Gender Determination using Gonial Angle - A Panoramic Study among South Indian Population

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

\textbf{Introduction:} Sex determination is a valuable and important factor in the forensic dentistry. Mandible has several useful traits for sex determination. Forensic practitioners study this by two methods: morphological and metrical analyses. Among various methods, the gonial angle may be used to differentiate male and female strongly to express sexual dimorphism.

\textbf{Aim:} To analyse the gender determination using gonial angle as panoramic study among south indian population.

\textbf{Materials and Methods:} This is a retrospective study conducted among 200 individuals. Gonial angle is a measurement taken by measuring the angle between the 2 tangents from the gonion. As a standard procedure, measurement of right gonial angle and left gonial angle were carried out by Adobe Photoshoph and the results were recorded and analysed statistically using SPSS tool.

\textbf{Results:} The mean right gonial angle for males is 95.25 and for females is 95.22. The mean left gonial angle for males is 95.39 and for females is 95.15. The significance of the right gonial angle is P=0.874 and significance of the left gonial angle is P= 0.147. The total mean value for right gonial angle was found to be 95.23 and for left gonial angle is 95.27. Therefore, there was no significant difference found between the right and left gonial angle.
**Conclusion:** Within the limitations of the study, there is no statistically significant difference observed between males and females in the gonial angle measurements. The Gonial angle measurements can be used to determine the gender and the growth pattern of the mandible. Measurement of gonial angle has its own surgical importance too in the field of orthodontics and therefore future studies should be carried out using larger samples to get reliable results.

**Keywords:** Gonial angle; sex determination; sexual dimorphism; mandible; innovative technique.

1. **INTRODUCTION**

Sex determination is a valuable and important factor in the forensic dentistry. Mandible has several useful traits for sex determination. Forensic practitioners study this by two methods: morphological and metrical analyses. Other than the mandibular measurements, pelvis plays an important role in determination of sex as it is the most sexually dimorphic region. Apart from gender determination, the gonial angle in Orthopantomogram is an important parameter for determining the growth pattern of an individual. It provides a significant amount of information about the dentition and the supporting bone [1].

Gonial angle can be used to differentiate male and female to express sexual dimorphism. The approximate measurement of the gonial angle reported in males is 100 degree to 148 degree whereas in females it is 103 degree to 153 degree with development and function, the mandibular angle has shown some changes in size, shape and length [2]. The mandible is the largest and strongest bone present in the face. The occurrence of Sexual dimorphism in the mandible may be due to differences in development of the musculoskeletal system [2,3]. The differences between ramus of the mandible among gender is appreciated based on the different stages of development and growth rates between male and female [2–4]. Assessment of gonial angle for sex determination according to age and gender are evidenced in certain studies [2–5]. The experience from our previous studies conducted among different fields [6,7,8,9,10,11,12,13,14,15] has led us to focus on the current topic. Measurement of gonial angle is essential for the treatment and surgery in orthodontics. Therefore, accurate determination of the gonial angle is important for assessing the orthodontic cases [16].

To evaluate the morphology of the mandible gonial angle ramus height and gonial width are measured. A wider gonial angle is found in edentulous individuals when compared to dentulous individuals. These factors are correlated with the function and architecture of the muscle of mastication. Aging causes changes in masticatory function and changes the contractile activity of individuals. Our team has extensive knowledge and research experience that has translated into high quality publications [17–24,25,26,27,28,29,30,31,32–36]. The aim of the present study is to assess the gender determination using gonial angle in OPGs of South Indian population.

2. **MATERIALS AND METHODS**

This was a retrospective study conducted in a private dental college and hospital in chennai. There were 200 randomly selected OPGs of population aged between 5-60 years that were used as samples. The measurement of the gonial angle was taken by Adobe Photoshop. Gonial angle measurements were taken by measuring the angle between the 2 tangents from the gonion. Panoramic radiographs with intact dentition were included for the study. Panoramic radiographs with fracture or deformation were excluded. The collected data was tabulated and analysed using spss software. The mean value was calculated and the comparison analysis carried for gender using independent t-test.

3. **RESULTS**

The mean value of gonial angle in the right side for males is 95.25 and for females is 95.22 (Fig. 1). The mean value of gonial angle in the left side for males is 95.35 and for females is 95.15 (Fig. 2). The mean value of left gonial angle is not statistically significant p=0.147 (p>0.05) and the mean value of right gonial angle is not statistically significant p=0.874 (p>0.05). The total mean value for right gonial angle was found to be 95.23 (Fig. 1) and for left gonial angle is 95.27 (Fig. 2). Therefore, there was no significant difference found between the right gonial angle and left gonial angle.

716
Fig. 1. Bar graph shows the comparison between gender. The X-axis represents the gender and mean right gonial angle. Y-axis represents the mean right gonial angle measurement. The red colour represents male and the green colour represents female. There was statistically no significant difference observed between the genders with p value > 0.05.

Fig. 2. This graph shows the comparison between gender and mean left gonial angle. The X-axis represents the gender. Y-axis represents the mean left gonial angle measurement. The red colour represents male and the green colour represents female. There was statistically no significant difference observed between genders with p value > 0.05.
4. DISCUSSION

According to the findings of this study, there is no significant difference in the mean value of both the right and left gonial angles between men and females. We looked at how the gonial angle can help determine sex in this circumstance. The gonial angle has been employed in forensics. There is a difference in mandibular angle with age and gender. Evidence reported the relationship between complete loss of teeth and changes in gonial angle and intends to evaluate variation in gonial angle with gender [37].

In case of females under 10 years of age, the gonial angle values are observed to be decreased. There were no significant gender differences in development and function, and the mandible angle has shown some changes in size and shape, which is supported by radiographs and anthropometric studies [38]. Gender determination can help establish a biological profile of the human body. All the linear measurements such as facial height, mandibular ramus height, mandibular plane, frontal sinus width were significantly larger in males except for angular variation which showed no significant differences between the two genders which is in agreement with the present study [3,38].

Gonial angle is formed from two lines, the inferior border of the mandible and the posterior border of the mandible ramus [39]. A study reporting the mean of gonial angle measurement confirmed that there was no difference in terms of data (p>0.05) which is in agreement with the present study. The condition and function of the masticatory muscles are linked to the shape of the mandible, according to research. A study evaluated the association of tooth loss on the shape of mandibles in subjects aged 60 years. Panoramic radiographs were used to determine the mandible's gonial angle, as well as the mandibular and condylar heights. As a result of tooth loss, the morphology of the mandible alters, with a widening of the gonial angle and a shortening of the ramus and condylar height [40]. Cross-sectional studies show that the size of the gonial angle grows from early embryonic stages until birth, then gradually decreases from birth to old age. A complete loss of teeth may reverse the normal ageing process, causing the gonial angle to become more obtuse. The proportion of face height and ramus height is linked to the magnitude of the gonial angle. Variations in face development found in the sagittal plane have little effect on the magnitude of the gonial angle [41].

Because the stages of mandibular development, growth rates, and longevity are diverse in both sexes, the mandibular ramus can distinguish between them. Furthermore, male and female masticatory pressures differ, influencing the shape and size of the mandibular, which is assumed to be influenced by the subject's age, with longitudinal studies showing that mandibular bone remodelling occurs with age. Males had statistically significant greater mean ramus linear measures and lower mean gonial angle values than females, according to a comparison of males and females [4]. The limitations of the study is that this is a retrospective study and future studies with larger sample size should be conducted to get definite results that it can be generalized.

5. CONCLUSION

Within the limitations of the study, there is no statistically significant difference observed between males and females in the gonial angle measurements. The Gonial angle measurements can be used to determine the gender and the growth pattern of the mandible. Measurement of gonial angle has its own surgical importance too in the field of orthodontics and therefore future studies should be carried out using larger samples to get reliable results.

CONSENT

It is not applicable.

ETHICAL APPROVAL

The study was approved by the institutional review board.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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