



## A2 The Frontal Versus Basal Region of the Cranium: A Comparison of the Best Sex Prediction Parameters Using Discriminant Function Analysis

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**Learning Overview:** After attending this presentation, attendees will understand the usefulness and methodology of sex estimation, especially from various measurements of the cranium, which will help attendees choose the preferred parameters for different regions of the cranium and enable them to conduct further research.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by presenting standards for sex estimation from various measurements of the cranial regions when the cranium as a whole or its parts, especially the frontal or facial and basal regions, is brought for forensic examination.

One of the primary goals of any medicolegal investigation of human skeletal remains is to ascertain its identity. To achieve this goal, estimation of the biological profile is the first step, which helps to narrow the area of search and potential number of suspects and, thus, helps in the medicolegal investigation. A biological profile includes estimation of age, sex, stature, and ancestry. Sex determination needs to be performed ahead of age, stature, and ancestry estimation as these factors are sex dependent. The cranium is among the most dimorphic parts of the skeleton, followed by the pelvis, when it comes to sex determination from skeletal remains. However, implications of factors such as age, stature, and secular trends in craniofacial morphology are yet to be understood and controlled completely and thus this variability in skull is so important that it has a direct bearing on the accuracy and reliability of forensic anthropology tools. These variations are population-specific due to their genetic, environmental, and socio-economic dependence. In this context, the present study was conducted to make discriminant function equations for determination of sex from the frontal and basal region of the cranium in a central Indian population. The study is based upon a random sample of 187 adult crania (116 male, 71 female) aged from 18 to 50 years. A total of 33 cranial measurements have been taken on each sample (24 on the frontal region; 9 on the basal region) according to the standard procedures. The data were statistically analyzed using the Statistical Package for the Social Sciences (SPSS) computer software. Sex differences in frontal and basal measurements were analyzed using Discriminant Function Analysis (DFA) and discriminant equations were calculated. The best parameters for sex prediction were estimated from various measurements of the two regions of the cranium using linear and stepwise DFA.

Statistically significant differences ( $p < 0.001$ ) were observed between males and females for most of the measurements of the cranium in both regions. A DFA was run on the measurements taken from both regions of the cranium separately. Mastoid breadth followed by bi-mastoid breadth proved to be the best assessors of sex among nine parameters of basal region when subjected to direct (80.7%) as well as stepwise (79.1%) DFA. However, in the frontal region, basion-bregma height followed by nasal height gave the best sex prediction among 24 parameters, with an overall accuracy of 81.8% with linear analysis and 78.1% when subjected to stepwise DFA. Height measurements showed higher degree of sexual dimorphism in the frontal region. However, the cranium showed maximum univariate sexual dimorphism in breadth parameters such as mastoid breadth and foramen magnum breadth. The present study shows that both the regions can be helpful in sex determination with almost comparable accuracy, the only difference being the dominant parameter in the frontal region is height dependent while that in the basal region is breadth dependent. Thus, in cases, where cranial fragmentary remains are from the basal region, breadth measurements should be preferred over other measurements and when only frontal parts of cranium are encountered, height measurements should be preferred over width measurements.

### Forensic Anthropology, Sex Estimation, Cranial Measurements