

Exploring Morphometric Changes in OPG for Gender Determination: A Comprehensive Evaluation

Afrin Nisha M¹, Dr. Jayanth Kumar^{2*}

¹Undergraduate, Department of Oral Medicine and Radiology, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai-600077.

Email: 152001076.sdc@saveetha.com

^{2*}Department of Oral Medicine and Radiology, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai-600077 (Corresponding Author).

Email: doctorjayanth@gmail.com

ABSTRACT

Background: Gender determination from skeletal remains is crucial in forensic anthropology, aiding in the identification of unknown individuals. Advances in imaging technology have enhanced the ability to assess skeletal features non-invasively, with Orthopantomogram (OPG) providing detailed images of the mandible. This study focuses on three key morphometric parameters derived from OPGs: condylar angle, ramus height, and bicondylar width. Condylar angle reflects the curvature of the mandibular condyle, influenced by biomechanical factors and genetics, potentially exhibiting sexual dimorphism. Ramus height and bicondylar width contribute additional measurements related to mandibular size and proportions, which may vary between males and females due to craniofacial sexual dimorphism. This research aimed to evaluate the utility of these OPG-derived morphometric parameters as reliable indicators of gender.

Materials and methods: Samples were collected from the department of oral medicine and radiology, Saveetha Dental College and Hospital, Chennai. Total number of samples is 60 patients between the age group 20 to 60 years. Image J software was used to measure the condylar angle, ramus height, and bicondylar width. The data was transferred to SPSS software (23 Versions) for further results, in which a sample T test was done.

Statistical analysis: The data were analysed by using SPSS software. The probability value $p < 0.05$ is considered as significant and the value $p > 0.05$ was considered as not significant.

Results: Tables and graphs show the sample size, mean and standard deviation of both males and females. In present research, a statistically significant correlation between condyle & Coronoid angle, ramus height, and bicondylar width of males and females was confirmed.

Conclusion: In summary, the assessment of morphometric alterations in orthopantomogram using variables including ramus height, bicondylar breadth, and coronoid and condyle angles shows promise as a means of determining gender. The study draws attention to the sexual dimorphism in mandibular structures, highlighting their potential use in clinical, forensic, and anthropological contexts.

Keywords: Sex determination, Condyle & Coronoid angle, orthopantomogram.

How to cite this article: Afrin Nisha M, Jayanth Kumar. Exploring Morphometric Changes in OPG for Gender Determination: A Comprehensive Evaluation. Int J Drug Deliv Technol. 2026;16(47s): 872-873. DOI: 10.25258/ijddt.16.47s.99

Source of support: Nil.

Conflict of interest: None.

Introduction:

Assessing chronological age and gender is a crucial aspect of medicolegal practice. Age determination processes are intricate and take into account a wide range of variables. Both the soft and hard tissues of the teeth exhibit age-related changes over time. After a long time of burial, the facial bones are typically the only remnants that survive because of their exceptional fire resistance. Consequently, forensic odontology has become more significant as a method of identifying the tooth and skeletal remains. Researchers have tried to show age-related changes in the tooth hard tissues, but the accuracy of the current "age-at-death" estimation methodologies is restricted. Dentofacial radiography, which involves taking radiographs at various points over the lifetime of vast parts of the patient, is now a standard practice in many dental, medical, and hospital clinics. Orthopantomogram (OPG) is a significant area of study in forensic science and anthropology. The OPG, a panoramic dental X-ray, offers a comprehensive view of the upper and lower jaws, capturing critical details of the facial bones and dental structures. These radiographs are valuable in forensic investigations, as they reveal subtle differences in the size and shape of craniofacial features that can be linked to gender. By analyzing specific measurements and structural variations in the mandible, maxilla, and teeth, researchers can identify patterns of sexual dimorphism, making OPG a useful tool for gender identification in various forensic contexts. This approach provides a non-invasive, reliable method for contributing to the identification process, especially when traditional methods are not applicable.

Materials and methods:

Samples were collected from the department of oral medicine and radiology,

Saveetha dental college and hospital, Chennai. Total number of samples is 60 patients between the age group 20 to 60 years. Image J software was used to measure the condylar angle, ramus height, and bicondylar width. The data was transferred to SPSS software(23 Versions) for further results, in which sample T test was done. Inclusion criteria: High-quality digital images without any positioning errors. Exclusion criteria: Patients with a history of extraction, fracture, developmental disturbances or any other mandibular pathologies leading to variation in the size of the mandible were excluded from the study

Results:

	Gender	Mean	Standard deviation	Significance
Condylar & Coronoid angle - right	Male	93	10	0.059
	Female	99	11	
Condylar & Coronoid angle - left	Male	92	9	0.167
	Female	98	19	
Height	Male	687	159	0.011

Exploring Morphometric Changes in OPG for Gender Determination: A Comprehensive Evaluation

of the ramus-Right	Male	93	10	0.011
	Female	589	124	0.011
Height of the ramus-Left	Male	699	159	0.010
	Female	596	129	0.010
Bicondylar width	Male	3472	5514	0.104
	Female	2035	415	0.104

The above table shows the mean, standard deviation and significance of both males and females. This study illustrates the mean and standard deviation of 93 ± 10 in males and 99 ± 11 in females for Condyle & Coronoid angle-right, 92 ± 9 in males and 98 ± 19 in females for Condyle & Coronoid angle-Left, 687 ± 159 in males and 596 ± 129 in females for Height of the ramus-right, 93 ± 10 in males and 99 ± 11 in females for Height of the ramus-Left and 3472 ± 5514 in males and 2035 ± 425 in females for Bicondylar width. In present research, a statistically significant correlation between condyle & Coronoid angle, ramus height, and bicondylar width of males and females was confirmed.

Discussion:

Our study investigated the utility of condylar angle, ramus height, and the bicondylar width measured from Orthopantomogram (OPG) images as indicators for gender determination. The findings reveal significant sexual dimorphism in these morphometric parameters, with males generally exhibiting larger condylar angles, taller ramus heights,

and wider bicondylar widths compared to females. These differences underscore the potential of OPG-derived measurements in enhancing gender assessment accuracy in clinical and forensic settings. The non-invasive nature and widespread availability of OPG imaging make these parameters valuable tools, offering objective data that can be analysed using statistical software for reliable classification. However, limitations include our modest sample size and demographic homogeneity, necessitating future research with larger, diverse populations to validate these findings across different ethnicities and age groups.

Conclusion:

In summary, the assessment of morphometric alterations in orthopantomogram using variables including ramus height, bicondylar breadth, and coronoid and condyle angles shows promise as a means of determining gender. The study draws attention to the sexual dimorphism in mandibular structures, highlighting their potential use in clinical, forensic, and anthropological contexts. The results indicate that the accuracy and reliability of gender determination using these morphometric parameters can be greatly improved with improvements in imaging technology and analysis techniques, despite limitations such as sample size, measurement variability, and two-dimensional imaging constraints. Subsequent investigations ought to concentrate on surmounting these constraints and broadening the range to encompass heterogeneous populations and all-encompassing clinical applications.

Acknowledgement:

We thank Saveetha Dental College and Hospitals for the successful completion of the study.

Conflict of Interest:

Exploring Morphometric Changes in OPG for Gender Determination: A Comprehensive Evaluation

The author declares no conflict of interest in the present study.

References:

1. Pokhrel R, Bhatnagar R. Sexing of mandible using ramus and condyle in Indian population: A discriminant function analysis *Eur J Anat.* 2013;17:39–42
2. Laster WS, Ludlow JB, Bailey LJ, Hershey HG. Accuracy of measurements of mandibular anatomy and prediction of asymmetry in panoramic radiographic images *Dentomaxillofac Radiol.* 2005;34:343–9
3. Kumar MP, Lokanadham S. Sex determination and morphometric parameters of human mandible *Int J Res Med Sci.* 2013;1:93–6
4. Mehta, Heena, et al. "Gender determination using mandibular ramus and gonial angle on OPG." *Journal of Indian Academy of Oral Medicine and Radiology* 32.2 (2020): 154-158.
5. More, C. B., Vijayvargiya, R., & Saha, N. (2017). Morphometric analysis of mandibular ramus for sex determination on digital orthopantomogram. *Journal of Forensic Dental Sciences*, 9(1), 1–5.
[PMC](#)
6. Saloni, Verma, P., Mahajan, P., Puri, A., Kaur, S., & Mehta, S. (2020). Gender determination by morphometric analysis of mandibular ramus: A digital orthopantomographic study. *Indian Journal of Dental Research*, 31(3), 421–425.
[PubMed](#)
7. Esfehiani, M., Ghasemi, M., Katiraei, A., Tofangchiha, M., Alizadeh, A., Taghavi-Damghani, F., Testarelli, L., & Reda, R. (2023). Forensic gender determination by using mandibular morphometric indices in an Iranian population: A panoramic radiographic cross-sectional study. *Journal of Imaging*, 9(2), 40.
[MDPI](#)
8. Shakya, T., Maharjan, A., & Pradhan, L. (2022). Morphometric analysis of mandibular ramus for sex determination on orthopantomogram. *Journal of Nepal Health Research Council*, 20(1), 65–71.
[Europe PMC](#)
9. Arthanari, A., Ravindran, V., Ramalingam, K., Prathap, L., & Raj, S. (2024). Gender determination through mandibular features on orthopantomograms: A preliminary study. *Cureus*, 16(7), e63790.
[Cureus](#)
10. Ingaleshwar, P., Bhosale, S., Nimbalkar, G., Britto, F., Chandrappa, P. R., & Hosur, M. B. (2023). Mandibular ramus: An indicator for gender determination: A digital panoramic study in Bagalkot population. *Journal of Oral and Maxillofacial Pathology*, 27(1), 66–70.
11. Saini, V., Srivastava, R., Rai, R. K., Shamal, S. N., Singh, T. B., & Tripathi, S. K. (2011). Mandibular ramus: An indicator for sex in fragmentary mandible. *Journal of Forensic Sciences*, 56(Suppl 1), S13–S16.
12. Indira, A. P., Markande, A., & David, M. P. (2012). Mandibular ramus: An indicator for sex determination: A digital radiographic study. *Journal of Forensic Dental Sciences*, 4(2), 58–62.
13. Humphrey, L. T., Dean, M. C., & Stringer, C. B. (1999). Morphological variation in great ape and modern human mandibles.

Exploring Morphometric Changes in OPG for Gender Determination: A Comprehensive Evaluation

- Journal of Anatomy*, 195(Pt 4), 491–513.
14. Kambylafkas, P., Murdock, E., Gilda, E., & Tallents, R. H. (2006). Validity of panoramic radiographs for measuring mandibular asymmetry. *The Angle Orthodontist*, 76(3), 388–393.