DOI Number: 10.37506/v14/i1/2020/ijfmt/192921

Relationship between Radiographic Evaluation with Age and Gender – A Radiographic Study

Nor Syakirah Binti Shahroom[1], Gheena.S[2]

[1]Undergraduate Student, Saveetha Dental College, [2]Reader, Department of Oral Pathology, Saveetha Dental College, Saveetha Institute of Medical and Technical Science, Saveetha University

Abstract

Background: Forensic odontology plays an important role in identification of man-made or natural disasters event which restricts identification through conventional methods. Various approaches have been specified which helps in the identification of the post-mortem remains. One such is the identification of the morphological features of the human skull and mandible. These features may help in sex differentiation. The aim of this study is to evaluate the relationship between radiographic evaluation with age and gender.

Materials and Method: A retrospective study was done with a total of 250 panoramic radiograph image. The images of 150 males and 100 females were selected with the range of age from 20 to 70 years old and divided into group 1 (20-45 years old) and group 2 (46-70 years old). Three parameters were evaluated from the panoramic radiograph which were gonial angle, antegonial angle and mental foramen against the age and gender. Statistical analysis was done for hypothesis testing.

Results: The results of this study suggests that there is no significant difference seen in the gonial angle and antegonial angle with relation to the age ($p \geq 0.05$). However, the relationship between age and mental foramen is highly significant ($p \leq 0.01$). With regards to gender, all the three parameter shows highly significant results with ($p \leq 0.01$).

Conclusion: In conclusion, the three parameter assessed in this study can be used for gender differentiation but not for age estimation which were highly significant. As for age estimation, the distance of mental foramen and tangent line of inferior border of mandible can be assessed.

Keywords: *Antegonial angle, gonial angle, mental foramen, panoramic, radiographic evaluation*

Introduction

An event which causes total destruction to the human body may require a group of specialist which deals with post-mortem identification. This team would include a forensic odontologist. Forensic odontology is a branch of dentistry which in the interest of justice, deals with the proper handling and examination of dental evidence, and with the proper evaluation and presentation of dental finding [(1)]. This specialised branch of dentistry helps in identification of human remains if the other conventional method such as fingerprints and visual recognition are not possible [(1)].

The skeletal remains play an essential role in identification of gender. Most common skeletal parts used in the previous study were the skull and mandible. However, mandible which is the almost dimorphic, largest and strongest bone contributes to the significant difference in identifying gender among the human remains [(2, 3)]. Mandible is made up of compact bone which makes it durable and highly resistant to fracture[(4)].

Corresponding author:
Dr. Gheena. S
Reader, Department of Oral Pathology
Saveetha Dental College, Saveetha Institute of Medical and Technical Science, Saveetha University
162, Poonamalle High Road, Chennai 600077
Tamil Nadu, India,
E-mail: gheena_ranjith@yahoo.co.in
Telephone Number: +91-9884033777

Apart from that, chronological age assessment is also an important factor in identifying human remains. Several factors may affect the morphological changes in the mandible which are the dental status and age. Some anatomical structure which might be affected are gonial angle, antegonial angle, condyle and ramus.

Dentofacial radiographs plays a significant role in identifying anatomical landmarks of the maxilla and mandible. Various intraoral and extra oral radiographs are available. However, the most commonly used radiograph in the assessment of anatomical landmarks in the mandible are the orthopantomography (OPG) or panoramic radiograph. This radiograph shows a whole view of the dentofacial tissues of the maxilla and mandible (5). Besides, the use of OPG in forensic anthropology which helps in the comparison of ante-mortem and post-mortem radiographs is one of the cornerstones of positive identification of human remains[4].

The aim of this study is to evaluate the relationship between the radiograph evaluation with age and gender. The radiographic evaluation includes the gonial angle, antegonial angle and mental foramen.

Materials and Method

This retrospective study was conducted in Department of Oral Medicine and Radiology at Saveetha Dental College and Hospital, Chennai, India. This study was approved by the institutional ethical committee of the college and informed consent was taken from all patients who were included in the study. A total of 250 panoramic radiographs were taken from the department. A few inclusion and exclusion criterias were assessed before including the radiographs in this study. The inclusion criteria was a clear radiographic image showing the anatomical landmarks of the gonial angle, antegonial angle and mental foramen. The exclusions criteria were any fractured mandible, mixed dentition, blurred radiographic images and micrognathia.

In this present study, three parameters were assessed which were the gonial angle, antegonial angle and mental foramen. Gonial angle is the angle between the distal ramus of mandible and lower border of the mandible. The angle can be determined by tracing two line intersecting from the distal ramus of mandible and lower border of mandible. Next, antegonial angle is an angle formed at the deepest antegonial notch at the lower border of the mandible. It can be measured by tracing a line parallel to the antegonial region. Third parameter was the mental foramen. It was measured by drawing a line tangent to the lower border of the mandible and a perpendicular line from the inferior most mental foramen was drawn along the tangent.

The panoramic radiographs were divided into two category: age and gender. For the first category, the age was divided into two groups. Group 1 consists of patient age from 20-45 years old and group 2 consists of patient age from 46-70 years old. Based on gender, the patients were divided into male and female. Statistical analysis was done by using t-test to test the hypothesis.

Results

Table 1 shows the result of this study which suggests that there are no significant differences seen in the gonial angle and antegonial angle in relation to the age ($p \geq 0.05$). However, the relationship between age and mental foramen is highly significant ($p \leq 0.01$). In regards of gender, all the three parameter shows a highly significance results with ($p \leq 0.01$) as shown in Table 2.

Table 1 Shows the relationship between radiographic evaluations with age

Parameters	Age	Mean ± Standard deviation	p-value
Gonial angles	Group 1	122.38 ± 7.27	≥0.05
	Group 2	123.15 ± 8.92	≥0.05
Antegonial angle	Group1	165.83 ± 7.49	≥0.05
	Group 2	165.06 ± 7.47	≥0.05
Mental foramen (mm)	Group 1	10.60 ± 1.79	≤0.01
	Group 2	11.33 ±1.08	≤0.01

The relationship between age and the radiographic evaluation shows that as the age increases, the more obtuse the gonial angle become. There is slight increase of gonial angle in group 2 with 123.15 ± 8.92 compared to group 1 with 122.38 ± 7.27. Meanwhile, there is no significance difference seen in the antegonial angle in both age groups. As for mental foramen, the distance is greater in group 2 compared to group 1 (11.33 ±1.08 and 10.60 ± 1.79).

Table 2 Shows the relationship between radiographic evaluations with gender

Parameter	Gender	Mean ± standard deviation	p-value
Gonial angle	Male	121.05 ± 8.74	≤0.01
	Female	124.89 ± 6.28	≤0.01
Antegonial angle	Male	164.60 ± 7.99	≤0.01
	Female	167.04 ± 5.44	≤0.01
Mental foramen (mm)	Male	11.09 ± 1.62	≤0.01
	Female	10.61 ± 1.51	≤0.01

This present study shows that male has a smaller gonial angle compared to female (121.05 ± 8.74 and 124.89 ± 6.28). To compare the antegonial angle, female has a greater antegonial angle compared to male (167.04 ± 5.44 and 164.60 ± 7.99). However, for the distance of inferior border of mental foramen to the tangent line of inferior border of mandible shows a slight differences between male and female (11.09 ± 1.62 and 10.61 ± 1.51).

Discussion

Based on the results of this study, there was no statistically significant difference between age and gonial angle. However, there was increase in gonial angle as the age increase. In the study done by Upadhyay et al, there was a significant decrease in the mean gonial angle as the age advances but the results were not statistically significant to be reliable (6). Meanwhile, in the study done by Bhardwaj et al., Kasat V et al., and Shendakar AT et al., suggested that there were changes of the gonial angle from more obtuse to less obtuse and become more obtuse as the age advances (7-9). Apart from that, another study done by Sicher H et al, suggested that edentulous patient will have a greater gonial angle due to the disuse atrophy and tooth loss [10]. In the study done by Carolina et al, there was significant difference between age and gonial angle in which the gonial angle decreases and stop from 21 years old onwards [11].

According to gender, many studies suggested that the gonial angle were greater in female compared to male which was similar to this present study (≤0.01). In the study done by Burak Apaydin et al. and Revant H. Cole et al. a statistically significance difference were found between male and female patients (p≤0.05) in which female has greater gonial angle than male (12, 13). However, in the study done by Upadhyay et al., Raustia AM and Salonen mam and Ceylan et al, there were no statistically significance between gender and gonial angle (6, 14, 15). Usually, male will have a greater mean angle of 3°-5° due to the large anatomical mandible (16). Nevertheless, the reason why female has a greater gonial angle is due to the masticatory forces act on the mandible [7]. On average, male will have a greater masticatory forces which results in smaller gonial angle. The rotation of the mandible which is different between male and female may also affect the gonial angle. Female will have a downward and backward rotation of the mandible whereas male will have a forward rotation of mandible [12, 17].

The next parameter assessed was the antegonial angle. This study suggested that the antegonial angle in female was greater than male with a statistically significant result (≤0.01). The result was comparable with the study done by Bhardwaj et al and Burak Apaydin et al which showed that antegonial angle was greater in female which was highly statistically significant (≤0.01) [7, 12]. Antegonial region is situated at the lower of mandible which is exposed to bone resorption which in turn decrease the antegonial angle and antegonial depth. The reason of the differences between male and female may be due to the hormonal changes. Testosterone and oestrogen affecting the bone metabolism of male and female respectively [7].

The relationship between the age and antegonial angle in this present study was not statistically significant (≥0.05) which was comparable to the study done Ghosh et al. Only a slight changes seen between group 1 and

group 2 with 0.77° difference (18).

Mental foramen is an anatomical landmark which is usually seen in the second premolar and first molar region. In this study, there was a statistically significant changes seen in the distance of mental foramen from the tangent line of the inferior border of the mandible (≤0.01) in relation to age and gender. As the age increases, the distance increases. Usually in the adults, the mental foramen is nearer to the inferior border but as the age advances, the mental foramen moves upward closer to the alveolar border due to tooth loss and bone resorption [19]. In the study done by Bhardwaj et al, Amorin M et al, Kasat V et al and Shendarkar et al suggested that there were no statistically difference between ages (7-9). However, with regards of gender, this study showed that the distance from mental foramen to the tangent line of inferior border of mandible is higher in male than female (≤0.01) which is consistent with the study done by Burak Apaydin et al and Thakur et al (12, 20). Meanwhile in the study done by Prabhu et al, there was no statistically significant between mental foramen and gender (≥0.05) [21].

Conclusion

In conclusion, the three parameter assessed in this study can be used for gender differentiation but not for age estimation as gender differentiation alone was highly significant. As for age estimation, the distance of mental foramen and tangent line of inferior border of mandible can be assessed. Further study should be done using advanced modalities device to reduce the limitation of this study.

Conflict of Interest: Nil

Source of Funding: Nil

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