Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.47750/jptcp.2022.1007

Gender Determination Using Bicondylar Breadth in Orthopantomogram

Saivarshine[1], Reshma Poothakulath Krishnan[2], Abirami Arthanari[3]

[1]Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences(SIMATS), Saveetha University, Chennai, Tamilnadu, India.

[2]Senior lecturer, Department of Oral Pathology, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences(SIMATS), Saveetha University, Chennai, Tamilnadu, India.

[3]Lecturer, Department of Oral Pathology, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences(SIMATS), Saveetha University, Chennai, Tamilnadu, India.

***Corresponding author**: Reshma Poothakulath Krishnan, Senior lecturer, Department of Oral Pathology, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences(SIMATS), Saveetha University, Chennai, Tamilnadu, India, Email : reshmapk.sdc@saveetha.com

Submitted: 14 September 2022. Accepted: 16 October 2022. Published: 17 November 2022

ABSTRACT

Introduction: Identification of gender is of primary importance in forensic investigations when only fragments of the skull remain. The mandible is located inferior to the facial skeleton. It is the largest and strongest bone of the face and exhibits a high degree of sexual dimorphism.The aim of the study is to determine gender by bigonial breadth using Orthopantomogram.

Materials and methods: The present study is a retrospective quantitative analytical study. The orthopantomograms of 20 subjects of age group 30-40 years were collected. Measurement of bicondylar breadth was done using a computerised software

Results: The mean value of bicondylar breadth was noted to be higher in males with 266.60 than females with 243.20. Independent sample t-test showed p value of 0.078 which is statistically not significant (<0.05).

Conclusion: Maximum bicondylar breadth was noted more among males than females. The Bicondylar breadth has anthropometric value. It can be used in determination of gender of subjects in medico-legal cases.

Keywords: *Gender determination, Bicondylar breadth, Orthopantomogram,innovative technology, novel method*

INTRODUCTION

Identification of ancestry is vital in forensic contexts and bioarchaeological research. After identification of human species, accurate gender determination from skeletal remains is the initial process towards the individual identification (1). In every human population, adult male and female skeletons contemplate different shape and size characteristics. This forms the groundwork of forensic anthropology (2). Three fundamental criteria guides the choice of skeletal elements that may be useful indicators of gender: The skeletal morphology should clearly reflect either anatomic or physiologic sex differences or both, they should be able to combat the rigors of skeletonization and fossilization, and ideally the trait should be recognizable through time (3).

The personal identification mainly depends on the gender determination and it entirely depends on how much the skeleton is remaining. Accordingly, in mass disasters and major catastrophic accidents it is very strenuous to determine gender as we could not find 100% remains of the victims (4). Sex determination by morphological estimation has been one of the medievial techniques in medico-legal examinations and forensic anthropology. The method may differ and they can be based upon the available bones and their conditions (5). The identification of sex is consequential in cases of mass fatality incidents where bodies are damaged beyond recognition. As a matter of fact, every so often intact skull may not be found, then the mandible may impart a great virtue in identification of victims in determining his/her gender (6)

Skull and pelvis are the most definitive sources for sex determination in the human body.

The accuracy of gender determination confides in the integrity of the remains and the degree of sexual dimorphism is characteristic in the population (7) In every way, gender can be determined with one hunderd percent accuracy, whereas during mass disasters where usually fragmented bones are found, sex determination depends largely on the available parts of the skeleton. The skull and pelvis, is the most common component of the skeleton used for gender determination. Supposing, when the undamaged skull is not found, mandible may play a significant role in sex determination as it is the most dimorphic bone of the skull.

Our team has extensive knowledge and research experience that has translate into high quality publications(8),(9),(10),(11),(12),(13),(14),(15),(16),(17),(18),(19),(20),(21),(22),(23),(24),(25),(26),(27). The aim of the study is to determine gender by bigonial breadth using Orthopantomogram.

MATERIALS AND METHODS

The current study is a retrospective quantitative analytical study. Data was obtained from the records of 20 patients between the age group of 30-40 years who visited the department of oral medicine and radiology, Saveetha Dental College, Chennai and underwent a radiolographic investigation of panoramic radiography (OPG). All the measurements were done on a digital orthopantomogram. The Bicondylar breadth was measured in each OPG, and finally the values obtained for males and females were compared.

J Popul Ther Clin Pharmacol Vol 29(4):e251–e258; 17 November 2022.

Subjects between the age group of 30 years to 40 years of age were included in the study while OPGs with developmental disturbances of the mandible, fractures or other pathologies were excluded from the study. Bicondylar breadth was obtained by measuring the distance between the most lateral points of the left and the right condyle (Figure 1). Categorical variables are presented in number and percentage (%) and continuous variables are presented as mean and SD. Quantitative variables were compared using the Unpaired t-test between two Males and Females. A p value of <0.05 is considered statistically significant. The data was entered in MS Excel spreadsheet and analysis was done using Statistical Package for Social Sciences (SPSS) version 23.0.

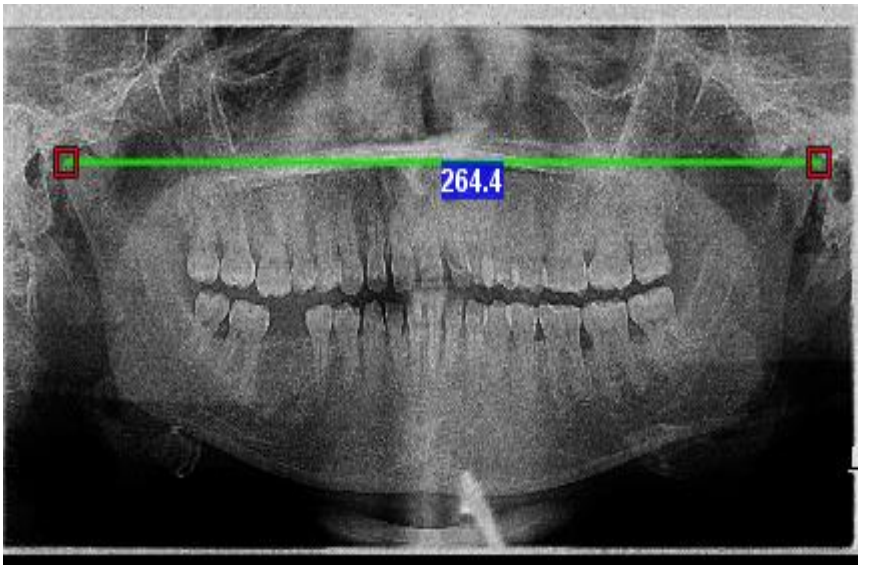

FIGURE 1: Measurement of bicondylar breath in an orthopantomogram

RESULTS

The present study included a total no. of 10 male and 10 female OPGs between the age group of 30-40 years. The mean value of bicondylar breadth was noted to be higher in males with 266.60 than females with 243.20 and the standard deviation of males was also higher with 17.122 than 11.736 . Comparing the values, from the independent sample t-test, the p value was found to be 0.078 which is statistically not significant (<0.05) (Fig 2).

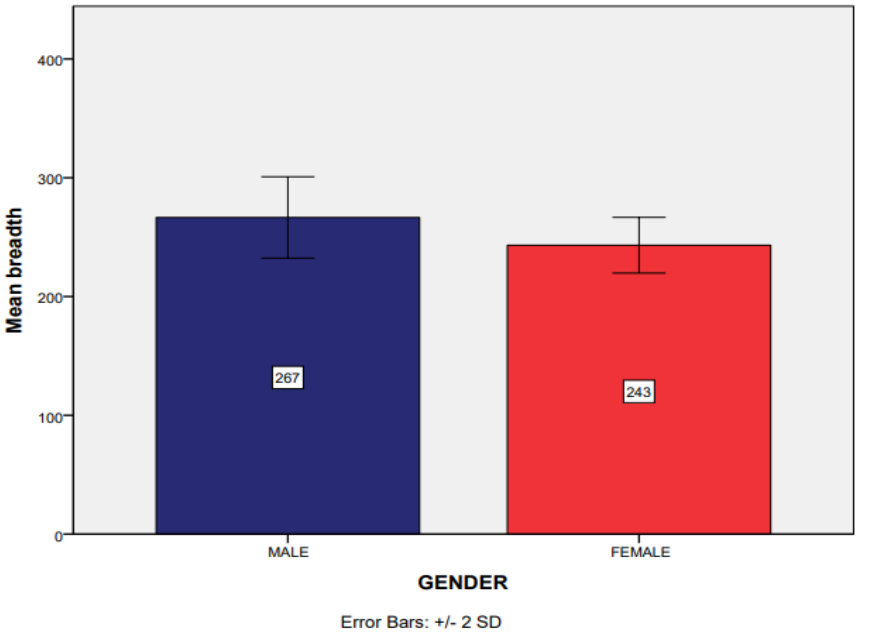

FIGURE 2: The bar chart represents the association between gender and mean bicondylar breadth, X-axis represents the gender and Y-axis represents the mean bicondylar breadth. Blue denotes males and Red denotes females. The mean bicondylar breadth of male is 267mm and female is 243mm. The mean bicondylar breadth was more in males when compared to females. Independent T test showed p value of 0.078 ($p>0.05$), Hence, it is statistically not significant.

DISCUSSION

In our study the bicondylar breath was more in males when compared to females. The identification of gender from skeletal remains is of great importance in forensic science and anthropology, specifically in criminal prosecutions, and also in the identification of missing person cases and efforts to recreate the lives of ancient populations. The identification of gender, morphological and anatomical marks is contextual and expected to be inaccurate, but measurement and morphometry methods are precise and can be used to assess the gender of the skull.

Forensic dentists can help other professionals to determine the gender and age of the remains by using teeth and skull.

Forensic odontology plays a crucial role in identifying the gender of victims with bodies deformed beyond identification due to huge mass disasters. Panoramic radiographs have been routinely advocated as one of the appropriate screening tools for the diagnosis of oral diseases. The main benefits of panoramic images (28)are their wide coverage, low patient radiation exposure, and quick image acquisition time. They've also proven to be a good source for retrospective studies.

Sexual dimorphism (29) displayed by the skull is largely based on changes occurring in the male puberty that signify increased muscle attachment, while the female skull appears to maintain pedomorphic features.

The male mandible generally has a higher body height, a more prolific chin and a more stable lower border, and more notable muscle markings than the female mandible. There seems to be good evidence to show that nutritional factors can influence the expression of dimorphism. It has been suggested that males are more vulnerable to nutritional quality fluctuations, therefore growth is reduced to a larger level than in females, likely to result in even more equal body size and decreased dimorphism.

In our study we stated that there was no significant association between males and females. It was found that there was no obvious significant correlation ($p>.05$) between gender of subjects and there was no significant correlation between male subjects with female subjects of the bicondylar breadth. The maximum bicondylar width in males was significant with 267mm and in females with 243mm. T. Kieser JA et al (30) explained that 'Sexual Dimorphism' refers to the variations in size, stature and appearance between male and female that can be used for dental identification. Mandible is the largest and toughest bone within the face and also has a greater shape than those of other bones in the forensic and physical anthropological fields (31). The mandible can also be used to differentiate among ethnic communities and genders. Mandibular ramus could also distinguish the difference between the genders, as the phases of mandibular growth, rate of growth and timeframe are markedly different in both males and females. In addition, the chewing forces imposed are different for males and females, which affect the shape of the mandibular ramus.

Behl et al (32) claimed that the condylar, coronoid and projection height of the ramus was maximum in males than in females, thus recognising that gender variations in the mandibular ramus are more prominent than in the body. He also said there was a gonial angle which was not higher in females and bigonial width was not significantly different in males and females.

Gamba Tde et al, analyzed brazilian Ramus length, gonion-gnathion length, minimum ramus width, bigonial angle, bicondylar breadth, and bigonial width using Cone-beam computed tomography, and found that the rate of accurate gender classification was 95.1%. A precision of 93.33 percent and 94.74 per cent were found for the assessment of males and females. The findings of the present research are consistent with other studies performed in various populations around the world. Further research should be conducted in a larger sample size for concluding the results obtained.

CONCLUSION

In this study maximum bicondylar breadth was noted more among males than females. Further studies are required with larger sample size to generalize these results.

ACKNOWLEDGEMENT

We extend our sincere gratitude to the Saveetha Dental College and Hospitals for their constant support and successful completion of this work.

CONFLICT OF INTEREST

The authors have none to declare.

SOURCE OF FUNDING

The present study was supported by the following agencies, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Self Zak Exports (Granite Exporters), Krishnagiri,Tamil Nadu.

REFERENCES

1. Ozer I, Katayama K, Sağir M, Güleç E. Sex determination using the scapula in medieval skeletons from East Anatolia. Coll Antropol. 2006 Jun;30(2):415–9.
2. Pramod J, Marya A, Sharma V. Role of forensic odontologist in post mortem person identification [Internet]. Vol. 9, Dental Research Journal. 2012. p. 522. Available from: http://dx.doi.org/10.4103/1735-3327.104868
3. Giles E. Sex determination by discriminant function analysis of the mandible [Internet]. Vol. 22, American Journal of Physical Anthropology. 1964. p. 129–35. Available from: http://dx.doi.org/10.1002/ajpa.1330220212
4. Vodanović M, Demo Ž, Njemirovskij V, Keros J, Brkić H. Odontometrics: a useful method for sex determination in an archaeological skeletal population? [Internet]. Vol. 34, Journal of Archaeological Science. 2007. p. 905–13. Available from: http://dx.doi.org/10.1016/j.jas.2006.09.004
5. G V, Vinay G. Sex Determination of Human Mandible Using Metrical Parameters [Internet]. JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH. 2013. Available from: http://dx.doi.org/10.7860/jcdr/2013/7621.3728
6. Chandra A, Singh A, Badni M, Jaiswal R, Agnihotri A. Determination of sex by radiographic analysis of mental foramen in North Indian population. J Forensic Dent Sci. 2013 Jan;5(1):52–5.
7. Patil K, Mahima VG, Srikanth HS. Zygomatic air cell defect: A panoramic radiographic study of a south Indian population [Internet]. Vol. 20, Indian Journal of Radiology and Imaging. 2010. p. 112. Available from: http://dx.doi.org/10.4103/0971-3026.63052
8. Aldhuwayhi, Sami, Sreekanth Kumar Mallineni, Srinivasulu Sakhamuri, Amar Ashok Thakare, Sahana Mallineni, Rishitha Sajja, Mallika Sethi, Venkatesh Nettam, and Azher Mohiuddin Mohammad. 2021. “Covid-19 Knowledge and Perceptions Among Dental Specialists: A Cross-Sectional Online Questionnaire Survey.” Risk Management and Healthcare Policy 14 (July): 2851–61.
9. Dua, Kamal, Ridhima Wadhwa, Gautam Singhvi, Vamshikrishna Rapalli, Shakti Dhar Shukla, Madhur D. Shastri, Gaurav Gupta, et al. 2019. “The Potential of siRNA Based Drug Delivery in Respiratory Disorders: Recent Advances and Progress.” Drug Development Research 80 (6): 714–30.
10. Gan, Hongyun, Yaqing Zhang, Qingyun Zhou, Lierui Zheng, Xiaofeng Xie, Vishnu Priya Veeraraghavan, and Surapaneni Krishna Mohan. 2019. “Zingerone Induced Caspase-Dependent Apoptosis in MCF-7 Cells and Prevents 7,12-Dimethylbenz(a)anthracene-Induced Mammary Carcinogenesis in Experimental Rats.” Journal of Biochemical and Molecular Toxicology 33 (10): e22387.
11. Jayaraj, Gifrina, Pratibha Ramani, Herald J. Sherlin, Priya Premkumar, and N. Anuja. 2015. “Inter-Observer Agreement in Grading Oral Epithelial Dysplasia – A Systematic Review.” Journal of Oral and Maxillofacial Surgery, Medicine, and Pathology. https://doi.org/10.1016/j.ajoms.2014.01.006.
12. Li, Zhenjiang, Vishnu Priya Veeraraghavan, Surapaneni Krishna Mohan, Srinivasa Rao Bolla, Hariprasath Lakshmanan, Subramanian Kumaran, Wilson Aruni, et al. 2020. “Apoptotic Induction and Anti-Metastatic Activity of Eugenol Encapsulated Chitosan Nanopolymer on Rat Glioma C6 Cells via Alleviating the MMP Signaling Pathway.” Journal of Photochemistry and Photobiology B: Biology. https://doi.org/10.1016/j.jphotobiol.2019.111773

J Popul Ther Clin Pharmacol Vol 29(4):e251–e258; 17 November 2022.

13. Markov, Alexander, Lakshmi Thangavelu, Surendar Aravindhan, Angelina Olegovna Zekiy, Mostafa Jarahian, Max Stanley Chartrand, Yashwant Pathak, Faroogh Marofi, Somayeh Shamlou, and Ali Hassanzadeh. 2021. "Mesenchymal Stem/stromal Cells as a Valuable Source for the Treatment of Immune-Mediated Disorders." Stem Cell Research & Therapy 12 (1): 192.
14. Mohan, Meenakshi, and Nithya Jagannathan. 2014. "Oral Field Cancerization: An Update on Current Concepts." Oncology Reviews 8 (1): 244.
15. Neelakantan, Prasanna, Deeksha Grotra, and Subash Sharma. 2013. "Retreatability of 2 Mineral Trioxide Aggregate-Based Root Canal Sealers: A Cone-Beam Computed Tomography Analysis." Journal of Endodontia 39 (7): 893–96.
16. Paramasivam, Arumugam, Jayaseelan Vijayashree Priyadharsini, Subramanian Raghunandhakumar, and Perumal Elumalai. 2020. "A Novel COVID-19 and Its Effects on Cardiovascular Disease." Hypertension Research: Official Journal of the Japanese Society of Hypertension.
17. Sheriff, K. Ahmed Hilal, K. Ahmed Hilal Sheriff, and Archana Santhanam. 2018. "Knowledge and Awareness towards Oral Biopsy among Students of Saveetha Dental College." Research Journal of Pharmacy and Technology. https://doi.org/10.5958/0974-360x.2018.00101.4.
18. Ponnulakshmi R, Shyamaladevi B, Vijayalakshmi P, Selvaraj J. In silico and in vivo analysis to identify the antidiabetic activity of beta sitosterol in adipose tissue of high fat diet and sucrose induced type-2 diabetic experimental rats. Toxicol Mech Methods. 2019 May;29(4):276–90.
19. Sundaram R, Nandhakumar E, Haseena Banu H. Hesperidin, a citrus flavonoid ameliorates hyperglycemia by regulating key enzymes of carbohydrate metabolism in streptozotocin-induced diabetic rats. Toxicol Mech Methods. 2019 Nov;29(9):644–53.
20. Alsawalha M, Rao CV, Al-Subaie AM, Haque SKM, Veeraraghavan VP, Surapaneni KM. Novel mathematical modelling of Saudi Arabian natural diatomite clay. Mater Res Express. 2019 Sep 4;6(10):105531.
21. Yu J, Li M, Zhan D, Shi C, Fang L, Ban C, et al. Inhibitory effects of triterpenoid betulin on inflammatory mediators inducible nitric oxide synthase, cyclooxygenase-2, tumor necrosis factor-alpha, interleukin-6, and proliferating cell nuclear antigen in 1, 2-dimethylhydrazine-induced rat colon carcinogenesis. Pharmacogn Mag. 2020;16(72):836.
22. Shree KH, Hema Shree K, Ramani P, Herald Sherlin, Sukumaran G, Jeyaraj G, et al. Saliva as a Diagnostic Tool in Oral Squamous Cell Carcinoma – a Systematic Review with Meta Analysis [Internet]. Vol. 25, Pathology & Oncology Research. 2019. p. 447–53. Available from: http://dx.doi.org/10.1007/s12253-019-00588-2
23. Zafar A, Sherlin HJ, Jayaraj G, Ramani P, Don KR, Santhanam A. Diagnostic utility of touch imprint cytology for intraoperative assessment of surgical margins and sentinel lymph nodes in oral squamous cell carcinoma patients using four different cytological stains. Diagn Cytopathol. 2020 Feb;48(2):101–10.
24. Karunagaran M, Murali P, Palaniappan V, Sivapathasundharam B. Expression and distribution pattern of podoplanin in oral submucous fibrosis with varying degrees of dysplasia – an immunohistochemical study [Internet]. Vol. 42, Journal of Histotechnology. 2019. p. 80–6. Available from: http://dx.doi.org/10.1080/01478885.2019.1594543

25. Sarode SC, Gondivkar S, Gadbail A, Sarode GS, Yuwanati M. Oral submucous fibrosis and heterogeneity in outcome measures: a critical viewpoint. Future Oncol. 2021 Jun;17(17):2123–6.
26. Raj Preeth D, Saravanan S, Shairam M, Selvakumar N, Selestin Raja I, Dhanasekaran A, et al. Bioactive Zinc(II) complex incorporated PCL/gelatin electrospun nanofiber enhanced bone tissue regeneration. Eur J Pharm Sci. 2021 May 1;160:105768.
27. Prithiviraj N, Yang GE, Thangavelu L, Yan J. Anticancer Compounds From Starfish Regenerating Tissues and Their Antioxidant Properties on Human Oral Epidermoid Carcinoma KB Cells. In: PANCREAS. LIPPINCOTT WILLIAMS & WILKINS TWO COMMERCE SQ, 2001 MARKET ST, PHILADELPHIA …; 2020. p. 155–6.
28. Phillips JL, Norman Weller R, Kulild JC. The mental foramen: Part III. Size and position on panoramic radiographs [Internet]. Vol. 18, Journal of Endodontics. 1992. p. 383–6. Available from: http://dx.doi.org/10.1016/s0099-2399(06)81224-0
29. İşcan MY, Sema Kedici P. Sexual variation in bucco-lingual dimensions in Turkish dentition [Internet]. Vol. 137, Forensic Science International. 2003. p. 160–4. Available from: http://dx.doi.org/10.1016/s0379-0738(03)00349-9
30. Kieser JA. Human Adult Odontometrics [Internet]. 1990. Available from: http://dx.doi.org/10.1017/cbo9780511983610
31. Singal K, Sharma S. Gender Determination by Mental Foramen Using Linear Measurements on Radiographs: A Study in Haryana Population [Internet]. Vol. 10, Indian Journal of Forensic Medicine & Toxicology. 2016. p. 44. Available from: http://dx.doi.org/10.5958/0973-9130.2016.00011.6
32. Behl A, Grewal S, Bajaj K, Baweja P, Kaur G, Kataria P. Mandibular ramus and gonial angle—Identification tool in age estimation and sex determination: A digital panoramic radiographic study in north indian population [Internet]. Vol. 32, Journal of Indian Academy of Oral Medicine and Radiology. 2020. p. 31. Available from: http://dx.doi.org/10.4103/jiaomr.jiaomr_172_19