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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

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.
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.

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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] have ed 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.

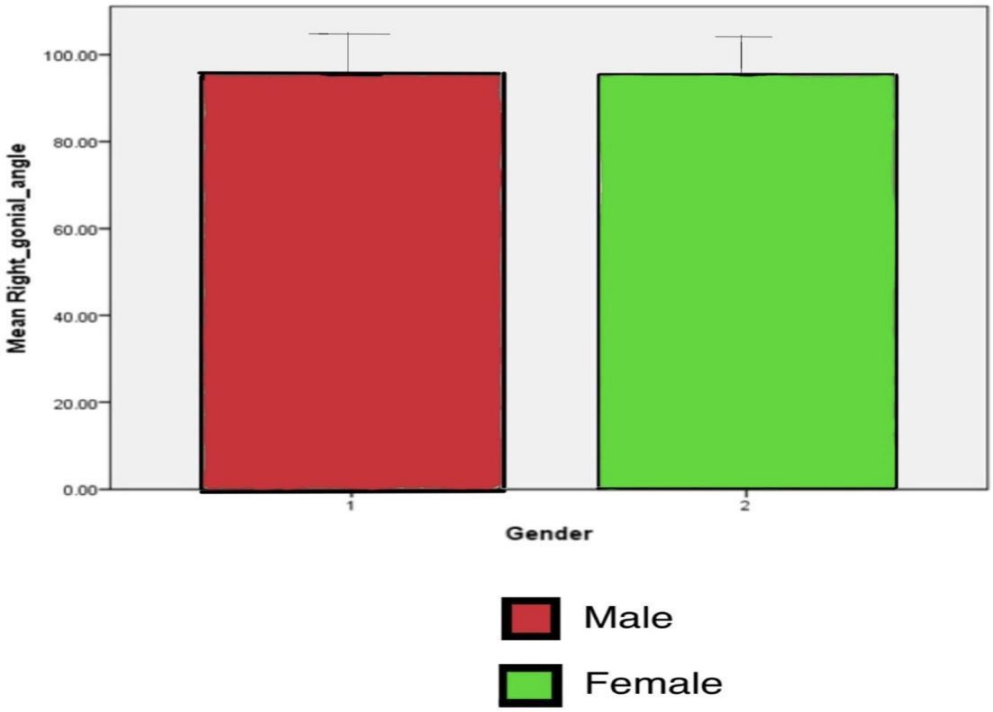

Fig. 1. Bar graph shows the comparison between gender. The X-axis represents the gender and mean right gonial angle. Y-axis represents the mean right gonial angle measurement. The red colour represents male and the green colour represents female. There was statistically no significant difference observed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

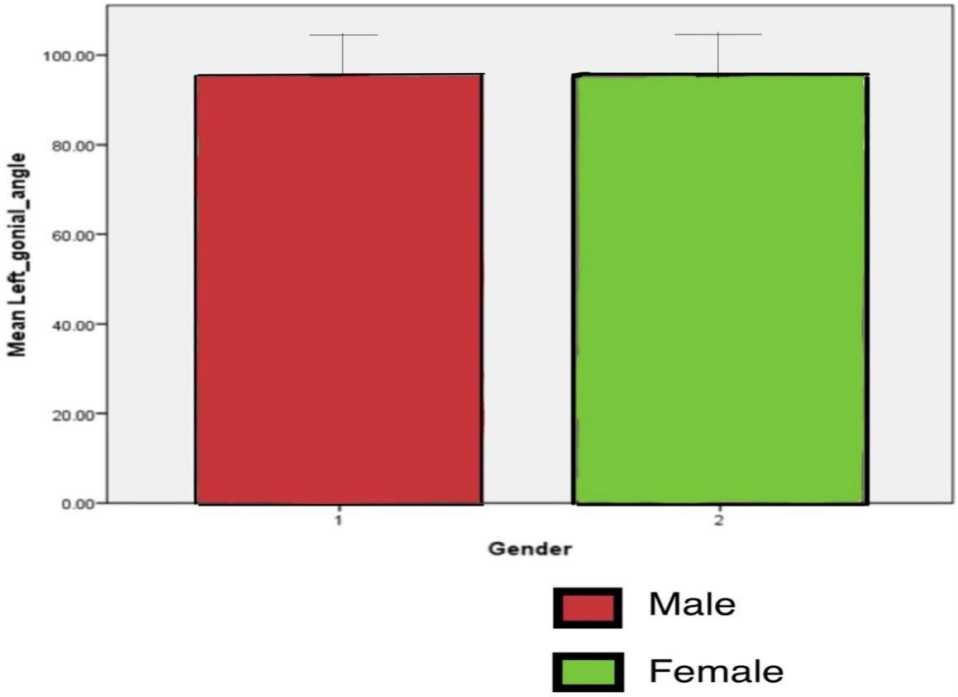

Fig. 2. This graph shows the comparison between gender and mean left gonial angle. The X-axis represents the gender. Y-axis represents the mean left gonial angle measurement. The red colour represents male and the green colour represents female. There was statistically no significant difference observed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

REFERENCES

1. Alfawzan AA. Gonial Angle as a Determinant of Gender, a Panoramic Study in a Sample of Saudi Population [Internet]. Indian Journal of Public Health Research and Development. 2020; 11:1689.

Available:http://dx.doi.org/10.37506/v11/i1/2020/ijphrd/194092

2. Upadhyay R, Upadhyay J, Agrawal P, Rao N. Analysis of gonial angle in relation to age, gender, and dentition status by radiological and anthropometric methods [Internet]. Journal of Forensic Dental Sciences. 2012;4:29. Available:http://dx.doi.org/10.4103/0975-1475.99160
3. Sharma M, Gorea RK, Gorea A, Abuderman A. A morphometric study of the human mandible in the Indian population for sex determination [Internet]. Egyptian Journal of Forensic Sciences. 2016;6:165–9. Available:http://dx.doi.org/10.1016/j.ejfs.2015.01.002
4. 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 [Internet]. Journal of Forensic Research. 2015;06. Available:http://dx.doi.org/10.4172/2157-7145.1000308
5. Abuhijleh E, Warreth A, Qawadi M, Abdulrida E, Radaideh A, Al Taki A, et al. Mandibular Gonial Angle Measurement as a Predictor of Gender-A Digital Panoramic Study [Internet]. The Open Dentistry Journal. 2019;13:399–404. Available:http://dx.doi.org/10.2174/1874210601913010399
6. Shruthi M, Preetha S. Effect of Simple Tongue Exercises in Habitual Snorers [Internet]. Research Journal of Pharmacy and Technology. 2018;11:3614. Available:http://dx.doi.org/10.5958/0974-360x.2018.00665.0
7. Preetha S, Packyanathan J. Comparison of the effect of Yoga, Zumba and Aerobics in controlling blood pressure in the Indian population [Internet]. Journal of Family Medicine and Primary Care. 2020;9:547. Available:http://dx.doi.org/10.4103/jfmpc.jfmpc_607_19
8. J SK, Saveetha Dental College and Hospitals, Road PH, Chennai, Tamilnadu, Preetha S, et al. Effect of aerobics exercise and yoga on blood pressure in hypertensives [Internet]. International Journal of Current Advanced Research. 2017;6:3124–6. Available:http://dx.doi.org/10.24327/ijcar.2017.3126.0200
9. Prathap L, Suganthirababu P, Ganesan D. Fluctuating Asymmetry of Dermatoglyphics and DNA Polymorphism in Breast Cancer Population [Internet]. Indian Journal of Public Health Research and Development. 2019;10:3574. Available:http://dx.doi.org/10.5958/0976-5506.2019.04141.x
10. Lavanya J, Prathap S, Alagesan J. Digital and palmar dermal ridge patterns in population with breast carcinoma. Biomedicine. 2014;34(3):315–21.
11. Prathap L, Jagadeesan V. Association of quantitative and qualitative dermatoglyphic variable and DNA polymorphism in female breast cancer population. Online J Health [Internet]. 2017. Available:https://www.researchgate.net/profile/Prathap_Suganthirababu/publication/321606278_Association_of_Quantitative_and_Qualitative_Dermatoglyphic_Variable_and_DNA_Polymorphism_in_Female_Breast_Cancer_Population/links/5a28c8f1a6fdcc8e8671c0cd/Association-of-Quantitative-and-Qualitative-Dermatoglyphic-Variable-and-DNA-Polymorphism-in-Female-Breast-Cancer-Population.pdf
12. Lavanya J, Kumar VJ, Sudhakar N, Prathap S. Analysis of DNA repair genetic polymorphism in breast cancer population. Int J Pharma Bio Sci [Internet]. 2015. Available:https://scholar.google.ca/scholar?cluster=8949053652564257518&hl=en&as_sdt=0,5&sciodt=0,5
13. Prathap L, Suganthirababu P. Estrogen Exposure and its Influence in DNA Repair Genetic Variants in Breast Cancer Population [Internet]. Biomedical and Pharmacology Journal. 2020;13:1321–7. Available:http://dx.doi.org/10.13005/bpj/2001
14. Ravikumar H, Prathap L, Preetha S. Analysis of palmar ATD angle in population with malocclusion. 2020;1174–82.
15. Prathap L. Interplay of oxidative stress and lipoproteins in breast carcinoma initiation, promotion and progression -A systematic review. PalArch's Journal of Archaeology of Egypt/ Egyptology [Internet]. 2021[cited 2021 Mar 9];17(7). Available:http://dx.doi.org/
16. Lim TW, Sabri BAM, Ahmad R. The effect of mandibular angulation on gonial angle and tooth length measurement of dental panoramic radiographs [Internet]. Bioresources Technology in Sustainable Agriculture. 2018;167–75.

Available:http://dx.doi.org/10.1201/9781315365961-12

17. Sekar D, Lakshmanan G, Mani P, Biruntha M. Methylation-dependent circulating microRNA 510 in preeclampsia patients. Hypertens Res. 2019;42(10): 1647–8.
18. Princeton B, Santhakumar P, Prathap L. Awareness on Preventive Measures taken by Health Care Professionals Attending COVID-19 Patients among Dental Students. Eur J Dent. 2020;14(S 01):S105–9.
19. Logeshwari R, Rama Parvathy L. Generating logistic chaotic sequence using geometric pattern to decompose and recombine the pixel values. Multimed Tools Appl. 2020;79(31-32):22375–88.
20. Johnson J, Lakshmanan G, M B, R M V, Kalimuthu K, Sekar D. Computational identification of MiRNA-7110 from pulmonary arterial hypertension (PAH) ESTs: A new microRNA that links diabetes and PAH. Hypertens Res. 2020;43(4): 360–2.
21. Paramasivam A, Priyadharsini JV, Raghunandhakumar S, Elumalai P. A novel COVID-19 and its effects on cardiovascular disease. Hypertens Res. 2020;43(7):729–30.
22. Pujari GRS, Subramanian V, Rao SR. Effects of Celastrus paniculatus Willd. and Sida cordifolia Linn. in Kainic Acid Induced Hippocampus Damage in Rats. Ind J Pharm Educ. 2019;53(3):537–44.
23. Rajkumar KV, Lakshmanan G, Sekar D. Identification of miR-802-5p and its involvement in type 2 diabetes mellitus. World J Diabetes. 2020;11(12):567–71.
24. Ravisankar R, Jayaprakash P, Eswaran P, Mohanraj K, Vinitha G, Pichumani M. Synthesis, growth, optical and third-order nonlinear optical properties of glycine sodium nitrate single crystal for photonic device applications. J Mater Sci: Mater Electron. 2020;31(20):17320–31.
25. Wu S, Rajeshkumar S, Madasamy M, Mahendran V. Green synthesis of copper nanoparticles using Cissus vitiginea and its antioxidant and antibacterial activity against urinary tract infection pathogens. Artif Cells Nanomed Biotechnol. 2020;48(1):1153–8.
26. Vikneshan M, Saravanakumar R, Mangaiyarkarasi R, Rajeshkumar S, Samuel SR, Suganya M, et al. Algal biomass as a source for novel oral nano-antimicrobial agent. Saudi J Biol Sci. 2020;27(12):3753–8.
27. Alharbi KS, Fuloria NK, Fuloria S, Rahman SB, Al-Malki WH, Javed Shaikh MA, et al. Nuclear factor-kappa B and its role in inflammatory lung disease. Chem Biol Interact. 2021;345:109568.
28. Rao SK, Kalai Priya A, Manjunath Kamath S, Karthick P, Renganathan B, Anuraj S, et al. Unequivocal evidence of enhanced room temperature sensing properties of clad modified Nd doped mullite Bi2Fe4O9 in fiber optic gas sensor [Internet]. Journal of Alloys and Compounds. 2020;838: 155603.
Available:http://dx.doi.org/10.1016/j.jallcom.2020.155603
29. Bhavikatti SK, Karobari MI, Zainuddin SLA, Marya A, Nadaf SJ, Sawant VJ, et al. Investigating the Antioxidant and Cytocompatibility of Mimusops elengi Linn Extract over Human Gingival Fibroblast Cells. Int J Environ Res Public Health [Internet]. 2021;18(13).
Available:http://dx.doi.org/10.3390/ijerph18137162
30. Marya A, Karobari MI, Selvaraj S, Adil AH, Assiry AA, Rabaan AA, et al. Risk Perception of SARS-CoV-2 Infection and Implementation of Various Protective Measures by Dentists Across Various Countries. Int J Environ Res Public Health [Internet]. 2021;18(11).
Available:http://dx.doi.org/10.3390/ijerph18115848
31. Barma MD, Muthupandiyan I, Samuel SR, Amaechi BT. Inhibition of Streptococcus mutans, antioxidant property and cytotoxicity of novel nano-zinc oxide varnish. Arch Oral Biol. 2021;126:105132.
32. Vijayashree Priyadharsini J. In silico validation of the non-antibiotic drugs acetaminophen and ibuprofen as antibacterial agents against red complex pathogens. J Periodontol. 2019;90(12): 1441–8.
33. Priyadharsini JV, Vijayashree Priyadharsini J, Smiline Girija AS, Paramasivam A. In silico analysis of virulence genes in an emerging dental pathogen A. baumannii and related species [Internet]. Archives of Oral Biology. 2018;94:93–8.
Available:http://dx.doi.org/10.1016/j.archoralbio.2018.07.001
34. Uma Maheswari TN, Nivedhitha MS, Ramani P. Expression profile of salivary micro RNA-21 and 31 in oral potentially

malignant disorders. Braz Oral Res. 2020;34:e002.
35. Gudipaneni RK, Alam MK, Patil SR, Karobari MI. Measurement of the Maximum Occlusal Bite Force and its Relation to the Caries Spectrum of First Permanent Molars in Early Permanent Dentition. J Clin Pediatr Dent. 2020; 44(6):423–8.
36. Chaturvedula BB, Muthukrishnan A, Bhuvaraghan A, Sandler J, Thiruvenkatachari B. Dens invaginatus: a review and orthodontic implications. Br Dent J. 2021;230(6):345–50.
37. Abbas B, Ministry of Health -Baghdad-Iraq, Najm AA. Evaluation of Gonial Angle, Ramus Height and Bigonial width in Relation to Age and Gender using Digital Panoramic Radiograph [Internet]. Diyala Journal of Medicine. 2020;18:55–61. Available:http://dx.doi.org/10.26505/djm.18024950922
38. Larrazabal-Moron C, Sanchis-Gimeno JA. Gonial angle growth patterns according to age and gender. Ann Anat. 2018;215:93–6.
39. Hariemmy M, Boedi RM, Utomo H, Margaretha MS. Sex determination using gonial angle during growth spurt period: A direct examination [Internet]. Indonesian Journal of Dental Medicine. 2018;1:86. Available:http://dx.doi.org/10.20473/ijdm.v1i2.2018.86-89
40. Huumonen S, Sipilä K, Haikola B, Tapio M, Söderholm A, Remes-lyly T, et al. Influence of edentulousness on gonial angle, ramus and condylar height [Internet]. Journal of Oral Rehabilitation. 2010;37:34–8. Available:http://dx.doi.org/10.1111/j.1365-2842.2009.02022.x
41. Jensen E, Palling M. The gonial angle [Internet]. American Journal of Orthodontics. 1954;40:120–33. Available:http://dx.doi.org/10.1016/0002-9416(54)90127-x

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