



MANDIBULAR RAMUS AND GONIAL ANGLE ANALYSIS AS PREDICTORS OF SEX DETERMINATION IN NORTHERN GUJARAT POPULATION: A DIGITAL PANORAMIC STUDY

Oral Medicine & Radiology

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ABSTRACT

BACKGROUND: In forensic dentistry and medico-legal investigations the identification of the skeletal remains is of paramount importance. Mandible may play a vital role in sex determination, as it is the most dimorphic bone of skull, which is often recovered intact. Mandibular ramus and gonial angle can be used to differentiate between sexes and age estimation

AIMS AND OBJECTIVES: The aim of the study was to assess the usefulness of digital panoramic radiographs to determine sex and age using linear measurements made with respect to gonial angle and ramus region in the population of north Gujrat

MATERIALS AND METHODS: A total of 200 patients (North Gujrat : Males and females in equal number) were further divided into age groups 30-40 years. The linear measurements were made in ramus and gonial angle region, which were calculated by using Adobe Acrobat Reader, and findings were statistically analyzed.

RESULTS: Males showed a higher average value in terms of ramus breadth, condylar and coronoid ramus height than females. In addition, a significant positive correlation was seen between age and ramus linear measurements. Males have higher gonial angle than females and with increase in age, gonial angle decreases. In relation to gonial angle, females showed a higher gonial angle. In addition, as age increases, decrease in gonial angle was found.

CONCLUSION: In selected North Gujrat populace, mandibular ramus showed higher sexual dimorphism in relation with age and sex estimation. However, gonial angle can only be used as an additional tool to establish the identity of a person.

KEYWORDS

OPG, Mandibular Gonial Angle, Mandibular Linear Measurements, Mandibular Ramus.

INTRODUCTION

The diagnosis of sex in bone remnants is necessary in forensic practice and forensic anthropology¹. Sex identification is of significance in cases of mass fatality incidents where bodies are damaged beyond recognition and it depends largely on the available parts of skeleton.² Skull is the most dimorphic and easily sexed portion of skeleton after pelvis³. But in cases where intact skull is not found, mandible may play a vital role in sex estimation, as it is the most dimorphic, largest and strongest bone of the skull that is often recovered largely intact^{4,5}. Mandibular ramus can differentiate between sexes, as the stages of mandibular development, growth rates, and duration are distinctly different in both sexes. Panoramic X-ray technology is commonly accessible and is used in daily clinical routine to assess mandibular vital structures bilaterally. The presence of plenty of panoramic radiographs provides a great opportunity to study the sexual dimorphism of individuals in certain population⁷. This was behind the idea of using panoramic images for mandibular ramus assessment in the current work.

AIMS & OBJECTIVES

The aim of this study is to assess the utility of various mandibular ramus linear and gonial angle measurements and analysis on digital panoramic images as indicators for sex determination in Northern Gujarat population.

MATERIAL & METHODS

- Total 200 panoramic images were taken (by using ORTHOCEPH R® OC200, Instrumentarium Dental, Finland)
- The selected images fulfilled the following inclusion criteria:
- Good quality
- Standard panoramic images without any grade of exposure or positioning errors.
- Absence of any pathological lesions, fracture or deformity.
- Absence of any missing teeth or edentulous region.
- Among these 100 males and 100 females of patients age ranging from (30-40) years were included.

Five mandibular ramus linear measurements

- Upper ramus breadth (URB)
- Lower ramus breadth (LRB)
- Projective height (PH)
- Condylar ramus height (CRH)
- Coronoid ramus height (CoRH)
- Gonial angle (GA)

RESULT/ STATISTICAL ANALYSIS:

Data was analyzed using SPSS Ver 23. Descriptive, independent t test was done for intergroup comparison and regression analysis was done for sex determination.

Formulation of Hypothesis:

Null Hypothesis: H_0 = There is no difference in the measurements of various parameters compared between both genders

Alternate Hypothesis H_a = There is no difference in the measurements of various parameters compared between both genders

P value < 0.05 is considered as statistically significant.

If P value < 0.05 we can reject the null hypothesis and consider the alternate hypothesis

Table 1: Comparison of mean values of various parameters in both gender **-Statistically Highly significant (p<0.01), *-Statistically Significant (p<0.05)

Parameter	N	Male		Female		t value	p Value
		Mean	SD	Mean	SD		
Upper Ramus Length	15	10.24	0.94	8.79	0.75	4.70	<0.001**
Lower Ramus Length	15	8.39	1.11	6.29	1.41	4.52	<0.001**
Projective height	15	6.44	0.86	4.54	0.94	5.79	<0.001**
condylar ramus height	15	5.73	1.25	4.57	0.55	3.26	0.003**

coronoid ramus height	15	6.01	1.20	4.41	0.64	4.57	<0.001**
Gonial angle	15	114.00	8.05	120.80	5.27	-2.74	0.11*

Inference:

The above tables shows the mean and SD of various parameters in both the genders. There is statistically significant differences present in the mean values of various parameters in both the genders with higher values in male when compared with females. The exception to it is gonial angle in which female has higher values than males.

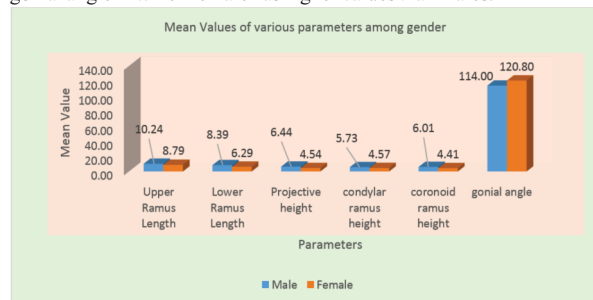


Table 2: Regression analysis (linear regression analysis to determine sex)

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.901 ^a	.811	.762	.248

The above table shows the reliability value of 0.81 which indicates the equation for sex determination is 81% accurate and the standard error of the estimate is 0.24

	Sum of Squares	df	Mean Square	F	Sig.
Regression	6.083	6	1.014	16.460	<0.001**
Residual	1.417	23	.062		
Total	7.500	29			

**..Statistically Highly significant (p<0.01)

The regression equation for the sex determination is

	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error			
(Constant)	3.016	1.028		2.933	.007**
Upper Ramus Length	-.166	.048	-.364	-3.458	.002**
Lower Ramus Length	-.063	.045	-.202	-1.400	.175
Projective height	-.109	.058	-.280	-1.864	.075
Condylar ramus height	.032	.056	.071	.574	.571
Coronoid ramus height	-.112	.049	-.275	-2.295	.031*
Gonial angle	.013	.007	.194	1.945	.064

**..Statistically Highly significant (p<0.01), *-Statistically Significant (p<0.05)

$$Y (\text{Gender}) = 3.01 - 0.166 * \text{URL} - 0.063 * \text{LRL} - 0.109 * \text{PH} + 0.032 * \text{CRH} - 0.112 * \text{CoRH} + 0.013 * \text{GA}$$

Inference:

If Y<1.5 – Male

If Y>1.5 – Female

Cross tabulation of actual and predicted sex

			Predicted sex		Total
			Male	Female	
Sex	Male	Count	14	1	15
		%	93.3%	6.7%	100.0%
	Female	Count	1	14	15
		%	6.7%	93.3%	100.0%
Total		Count	15	15	30
P<0.001**, K= 0.86		%	50.0%	50.0%	100.0%

**..Highly Significant (p<0.01)

The equation has overall accuracy of 100%.

It has 93.3% accuracy of prediction of male and female accurately.

Kappa value of agreement is 86%

All The Parameters Showed Statistically Significant Differences

DISCUSSION

- The present study results revealed that :
- Males had statistically significant higher mean values regarding all the mandibular ramus linear measurements than females.
- Such as projected ramus height: 5.6 and 6.5 v coronoid ramus height 6.2 and 5.0; condylar ramus height: 6.1 and 4.8v in males and females respectively.
- This was in agreement with the studies performed by Saini et al., Indira et al., Vodanovic et al. and Al-Shamout et al.^{3,8,9,10}
- In these studies it was found that that all the ramus metric parameters were significantly higher in males than females.
- As regards the gonial angle, males showed statistically significant lower mean gonial angle values than females (122.20 and 125.10 respectively)
- This was in agreement with studies performed by Xie et al. and Sujoy et al.^{11,12}
- Conversely, other researchers found that males showed statistically significant higher mean gonial angle values than females¹²⁻¹⁸ & others did not find any statistically significant differences between both sexes.¹⁹⁻²⁰

CONCLUSION

This study shows that ramus height shows significant sexual dimorphism. Thus the use of radiometric analysis of gender indicates a promising future for the forensic analysis of fragmented craniofacial skeletons.

It was also concluded that Sexual dimorphism can be assessed using the gonial angle.

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