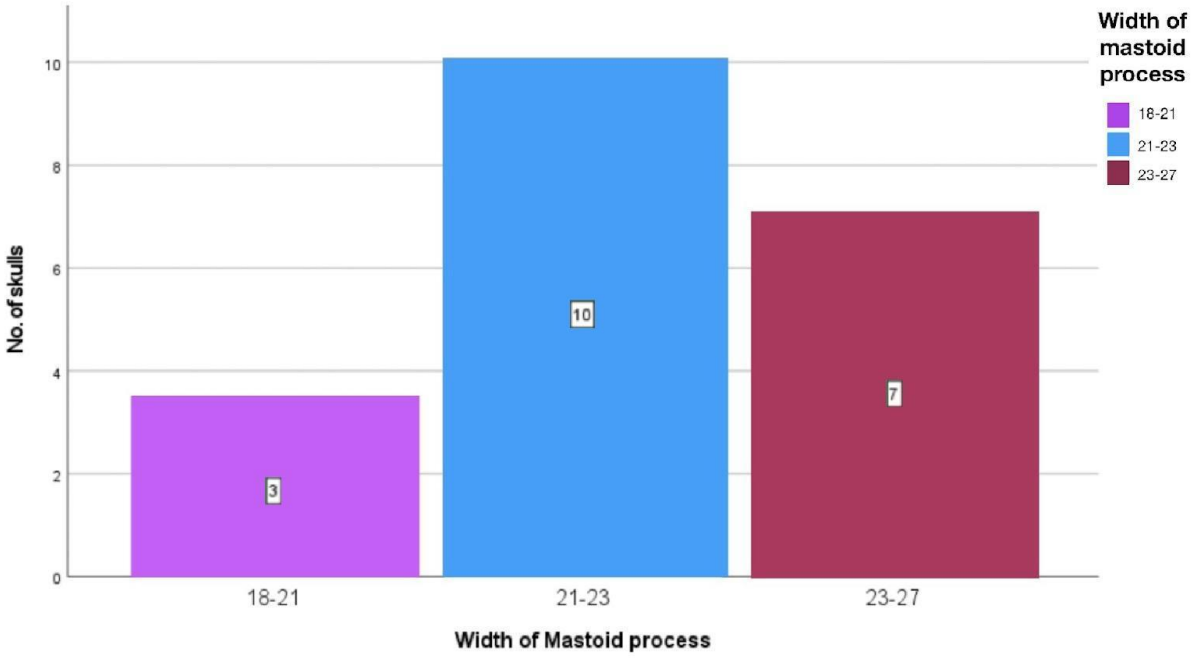

Figure 2: The bar graph represents the distribution showing responses to the height of the mastoid process . X axis represents the width of the mastoid process and Y axis represents the number of skulls. 3 skulls,10 skulls and 7 skulls range between 18-21,21-23,23-27 widths respectively.

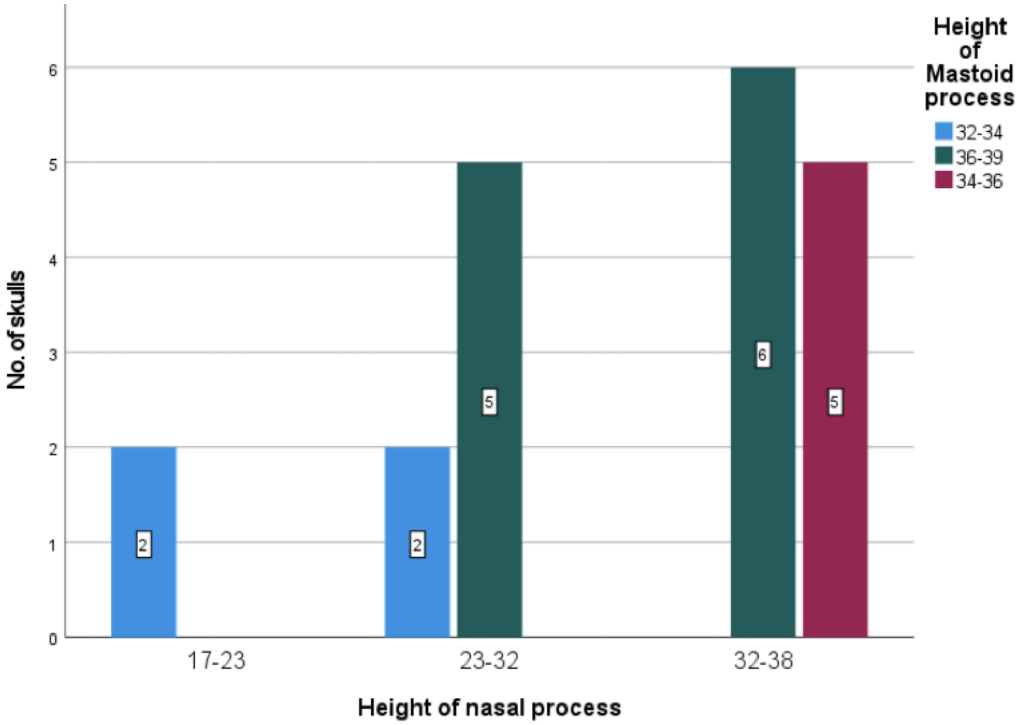

Figure 3: The bar graph represents the association between the height of the nasal process and height of the mastoid process . X axis represents the height of the nasal process and Y axis represents the number of skulls. The blue bar represents 32-34 and the green bar represents 36-39and the pink bar represents 34-36.. Chi square test was done and association was found to be statistically significant (P =0.105, p<0.01).

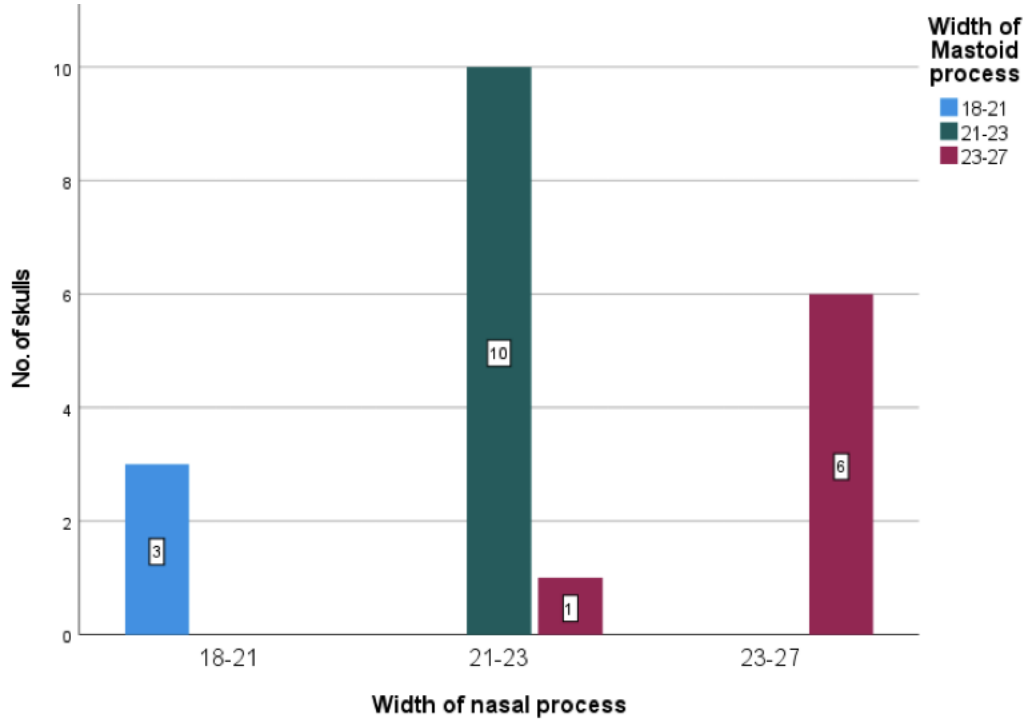

Figure 4: The bar graph represents the association between the width of the nasal process and width of the mastoid process . X axis represents the width of the nasal process and Y axis represents the number of skulls. The blue bar represents 18-21 and the green bar represents 21-23 and the pink bar represents 23-27. Chi square test was done and the association was found to be statistically significant (P =0.123, p<0.01).

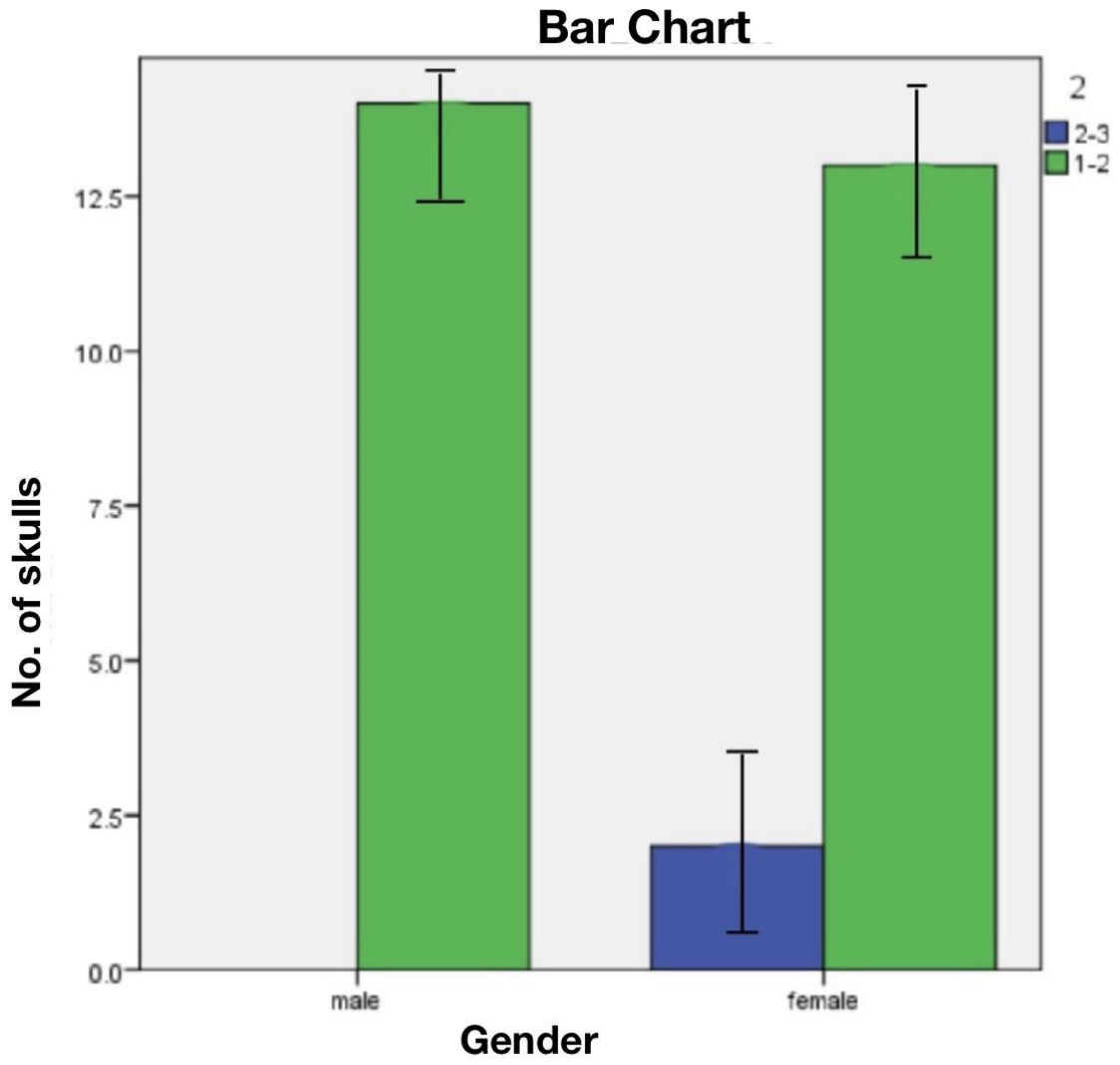

Figure 5:Bar graph representing the knowledge between gender and the measurement of width of nasal process. The X axis represents the gender of the dry skull samples and the Y axis represents the number of skulls. Majority of the female skulls had greater nasal process width than male skulls. The P value was found to be 0.002(p value<0.05) which was found to be statistically significant.

DISCUSSION:

In the present forensic scenario, dismemberment or body mutilations has become a recurrent method to reveal the identity of the victim. In such cases, the pelvises are considered to be the best bone to determine the sex of an individual (7,13). While the pelvises are unavailable, the skull is also widely considered the best indicator of sex. Skull is the most dimorphic and easily sexed portion of the skeleton after the pelvis, providing up to 92% reliability. The present study is different from previous studies by focusing on sex determination using the various variables of mastoid processes such as length, breadth, anterio posterior diameter, size, perimeter, Po As, As Ma, Po Ma, and area of mastoid triangle (7,13,14)

Mastoid process plays an important role in Gender identification because of its field of view and its triangular dimension. Using discriminant function analysis, a maximum of 82% correct classification were achieved with all variables. It is similar and in few cases considerably better, than those of conventional cranial measurements used earlier. Moreover, separate discriminatory equation was calculated based on each variable hence, even by measuring one variable from a fragment of skull, sex can be effectively determined. Mastoid region is measured as one of the slowest and later growing regions of the cranium, presenting a higher degree of sexual dimorphism in adulthood. Disparity between the size of mastoid process in males and females may be due to the discrepancy in the growth of mastoid process in both males and females along with response of stronger muscle action of sternocleidomastoideus, splenius capitis(the posterior belly of the digastric muscle); and longissimus capitis could enhance the greater development of mastoid process in males. The results of the present study highlighted the significant difference between males and females in all the measurements of the mastoid process. These results were similar to the findings reported by Patnaik VV .(15)

A forensic study is significant in the identification of sex especially whilst the body of the deceased has been damaged as a result of physical injury due to weapons, fire or strong chemicals (16). Additionally to the maxillary sinus, sexual dimorphism can be completed using other skeletal structures such as foramen magnum, occipital bone and frontal bone. Sinus radiography are employed for identification of remains and determination of sex and ancestry. They offer an accurate assessment of the paranasal sinuses, craniofacial bones, along with the extent of pneumatization of the sinuses. It provides detailed information unavailable from standard radiographs. Sexual dimorphism refers to the systemic difference in the form either in shape or size between individuals of different sexes in the same species. Maxillary sinuses of various species are known to exhibit sexual dimorphism (17). The maxillary sinus in males is larger than in females in contemporary human populations.

A previous Study about the gender determination from the foramen magnum, resulted that sexual dimorphism is present in foramen magnum ((17,18). Another study on gender determination was done using calvarial thickness in different skeletal patterns. They deduced that frontal and

occipital bones can be used as important key bones for understanding the calvarial phenotypic description and sexual dimorphism. A study on volume quantification of healthy paranasal cavities by three dimensional CT imaging in 20 Japanese subjects and substantiated that paranasal sinuses were individually and apparently larger in males than of females (19) .This present study stands significant with the earlier studies done.

A study done (20)stated that the mean value of the maxillary sinus volume was significantly larger in males than in females which is in line with the present study. A Study done by Teke with width, length and the height of the maxillary sinus in 127 adult patients by CT and observed that the measurements of the maxillary sinuses of males are larger than those of females. The mean estimated rate of gender was detected at 69.3%. A Study done (21)The height, length, width and volume of maxillary sinuses on each side were determined. The results showed the measurements and volume of maxillary sinus of males were slightly more compared with females. The left width and right sided volume showed statistically significant values which correlates with the result of the present study.

CONCLUSION:

Gender determination is an important step in identifying forensic science. The result of the present study showed that the nasal process and mastoid process shows the evidence of anatomic variability between the genders as a good indicator of sex when all the parameters are considered. Combination of various parameters can be used for gender determination with a good accuracy**.**

CONFLICT OF INTEREST : NIL

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