AGE ESTIMATION USING MANDIBULAR PROJECTIVE RAMUS HEIGHT - A RETROSPECTIVE DIGITAL ORTHOPANTOMOGRAPHIC STUDY

ABSTRACT

Background: Mandibular projective ramus height is one of the accurate parameters in age estimation.Estimation of age by mandibular ramusheight using various digital softwares is one of the newest approach in forensic dentistry. The aim of the present study is to derive a new linear regression formula for estimating age of south Indian population using mandibular projective ramus height.

Materials and methods: This retrospective study included OPG samples n=260 from 5 age groups between 30 to 79.9 years. Measurement of mandibular projective ramus height was done using Planmeca Romexis Viewer software and tabulated and exported to SPSS software for linear regression analysis.

Result: Mean mandibular projective ramus height value of males (28.7) is higher compared to females (27.3) in all age groups and there is also a significant decrease in mandibular projective ramus height in both gender as the age advances. The gender specific and general linear regression formula derived for estimation of age in the South Indian population

Conclusion: Even though the current linear regression formula for estimating age carries 65% accuracy, further research with adequate sample size should be carried out across the hospitals in Chennai for more significant and region specific results.

Keywords: age estimation; mandibular projective ramus height; orthopantomograph

INTRODUCTION

Determination of age is having paramount importance in forensic anthropology and medicolegal investigations (1). In case of mass disaster where the entire skull and pelvis is not available, mandible being a practical element to analyze the age and sexual dimorphism. Presence of a dense layer of compact bone makes it more durable

and well preserved than many other bones(2). Mandibular condyle and ramus are associated with remodelling during growth and undergo greatest morphological changes in size(3). Determination of age and sex using morphometric measurements of manibular ramusheight using various digital softwares is one of the newest approach in forensic dentistry(4). The occlusal forces and age can influence the morphological status of the mandible and some studies have shown that remodeling of the mandibular bone occurs with age (5). Evidence suggested that there is a strong correlation between chronological age and the morphology of the mandibular ramus(6,7) .

Several metric and non metric studies have been performed using mandibular ramus measurements for estimation of sex(8–10) and age(11,12).Few of the earlier studies in literature have concluded that mandibular ramus showed high sexual dimorphism and can be beneficial in age estimation(13). Projective ramus height is one of the accurate parameters in age estimation(14). The availability of recent studies using projective mandibular ramus height for estimation of age in indian population using orthopantomograph is very rare. The aim of the present study is to derive a new linear regression formula using mandibular projective ramus height for age estimation of south indian population.

MATERIALS AND METHODS

The present study was conducted with approval from the Institutional Human Ethical Committee, Saveetha dental College and Hospitals (SDC), Chennai. This retrospective study included n=260 samples and which were digital orthopantomogram(OPG). The age groups selected for the present study ranged between 30 to 79.9 years and included 5 groups (30-39.9, 40-49.9, 50-59.9, 60-69.9, 70-79.9). Each group included 30 males and 30 females except for the last group(70-79.9) which included 10 males and 10 females. The sample OPGs were retrieved from the archives of Saveetha dental college and hospitals and tabulated in MS Excel according to age and gender. OPGs of patients less than 30 years and greater than 80 years were excluded.

The retrieved OPGs were converted to .jpg format and measurement of mandibular projective ramus height was done using PlanmecaRomexis Viewer software. The mandibular projective ramus height is recorded in such a way that the point of line of intersection from the highest projection point of the condyle to the lower margin of the bone. Figure 1 and Figure 2 showing the linear measurements of mandibular projective ramus height in male and female using PlanmecaRomexis Viewer software. The mandibular projective ramus height measurements were tabulated and exported to SPSS software for statistical analysis. Discriminant function analysis and regression formulas for the estimation of age were derived with a precision of 70%.

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RESULTS

The result shows the mean age of the total sample was 50.26 years with a standard deviation of 2.7 years. Mean age of males was higher than females in two groups. Figure 3 shows the mean age of male and female in each age group. Mean mandibular projective ramus height of the total sample was 28.51 with a standard deviation of 3.03. The average linear measurement of mandibular projective ramus height of males (28.7) was higher when compared to females (27.3) in all the groups. In first group females, the standard deviation of mandibular projective ramus height is 1.84, which is less when compared to all the other groups (Table 1). There was a decrease in mean mandibular projective ramus height as age advances. The linear regression formula derived for estimation of age of the general South Indian population and separate gender specific formula for males and females are represented below.

Linear regression Formula for general South Indian Population

Age=(□□□□−33.7)/(-0.1032) +/- 7.8 years

Linear regression Formula for Female

Age=(□□□□−33.31)/(−0.1077) +/- 7.2 years

Linear regression Formula for Male

Age=(□□□□−34.05)/(−0.09787) +/- 7.4 years

DISCUSSION

Mandible is one of the most sexually dimorphic bone and mandibular ramus in particular is associated with the greatest morphological changes in size and remodeling during growth (15,16). Forensic anthropology uses the mandible as an age estimation tool in morphometric studies because the mandible is durable and spared in conditions where skeletal integrity is compromised(17). Apart from that, growth rate, dimensional and morphological change of mandible accumulating over years can accurately reflect in the skeletal developmental state (18,19). Franklin et al suggested that with morphological and dimensional assessment of the mandible, age estimation can be done with an error margin of 1.3-3.0 years (20).

In the present study, the mean age of males was higher than females in two groups which showed in figure 2 and figure 3. This could be due to the variations in the sampling process. The average linear measurement of mandibular projective ramus height of males was higher when compared to females in all the groups showed in figure 1. This was in agreement with Saini et al, who did a study on mandibles of Northern Indian population (92 males, 24 females, mean age 37.4 years) and found that all the ramus metric parameters were higher in males than females (10). Similarly, Indira et al in the Bangalore population, Vodanovic et al in Croatian population and Al-Shamout et al in Jordanian population also found that morphometric linear measurements of mandibles were higher in males when compared to females (21–23). This could be due to the greater masticatory force of males than females which can influence the bone size (23). Sex hormones also have an effect on mandibular shape and measurements and Weinberg et al explained a biological link between androgen exposure in prenatal period and the development of male facial characteristics(24).

In the present study, there was a decrease in mandibular projective ramus height as age advances. This was in accordance with Joo et al (25). This could be due to increased rate of resorption in the older age group. But there are few studies by Taleb et al-2015 and Behl et al 2020, which contradicts this observation (26,27). This difference could be due to geographical variations of sampling, non-random sampling and variations in sample size.

The linear regression formula derived using mean mandibular projective ramus height for age estimation of general South Indian population and separate gender specific formula carries 65% accuracy. This may be due to regional variations since we conducted the study as a hospital based study and regional stratification was not carried out during the study process. The limited sample size is also one of the disadvantages of the present study which can affect the accuracy of the regression model.

CONCLUSION

Males have statistically significant higher mean values of mandibular projective ramus height compared to females in all age groups and there is also a significant decrease in mandibular projective ramus height in males and females as the age advances. The gender specific and general linear regression formula derived for estimation of age carries an accuracy of 65%. Further research with adequate sample size should be carried out across the hospitals in Chennai for more significant and region specific results. Even cone beam computed tomography can be used instead of OPG because it provides accurate measurements.

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Figure 1: Represents the projective ramus height measurements.

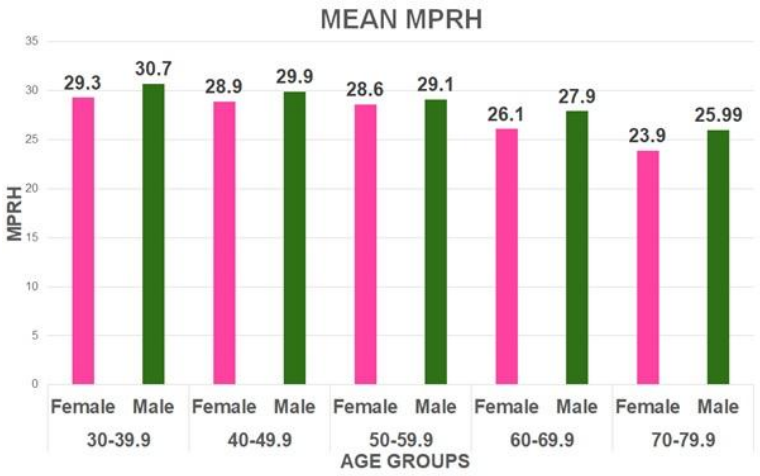

Figure 2: Represents the MPRH of the two variables Male and Female and their mean values.

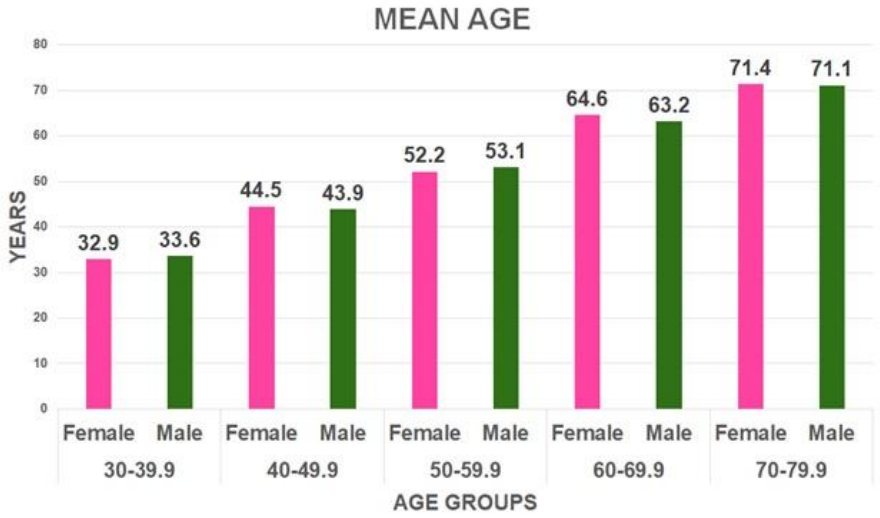

Figure 3: Represents the two variables Male and Female and their mean age values.

List of tables

Table 1: Showing the average age, average mandibular projective ramus height and standard deviation in different age groups

Age group	Gender	Mean Age	SD	Mean MPRH	SD
30-39.9	Female	32.9	2.86397	29.3	1.84792
	Male	33.6	2.82355	30.7	2.87396
40-49.9	Female	44.5	2.68756	28.9	2.98010
	Male	43.9	2.58555	29.9	2.62780
50-59.9	Female	52.2	2.88974	28.6	2.46674
	Male	53.1	2.60944	29.1	3.20396
60-69.9	Female	64.6	2.14127	26.1	4.35379
	Male	63.2	3.13691	27.9	3.63124
70-79.9	Female	71.4	2.79682	23.9	4.21269
	Male	71.1	2.84605	25.99	2.07389

List of figure legends

Figure 1: Mandibular projective ramus height(AB) of female measured using planmeca software

Figure 2: Mandibular projective ramus height(AB) of male measured using planmeca software

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Figure 3: Bar graph showing the mean age of male and female in each age group

Figure 4: Bar graph showing the mean mandibular projective ramus height(MPRH) of male and female in each age group