Original Research Article

Gender determination using Gonial Angle - a panoramic study among South Indian Population

ABSTRACT:

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.

AIM: To analyse the gender determination using gonial angle as panoramic study among south indian population.

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 Photoshop and the results were recorded and analysed statistically using SPSS tool.

RESULT: 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.

KEYWORD: Gonial angle; sex determination; sexual dimorphism; mandible;Innovative technique.

Running title: Gonial angle and gender determination

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) (7)(9)(10)(11)(12)(10,12)(13)(14) (15) have 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.

MATERIALS AND METHODS: This was a retrospective study conducted in a private dental college and hospital in chennai. The study was approved by the institutional review board. 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.

RESULT: 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.

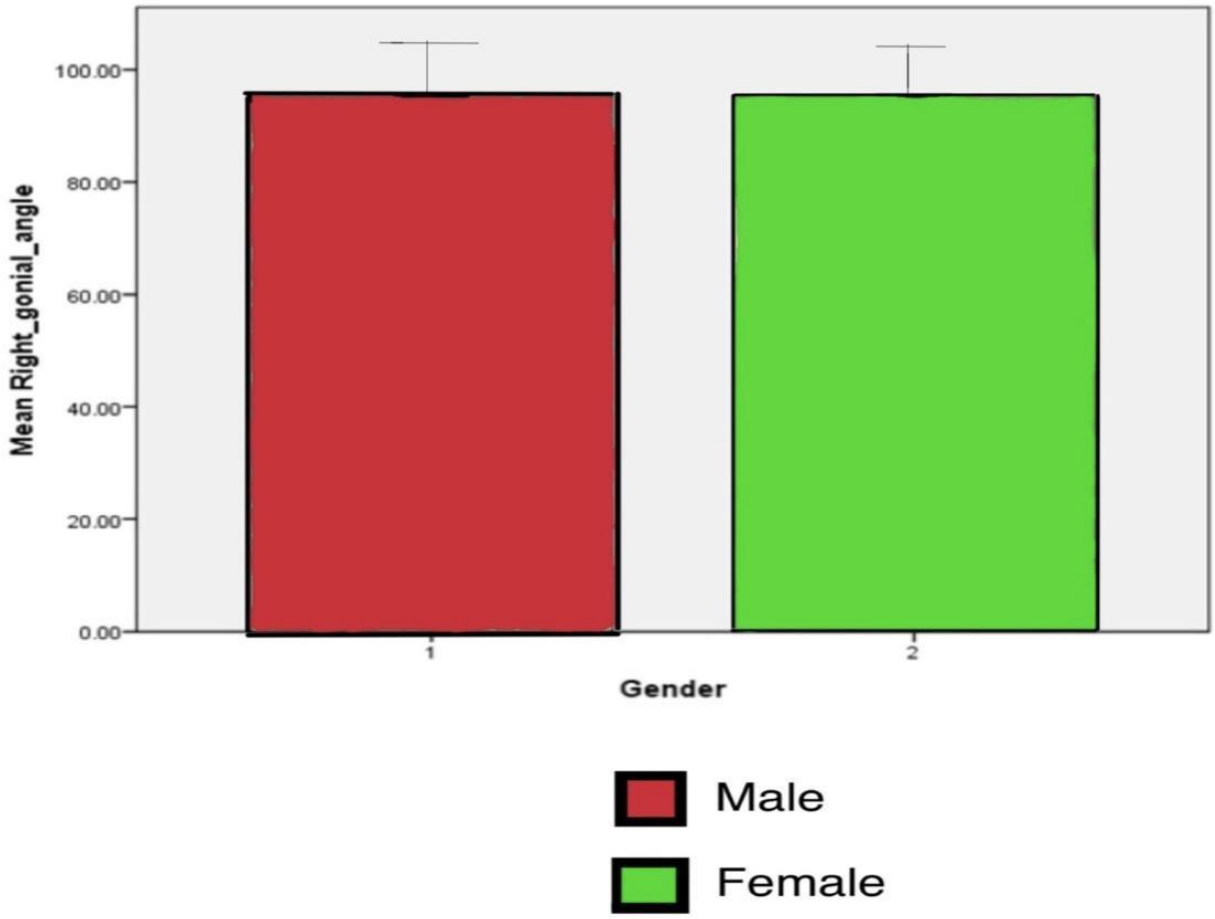

Figure 1: Bar graph shows the comparison between gender. The X-axis represents the gender and mean right gonial angle. Y-axis represents the mean right gonial angle measurement. The red colour represents male and the green colour represents female. There was statistically no significant difference observed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

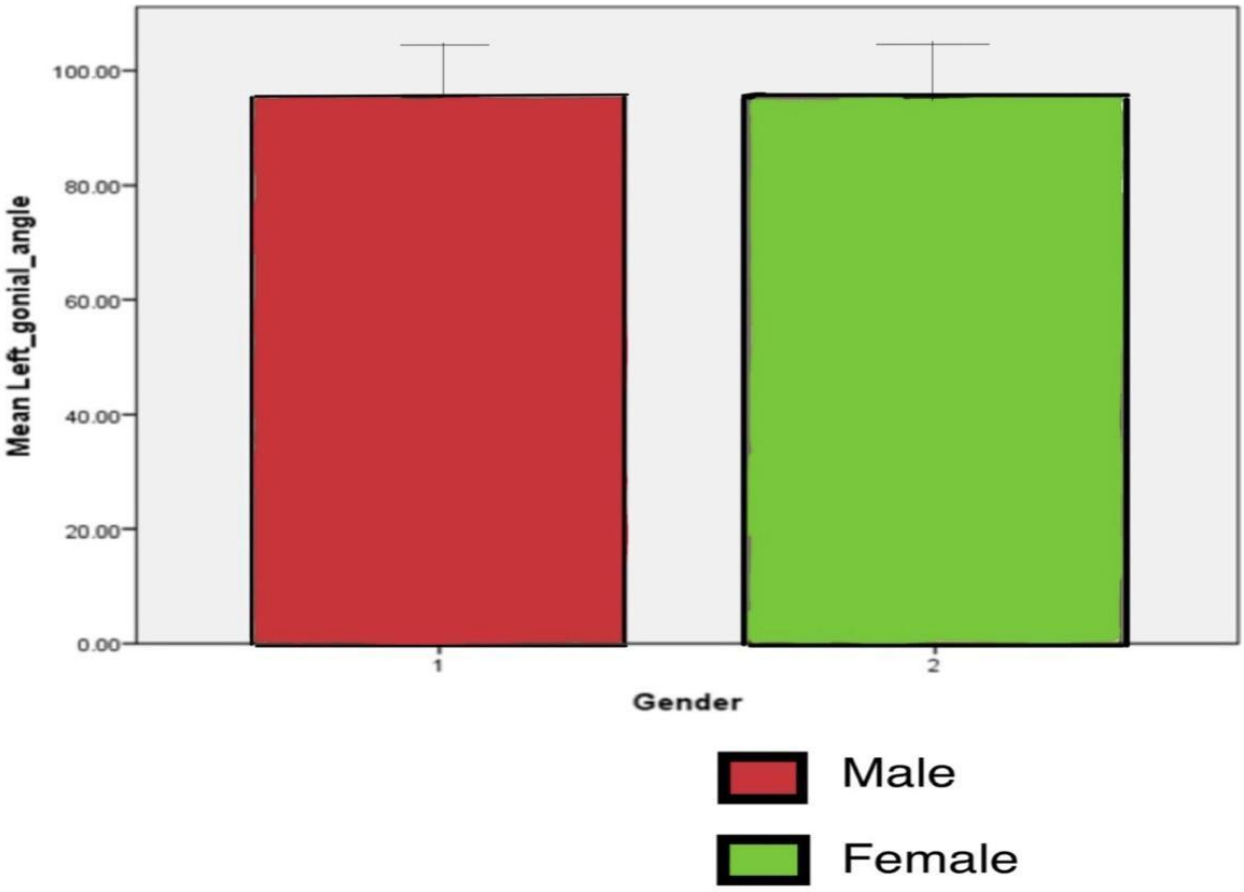

Figure 2: This graph shows the comparison between gender and mean left gonial angle. The X-axis represents the gender. Y-axis represents the mean left gonial angle measurement. The red colour represents male and the green colour represents female.There was statistically no significant difference observed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

DISCUSSION:

From the results of the current study, it was observed that the mean value of both right and left gonial angle has no significant difference between male and female. In this context, we studied how gonial angle helps to determine sex. Gonial angle has been used as a forensic parameter. A variation in mandibular angle with age and gender can be observed. 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. It has been shown that the shape of the mandible correlates with condition and function of the masticatory muscles. A study evaluated the association of tooth loss on the shape of mandibles in subjects aged 60 years. The gonial angle of the mandible and the mandibular and condylar height were measured using panoramic radiographs. The morphology of the mandible changes as a consequence of tooth loss, which can be expressed as a widening of the gonial angle and shorting of the ramus and condylar height(40). Cross sectional studies indicate an increase in the size of the gonial angle from early embryonic stages to the time of birth and a continuous decrease from birth to old age. A complete loss of teeth may reverse the usual age changes and the gonial angle becomes more obtuse again. The size of the gonial angle is associated with the proportion between facial height and ramus height. The size of the gonial angle is rather independent of variations in facial development seen in the sagittal plane(41).

Mandibular ramus can differentiate between sexes, as the stages of mandibular development, growth rates, and duration are distinctly different in both sexes. Furthermore, the masticatory forces exerted by males and females differ, which influences the shape and size of the mandibular, which is thought to be influenced by the subject's age, where longitudinal studies have shown that remodeling of the mandibular bone occurs with age.Comparison between males and females revealed that males showed statistically significant higher mean ramus linear measurements and lower mean gonial angle values than 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.

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.

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