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# AGE DETERMINATION WITH RADIO MORPHOMETRIC INVESTIGATION EMPLOYING ORTHOPANTOMOGRAPHY AND MANDIBULAR MORPHOMETRICS - AN ORIGINAL RESEARCH

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## ABSTRACT

**BACKGROUND** - Mandible is a thick, dimorphic bone that is remarkably well-preserved might help in morphometric analysis, structural changes related to age and sex and forensic age determination. **MATERIALS AND METHODS** - The main aim was to evaluate the accuracy of the mandibular radio morphometric parameters for age estimation in the South Indian population utilizing digital over-the-glass age gauges, as well as their association with chronological age. **RESULTS** - Minimal correlation was observed between gonial angle and age, ramus breadth and age whereas moderate correlation was observed between bicondylar/bigonial width and age. Moderate-to-high correlation observed between condylion gonion/coronoid gonion lengths with age. **CONCLUSION** - Important indicators for age estimation include the bigonial breadth, bicondylar width, and coronoid, or gonion length. As such, the morphometric analysis of the mandible might be useful in forensic odontology.

**KEYWORDS:** age; mandible; forensic; odontology; orthopantomogram.

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# DETERMINACIÓN DE LA EDAD CON INVESTIGACIÓN RADIOMORFOMÉTRICA EMPLEANDO ORTOPANTOMOGRAFÍA Y MORFOMÉTRICA MANDIBULAR: UNA INVESTIGACIÓN ORIGINAL

## RESUMEN

**ANTECEDENTES -** La mandíbula es un hueso grueso y dimórfico que está notablemente bien conservado y podría ayudar en el análisis morfométrico, los cambios estructurales relacionados con la edad y el sexo y la determinación forense de la edad. **MATERIALES Y MÉTODOS** - El objetivo principal fue evaluar la precisión de los parámetros radiomorfométricos mandibulares para la estimación de la edad en la población del sur de la India utilizando medidores de edad digitales sobre vidrio, así como su asociación con la edad cronológica. **RESULTADOS** - Se observó una correlación mínima entre el ángulo gonial y la edad, la anchura de la rama y la edad, mientras que se observó una correlación moderada entre la anchura bicondilar/bigonial y la edad. Se observó una correlación moderada a alta entre la longitud del gonión condilion/gonión coronoides con la edad. **CONCLUSIÓN** - Los indicadores importantes para la estimación de la edad incluyen la anchura bigonial, la anchura bicondilar y la longitud coronoides o gonion. Como tal, el análisis morfométrico de la mandíbula podría ser útil en odontología forense.

**PALABRAS CLAVE:** edad; mandíbula; forense; odontología; ortopantomograma.

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## INTRODUCTION

Determining age in the forensics profession in situations involving mass disasters, law enforcement, medicine, criminality and the identification of unidentified victim bodies is critical. Regarding living individuals, issues relating to legal age, including criminal activity, licenses, visa applications, pension plans, etc.., age can be ascertained by skeletal, dental, chronological, biological, psychological, physiological, and mental variables[1]. In legal circumstances, an individual's skeletal and dental ages are ascertained when their chronological age is uncertain. Age estimation differs for paediatric-adolescence and adult population. In paediatric-adolescence population, radiographical methods involve atlas, incremental staging and mandibular morphometrics whereas secondary method is of biochemical nature. In adult population, three methods are of morphological, radiographical and biochemical. Mandible is a thick, dimorphic bone that is remarkably well-preserved might help in morphometric analysis, structural changes related to age and sex and forensic age determination. Mandibular structures can be easily evaluated with the commonly used, non-invasive panoramic radiography technique[2]. Maximum ramus breadth is the distance between the angle of the jaw and the most posterior point on the condyle, as well as the most anterior point on the mandibular ramus. The minimum ramus width is the smallest ramus diameter, both anterior and posterior.

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Gonial angle is the intersection of two lines among which one tangential to the posterior border of the ramus and the condyle, and the other tangential to the lower border of the mandibular body and the most inferior point at the angle. Minimum width of ramus refers to the region in ramus with the smallest anterior-posterior diameter[3].

## MATERIALS AND METHODS

The main aim was to evaluate the accuracy of the mandibular radio morphometric parameters for age estimation in the South Indian population utilizing digital orthopantomogram, as well as their association with chronological age. And also to measure gonial angle, maximum ramus breadth, minimum ramus breadth, bicondylar width, bigonial width, condylion-gonion length and coronoid-gonion length**.** The Institutional Ethics Committee granted authorization for our dental college to conduct the current retrospective radio morphometric investigation. For analysis, panoramic radiographs of the patients documented between September 2022 and June 2023 were retrieved from the department's records. G power statistics were used to determine the sample size, and 294 OPGs between the ages of 5 and 70 were included in the research. High-quality panoramic pictures excellent resolution and contrast for the structures either totally or partly missing teeth were included. Existence of a pathological lesion, fracture, or

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mandibular deformity. bone plates and splinting were excluded.

## RESULTS

Details regarding gender and age estimation is mentioned below,

Group1: Ages 5 to 19 (30 males and 30 females in the sample)

Group2: Ages 20 to 29 (60 sample, 28 men and 32 women)

Group 3: 30-39 years old (25 men and 33 women in the sample of 60).

Group 4: 60 sample people, 29 men and 31 women, aged 40 to 49.

Group 5: Ages 50–70 (26 males and 28 females out of 54 sample members)

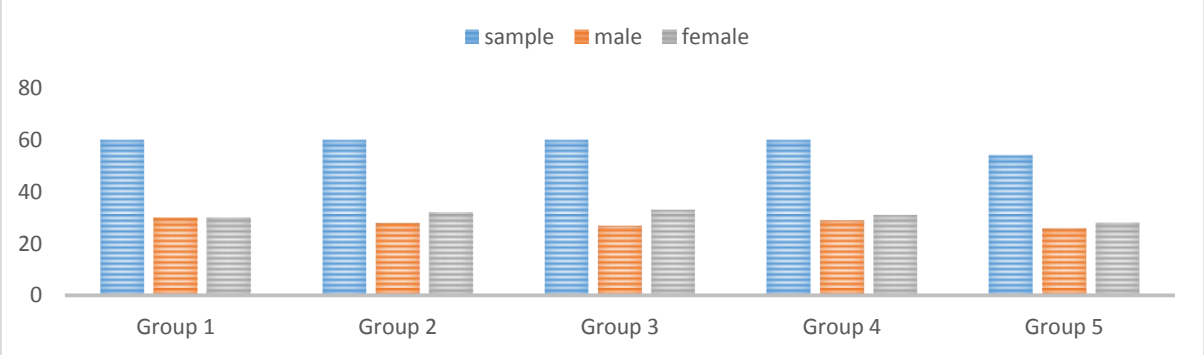


FIGURE 1- Gender and age estimation

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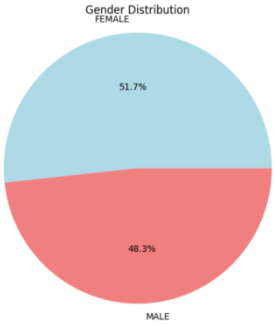


Figure 2 - Gender distribution

Python was used for statistical analysis. The research subjects' descriptive data were reported as minimum, maximum, mean, and standard deviation (SD) for each parameter. The study employed the stepwise regression technique to identify important age factors.

Summary Statistics:

| | AGE | GONIAL_ANGLE | MAXIMUM_RAMUS_BREADTH | MINIMUM_RAMUS_BREADTH | BICONDYLAR_WIDTH | BIGONIAL_WIDTH | CONDYLION_GONION |
|---|---|---|---|---|---|---|---|
| count | 294.000000 | 294.000000 | 294.000000 | 294.000000 | 294.000000 | 294.000000 | 294.000000 |
| mean | 31.013605 | 125.076156 | 35.058061 | 27.977925 | 169.446633 | 139.672517 | 54.431667 |
| std | 18.131483 | 7.106388 | 4.269407 | 3.484636 | 15.627625 | 15.843234 | 6.299802 |
| min | 3.000000 | 107.540000 | 23.090000 | 19.620000 | 115.750000 | 85.600000 | 31.780000 |
| 25% | 17.000000 | 120.357500 | 32.392500 | 25.512500 | 160.200000 | 128.782500 | 50.942500 |
| 50% | 24.000000 | 125.300000 | 35.250000 | 27.800000 | 171.045000 | 140.780000 | 54.660000 |
| 75% | 46.000000 | 129.877500 | 37.925000 | 30.420000 | 180.982500 | 149.435000 | 58.462500 |
| max | 78.000000 | 149.860000 | 46.340000 | 39.060000 | 207.500000 | 185.540000 | 74.620000 |

Figure 3 - Relationship between age and gonial angle, maximum - minimum breadth of ramus, bicondylar width, bigonial width, condyle-gonion aspect

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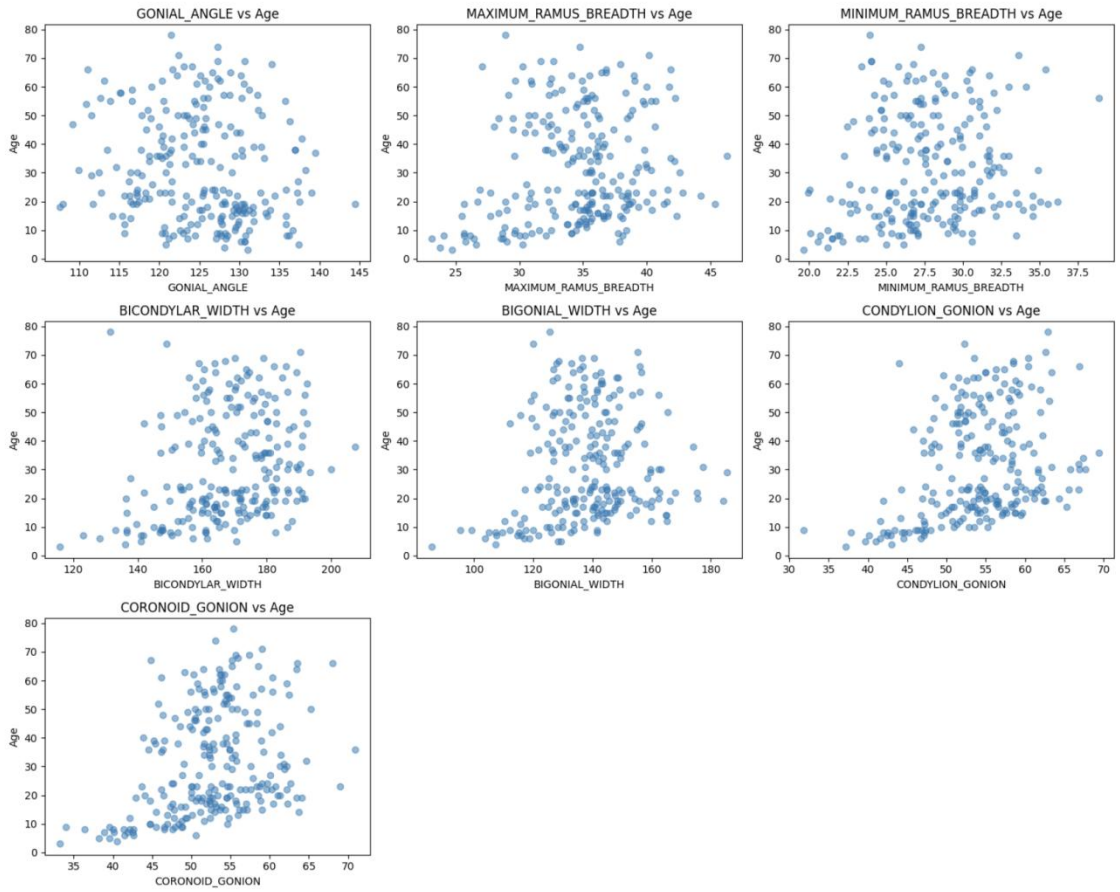


Figure 4 - Correlation of independent variables with age

Minimal correlation was observed between gonial angle and age, ramus breadth and age whereas moderate correlation was observed between bicondylar/bigonial width and age. Moderate-to-high correlation observed between condylion gonion/coronoid gonion length with age.

OLS Regression Results

| | | | |
|---|---|---|---|
| Dep. Variable: | AGE | R-squared: | 0.215 |
| Model: | OLS | Adj. R-squared: | 0.190 |
| Method: | Least Squares | F-statistic: | 8.858 |
| Date: | Thu, 14 Sep 2023 | Prob (F-statistic): | 1.24e-09 |
| Time: | 18:42:04 | Log-Likelihood: | -992.42 |
| No. Observations: | 235 | AIC: | 2001. |
| Df Residuals: | 227 | BIC: | 2029. |
| Df Model: | 7 | | |
| Covariance Type: | nonrobust | | |

| | coef | std err | t | P>\|t\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| const | -9.7710 | 32.535 | -0.300 | 0.764 | -73.880 | 54.339 |
| GONIAL_ANGLE | -0.2454 | 0.204 | -1.204 | 0.230 | -0.647 | 0.156 |
| MAXIMUM_RAMUS_BREADTH | -0.5940 | 0.487 | -1.219 | 0.224 | -1.555 | 0.367 |
| MINIMUM_RAMUS_BREADTH | -0.6326 | 0.579 | -1.092 | 0.276 | -1.774 | 0.509 |
| BICONDYLAR_WIDTH | 0.6883 | 0.147 | 4.678 | 0.000 | 0.398 | 0.978 |
| BIGONIAL_WIDTH | -0.5479 | 0.132 | -4.155 | 0.000 | -0.808 | -0.288 |
| CONDYLION_GONION | 0.5015 | 0.347 | 1.447 | 0.149 | -0.181 | 1.184 |
| CORONOID_GONION | 0.8237 | 0.368 | 2.241 | 0.026 | 0.099 | 1.548 |

| | | | |
|---|---|---|---|
| Omnibus: | 17.621 | Durbin-Watson: | 1.963 |
| Prob(Omnibus): | 0.000 | Jarque-Bera (JB): | 16.199 |
| Skew: | 0.575 | Prob(JB): | 0.000304 |
| Kurtosis: | 2.425 | Cond. No. | 7.91e+03 |

```
R-squared: 0.2145436169098962
Significant Variables:
['BICONDYLAR_WIDTH', 'BIGONIAL_WIDTH', 'CORONOID_GONION']
Coefficients:
const                   -9.770980
GONIAL_ANGLE            -0.245372
MAXIMUM_RAMUS_BREADTH   -0.594041
MINIMUM_RAMUS_BREADTH   -0.632634
BICONDYLAR_WIDTH         0.688305
BIGONIAL_WIDTH          -0.547919
CONDYLION_GONION         0.501493
CORONOID_GONION          0.823739
```

Figure 5 - Age prediction by linear regression

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Significant variables that enable age prediction were bicondylar width, bigonial width and coronoid-gonion length

Regression equation - AGE = -9.77 + (0.688 * BICONDYLAR WIDTH) + (-0.548 * BIGONIAL WIDTH) + (0.823 * CORONOID-GONION LENGTH

## DISCUSSION

The ramus and mandibular condyle are reliable indicators of age. As these structures develop, they vary morphologically, and the pace at which they grow varies with age and gender. Several studies have demonstrated the differentiability of these radio-morphometric indices as age markers[4]. Coronoid ramus height has been found to be a better predictor of age than condylar height in several of the studies. Age estimates are helpful in organizing victims of catastrophic tragedies based on comparable ages. The age at which a person is deemed to have attained adulthood and proclaimed themselves to be a full member of the legal community is known as the age of majority[5,6]. When determining the post-mortem. For refugees who enter the country without legitimate identity documents and who want to enjoy civil rights and/or social benefits in a modern society; they could also require age verification. while verifying the age of individuals who are hesitant to reveal their age, such as immigrants and people with criminal records. as verification of age for the purpose of receiving retirement benefits[7,8].

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## CONCLUSION

Important indicators for age estimation include the bigonial breadth, bicondylar width, and coronoid, or gonion length. As such, the morphometric analysis of the mandible might be useful in forensic odontology. More studies with larger sample sizes and individuals with different bone types are needed.

## REFERENCES

1. Chole RH, Patil RN, Balsaraf Chole S, Gondivkar S, Gadbail AR, Yuwanati MB. Association of mandible anatomy with age, gender, and dental status: A radiographic study. ISRN radiology. 201318;2013.

2. Leversha J, McKeough G, Myrteza A, Skjellrup-Wakefiled H, Welsh J, Sholapurkar A. Age and gender correlation of gonial angle, ramus height and bigonial width in dentate subjects in a dental school in Far North Queensland. Journal of clinical and experimental dentistry. 2016 Feb;8(1): e49.

3. Abu-Taleb NS, El Beshlawy DM. Mandibular ramus and gonial angle measurements as predictors of sex and age in an Egyptian population sample: A digital panoramic study. Journal of Forensic Research. 2015

4. Upadhyay RB, Upadhyay J, Agrawal P, Rao NN. Analysis of gonial angle in relation to age, gender, and dentition status by radiological and anthropometric methods. Journal of forensic dental sciences. 2012 Jan;4(1):29.

5. Muskaan A, Sarkar S. Mandible-An indicator for age and sex determination using digital orthopantomogram. Scholars J. Dent. Sci. 2015; 2:82-95.

6. Al-Shamout R, Ammoush M, Alrbata R, Al-Habahbah A. Age and gender differences in gonial angle, ramus height and bigonial width in

Volumen 15, N° 30 Especial, 2025
Depósito Legal: PPI201102ME3815
ISSN: 2244-8136

dentate subjects. Pakistan Oral & Dental Journal. 2012 Jun 1;32(1).

7. Behl AB, Grewal S, Bajaj K, Baweja PS, 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. Journal of Indian Academy of Oral Medicine and Radiology. 2020 Jan 1;32(1):31.

8. Poongodi V, Kanmani R, Anandi MS, Krithika CL, Kannan A, Raghuram PH. Prediction of age and gender using digital radiographic method: A retrospective study. Journal of pharmacy & bioallied sciences. 2015.