# Morphometric Analyses of Bony Orbital Dimensions Related to Gender in South Indian Population: A Cross-Sectional Study

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## I. INTRODUCTION

Orbits are paired bony sockets which lodge important structures such as eyeball, extraocular muscles, vessels and nerves acting on the eyeball.
Its morphometry is important in various procedures in facial reconstructive surgery, during trauma and other clinical interventions. Many studies showed variations in the morphometry and volumetry of orbit and variations in the foramina with respect to ethnicity is widely known. The present study is an attempt to study the morphometry in south Indian population related to gender.

## II. AIM AND OBJECTIVES

- To study the morphometry of bony orbit related to gender by using standard bony landmarks.
- To study the orbital dimensions and determine gender disparity.
- To compare the findings of the present study with previous authors.

## III. MATERIAL AND METHODS

In the present study, 33 dry adult skulls will be used. Deformed skulls or skulls with defects in the areas of measurement and foetal skulls will be excluded.
All the skulls will be identified of its gender and the following parameters will be studied using vernier caliper. All the measurements will be taken twice by a single observer to ensure accuracy. The landmarks on the base of the orbit from which orbital dimensions will be studied are:

- Maxillofrontale landmark (MFL)
- Ectoconchian landmark (ECL)
- Supraorbital landmark (SOL)
- Infraorbital landmark (IOL)

Orbital dimensions:
Orbital height: Between SOL and IOL Orbital breadth: Between MFL and ECL
Inter-orbital breadth: Straight distance between to MFL
Bi-orbital breadth: Straight distance between two ECL

$$\text{Orbital index: } \frac{\text{Orbital height}}{\text{Orbital breadth}} \times 100$$

All the parameters will be measured on both right and left side. Mean and standard deviation will be calculated for all the parameters. The data will be statistically evaluated using student t-test and data with $P < 0.05$ will be considered statistically significant.

## IV. RESULTS


Statistical Table

| S. No | Sex | Orbital Height | | Orbital Breadth | | Orbital Index | | Interorbital Breadth (in mm) | BI Orbital Breadth (in mm) |
|---|---|---|---|---|---|---|---|---|---|
| | | Right (in mm) | Left (in mm) | Right (in mm) | Left (in mm) | Right (in mm) | Left (in mm) | | |
| 1. | Male | 21.35 | 27.36 | 31.93 | 33.53 | 98.1 | 81.59 | 17.71 | 87.83 |
| 2. | Male | 34.35 | 33.51 | 42.84 | 38.62 | 80.1 | 80.96 | 25.46 | 94.01 |
| 3. | Male | 35.03 | 35.04 | 35.03 | 36.11 | 100 | 97.03 | 28.21 | 95.63 |
| 4. | Male | 38.09 | 33.53 | 33.76 | 35.68 | 112.8 | 93.97 | 19.5 | 90.98 |
| 5. | Male | 35.26 | 34.56 | 40.69 | 39.45 | 86.65 | 87.6 | 20 | 93.79 |
| 6. | Male | 31.89 | 32.87 | 4.01 | 41.25 | 79.52 | 79.68 | 20.51 | 99.8 |
| 7. | Male | 34.27 | 32.8 | 37.11 | 37.74 | 92.34 | 86.91 | 19.36 | 98.2 |
| 8. | Male | 31.52 | 30.96 | 39.18 | 36.47 | 80.44 | 84.89 | 21.64 | 94.63 |
| 9. | Male | 30.95 | 31.54 | 41.34 | 39.87 | 74.86 | 79.1 | 21.22 | 99.7 |
| 10. | Male | 32.58 | 37.46 | 43.82 | 44.44 | 73.34 | 51.07 | 19.26 | 99.47 |
| 11. | Male | 39.38 | 30.64 | 29.42 | 31.11 | 133.85 | 98.5 | 16.15 | 95.11 |
| 12. | Male | 32.72 | 33.76 | 27.8 | 29.06 | 117.69 | 115.86 | 20.46 | 99.89 |

Statistical Table

| S. No | Sex | Orbital Height | | Orbital Breadth | | Orbital Index | | Interorbital Breadth (in mm) | BI Orbital Breadth (in mm) |
|---|---|---|---|---|---|---|---|---|---|
| | | Right (in mm) | Left (in mm) | Right (in mm) | Left (in mm) | Right (in mm) | Left (in mm) | | |
| 13. | Male | 35.29 | 34.51 | 38.88 | 36.86 | 90.07 | 93.62 | 20.82 | 97.23 |
| 14. | Male | 33.29 | 33.29 | 36.92 | 36.93 | 90.16 | 90.14 | 27.33 | 88.88 |
| 15. | Male | 37.8 | 36.3 | 39.68 | 39.7 | 95.26 | 91.43 | 26.6 | 99.1 |
| 16. | Male | 36.61 | 34.6 | 40.46 | 35.9 | 90.48 | 96.37 | 24.57 | 95.73 |
| 17. | Male | 39.49 | 36.62 | 43.69 | 43.70 | 90.38 | 83.79 | 27.5 | 102.34 |
| 18. | Male | 34.87 | 38.50 | 39.82 | 41.23 | 87.56 | 93.37 | 23.56 | 99.4 |
| 19. | Male | 43.62 | 37.82 | 46.24 | 42.96 | 94.33 | 88.03 | 23.25 | 105.38 |
| 20. | Male | 338.72 | 35.59 | 39.38 | 33.01 | 98.32 | 107.81 | 28.15 | 100.91 |
| 21. | Male | 32.57 | 31.45 | 43.68 | 40.47 | 74.56 | 77.79 | 25.45 | 97.3 |
| 22. | Male | 37.32 | 38.9 | 39.37 | 44.45 | 94.79 | 87.51 | 24.64 | 108.9 |
| 23. | Male | 34.45 | 37.05 | 44.26 | 42.89 | 77.83 | 86.38 | 23.9 | 109.6 |
| 24. | Male | 39.02 | 38.31 | 43.17 | 42.18 | 90.38 | 90.82 | 25.05 | 102.13 |

Statistical Table

| S. No | Sex | Orbital Height Right (in mm) | Orbital Height Left (in mm) | Orbital Breadth Right (in mm) | Orbital Breadth Left (in mm) | Orbital Index Right (in mm) | Orbital Index Left (in mm) | Interorbital Breadth (in mm) | BI Orbital Breadth (in mm) |
|---|---|---|---|---|---|---|---|---|---|
| 25. | Male | 31.43 | 35.26 | 44.79 | 42.57 | 70.17 | 82.82 | 26.81 | 104.99 |
| 26. | Male | 31.05 | 33.95 | 42 | 36.66 | 73.92 | 92.6 | 22.99 | 97.26+ |
| 27. | Male | 34.13 | 32.56 | 41.84 | 39.61 | 81.57 | 82.2 | 25.17 | 105.23 |
| 28. | Female | 25.4 | 23.68 | 28.51 | 30.75 | 77 | 77 | 22.1 | 84.65 |
| 29. | Female | 21.1 | 22.6 | 30.74 | 30.48 | 68.64 | 74.14 | 21.5 | 94.1 |
| 30. | Female | 34.01 | 34.96 | 39.74 | 37.75 | 88.58 | 92.6 | 24.9 | 101.5 |
| 31. | Female | 35.4 | 33.18 | 45.03 | 41.64 | 78.61 | 79.68 | 26.35 | 101.2 |
| 32. | Female | 29.72 | 32.05 | 38.72 | 36.79 | 76.75 | 87.11 | 26.13 | 90.9 |
| 33. | Female | 35.9 | 36.02 | 40.9 | 38.19 | 87.77 | 94.31 | 20.77 | 93.14 |

Descriptive statistics of the general morphology of bony orbit in right and left male orbits

| Variable (mm) | Male (Right Orbit) (N=27) | | Male (LEFT Orbit) (N=27) | | Mean Difference |
|---|---|---|---|---|---|
| | Mean ± SD | Range | Mean ± SD | Range | |
| Orbital height (mm) | 34.705 ± 4.121 | 43.62 – 21.35 | 34.435 ± 2.709 | 38.9 – 27.36 | 0.27 |
| Orbital breadth (mm) | 39.53 ± 4.620 | 46.34 – 27.8 | 38.609 ± 4.035 | 44.45 – 29.06 | 0.921 |
| Orbital Index (mm) | 89.980 ± 14.480 | 133.85 – 70.17 | 88.205 ± 11.392 | 115.86 – 51.07 | 1.775 |
| Inter Orbital distance | 23.158 ± 3.354 | 28.21 – 16.15 | | | |
| Bi Orbital distance | 98.645 ± 5.402 | 109.6 – 87.83 | _ | _ | _ |

Descriptive statistics of the general morphology of bony orbit in right and left female orbits

| Variable (mm) | Female (Right Orbit) (N=6) | | Female (Left Orbit) (N=6) | | Mean Difference |
|---|---|---|---|---|---|
| | Mean ± SD | Range | Mean ± SD | Range | |
| Orbital height (mm) | 30.255 ± 6.001 | 35.9 – 21.1 | 30.415 ± 5.810 | 36.02 – 22.6 | -0.16 |
| Orbital breadth (mm) | 37.273 ± 6.339 | 45.03 – 28.51 | 35.933 ± 4.433 | 41.64 – 30.48 | 1.34 |
| Orbital Index (mm) | 79.558 ± 7.528 | 88.58 – 68.64 | 84.14 ± 8.422 | 94.31 – 74.14 | -4.582 |
| Inter Orbital distance | 23.625 ± 2.462 | 26.35 – 20.77 | _ | _ | _ |
| Bi Orbital distance | 94.248 ± 6.410 | 101.5 – 84.65 | _ | _ | _ |

Descriptive statistics of the sex differences between total means of male and female bony orbits general morphology

| Variable (mm) | Male (Right Orbit) (N=27) | | Male (Left Orbit) (N=6) | | Mean Difference |
|---|---|---|---|---|---|
| | Mean ± SD | Range | Mean ± SD | Range | |
| Orbital height (mm) | 34.57 ± 3.415 | 43.62 – 21.35 | 30.335 ± 5.905 | 36.02 – 21.1 | 4.235 |
| Orbital breadth (mm) | 39.07 ± 4.328 | 46.034 – 27.8 | 36.603 ± 5.386 | 45.03 – 28.51 | 2.467 |
| Orbital Index (mm) | 89.092 ± 12.936 | 133.85 – 51.07 | 79.349 ± 7.975 | 94.31 – 68.64 | 9.743 |
| Inter Orbital distance | 23.158 ± 3.354 | 28.21 – 16.15 | 23.625 ± 2.462 | 26.35 – 20.77 | -0.467 |
| Bi Orbital distance | 98.645 ± 5.402 | 109.6 – 87.83 | 94.248 ± 6.410 | 101.5 – 84.65 | 4.397 |

## V. DISCUSSION

The findings of the present study will have variations in terms of orbital index related to gender.

The findings will provide normative or baseline data in the study population.

The present study is a unique attempt to study the parameters comprehensively including the dimensions and gender differences related to orbital morphometry.

## VI. CONCLUSION

Owing to the significance of the bony orbit and its skeletal anatomy with many bones united by sutures the morphometric variations will be immensely useful to learn the pattern of injuries during trauma and help clinicians approach this important neurovascular area carefully during surgical interventions.

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