ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 2, Issue – 6, November - December - 2019, Page No. : 367 - 372

Precision of Various Metrical Parameters in Determination of Sex on Panoramic Radiograph.

Dr. R. Adisree (Crri), Dr. M.Hemalatha (Crri), Dr. Pavani. M MDS, Dr. M. Abi Remolin (Crri), Dr. Sridhar. T MDS.

Department of Oral Medicine and Radiology, Priyadarshini Dental College and Hospital, Pandur, Tiruvallur, Tamil Nadu, India.

Corresponding Author: DR. R. Adisree (CRRI), Priyadarshini Dental College and Hospital, Pandur, Tiruvallur, Tamil Nadu, India.

Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Aim: The study aims to assess the precision of various metrical parameters in determination of sex using panoramic radiographs.

Materials and Methods: A total sample of 100 panoramic radiographs was selected and five parameters like Bigonial width, Height of Ramus, Bicondylar breadth, Bimental width and Body height were used for assessment on the radiographs. The data categorized were subjected to statistical analysis.

Result: The data were expressed as Mean ± SD and then analyzed by unpaired t-test.

Conclusion: The study highlighted sex determination using different mandibular parameters.

Keywords: Mandible, Metrical parameters, Sexual dimorphism.

Introduction

Determination of sex is essential in identification of an individual in general. The sex determination of an individual is important and necessary in both living and the dead for medicolegal purpose and anthropological work. The mandibleis the most durable bone of the craniofacial complex and it retains its shape better when compared to other bones; henceforth it plays a greater role in sex determination. [1,2]Panoramic radiographs are routinely used in dental practices to evaluate maxillary and mandibular vital structures.[3]The gonial angle is an important parameter for determining the growth pattern of an individual. [4]Female bones are generally smaller and less strong than male bones.[5] The present study aims in assessing the accuracy of different mandibular metrical parameters in determination of sex on panoramic radiographs.

Material and Method

A. **Study Design and Collection of Data**: A total sample of 100 panoramic radiographs of males and females with age ranging between 20 to 50 years was obtained from the Department of Oral medicine and Radiology at Priyadarshini Dental College and Hospital, Pandur. The five mandibular parameters were studied using pantomographs obtained from X-mind Panod+ (77Kv; 10 sec; 100mA) and measurements were made using DfW (Digora for Window) 2.7 software. The parameters included were bigonial width, height of the ramus, bicondylar breadth, bimental breadth and body height. (figure-1)

B. **Bigonial Width**: It is the width that measures the straight distance between two gonia.(figure-2)

C. **Height of Ramus**: It is the height that measures the direct distance from the highest point on the mandibular condyle to gonion.(figure-3)

D. **Bicondylar Breadth**: It is the breadth that measures the straight distance between two condylia lateralia.(figure-4)

E. **Bimental Breadth**: It is the breadth that measures the straight distance between the inner margins of two mental foramina. (figure-5)

F. **Body Height**: It is the height that measures the distance from alveolar margin to the lower margin of the mandible in the level of mental foramen perpendicular to the base.(figure-6)

Incase of height of ramus and body height, the average value of right and left side of the mandible was taken into consideration into the study.

G. **Inclusion Criteria**: Intact, well-formed adult mandibles were included in the study.

H. **Exclusion Criteria**: Damaged, mutilated and deformed mandible pathologically diseased, fractured, developmental disturbance, completely and partially edentulous mandibles were excluded from the study.

Data Management and Statistical Analysis with Results

Initially the samples were categorised as males and females and later they were compared by five mandibular parameters. After the measurements were done, observation was statistically analysed by unpaired t test.

Mean and Standard Deviation were calculated for the ranges of each parameter of both the genders. Group statistics of the five mandibular parameters was shown in the Table: 1 with $p < 0.001$ sig. The independent samples test was shown in Table: 2 and descriptive statistics of the five mandibular parameters was shown in Table: 3. The mean values showed that all dimensions were higher for males compared to females.

Bigonial Width

Bigonial width of male varies from 175.94 - 181.13 mm with an average of 178.53 ± 9.77 mm and that of female varies from 166.86 - 172.28 mm with an average of 169.57 ± 8.81 mm. The gender differences in mean values of male and female are statistically highly significant for mandible.

Bicondylar Breadth

Bicondylar breadth of male varies from 187.98 - 192.26 mm with an average of 190.12 ± 8.07 mm and that of female varies from 177.69 - 183.05 mm with an average of 180.37 ± 8.71 mm. The gender differences in mean values of male and female are statistically highly significant for mandible.

Bimental Breadth

Bimental breadth of male varies from 52.69 - 57.66 mm with an average of 55.17 ± 9.37 mm and that of female varies from 52.57 - 57.72 mm with an average of 55.15 ± 8.37 mm. The gender differences in mean values of male and female are statistically highly significant for mandible.

Height of Ramus

Height of ramus of male varies from 53.51 - 56.10 mm with an average of 54.81 ± 4.86 mm and that of female varies from 47.85 - 50.55 mm with an average of 49.20 ± 4.37 mm. The gender differences in mean values of male and female are statistically highly significant for mandible.

Body Height

Body height of male varies from 31.13 - 32.70 mm with an average of 31.91 ± 2.96 mm and that of female varies from 28.40 - 30.79 mm with an average of 29.59 ± 3.87mm. The gender differences in mean values of male and female are statistically highly significant for mandible.

Discussion

The pelvis is considered to be the best skeletal structure for sexing, followed by parts of the skull such as the cranium, [12, 13, 20] mandible, [14] glabellum, [15] mastoid process [16, 17] and occipital bone. [18, 19] The mandible is the strongest bone of the face and it can withstand mechanical, chemical or physical stress. The maxilla and mandible can be studied at the same time in a single image using the conventional panoramic radiographs. Most dimorphic regions of the mandible were the condyle and ramus, and to a lesser extent the lateral body. [9]Mandible condyles were smaller in females. [10, 11] The present study is an attempt made to analyze the mandibular parameters that gives the most reliable information to differentiate males and females in South Indian population.

In this study, it has been found that Bigonial width of male varies from 175.94 - 181.13 mm with an average of 178.53 ± 9.77 mm and that of female varies from 166.86 - 172.28 mm with an average of 169.57 ± 8.81 mm. Bicondylar breadth of male varies from 187.98 - 192.26 mm with an average of 190.12 ± 8.07 mm and that of female varies from 177.69 - 183.05 mm with an average of 180.37 ± 8.71mm.Bimental breadth of male varies from 52.69 - 57.66 mm with an average of 55.17 ± 9.37 mm and that of female varies from 52.57 - 57.72 mm with an average of 55.15 ± 8.37 mm. Height of ramus of male varies from 53.51 - 56.10 mm with an average of 54.81 ± 4.86 mm and that of female varies from 47.85 - 50.55 mm with an average of 49.20 ± 4.37 mm. Body height of male varies from 31.13 - 32.70 mm with an average of 31.91 ± 2.96 mm and that of female varies from 28.40 - 30.79 mm with an average of 29.59 ± 3.87 mm. The gender differences in mean values of male and female are statistically highly significant for mandible. Hence all the five mandibular parameters show high significance in determination of sex of an individual.

Study done on mandible bone by Anupam Datta et al. showed that the mean for bigonial breadth for male was 8.68 cm and for females was 8.62 cm. The values in the female mandible was lesser compared to that obtained in males. The mean value of the height of ramus of mandible was found to be 67.98 in males and 55.10 in females. The values in the female mandibles was lesser compared to that obtained in males. The mean value of the bicondylar breadth of mandible was found to be 112.72 mm in males and 107.48 mm in females. The mean value of body height was found to be 28.65 mm in males and 22.83 mm in females. Mean value of the bimental breadth was found to be 44.38 mm in males and 42.38 mm in females. All the values in the female mandible was lesser compared to that obtained in males. [1]

According to Rani, et al, The vertical distances from the upper and lower border of the mental foramen to basal bone of mandible from any of the sides can be used as a representative for sexual dimorphism. [2]

According to Sandeepa NC, AtheerAbdulhaeGanem, Wala Abdullah Alqhtani, et al, the Overall prediction rate using all nine variables was 92.75%. When minimum ramus width was removed; accuracy was 92.65%. When combined maximum ramus width, maximum condylar height, maximum coronoid height and height of mandible in premolar region excluding maximum ramus height, accuracy was 92%. Even when 3 parameters were combined accuracy was 91% variable being maximum ramus width, coronoid height and body height in the premolar region. [3]

Study done by Dayal, et al. found that mandibular ramus height is the best parameter with 75.8% accuracy. He studied six mandibular measurements of South African Blacks and noted that average accuracy for sexing varies

from 80 to 85%. Six mandibular measurements showed the highest classification rate of 85.0% with the selection of bigonial width, mandibular ramus height and total mandibular length. [6] Vodanovic*et al.*, found 92.06% accuracy. Length of the mandibular body, mandibular angle and minimum ramus width exhibit the highest degree of sexual dimorphism. [7]

According to Giles, In American white and Negros, that mandibular ramus height, maximum ramus width, and minimum ramus width are noteworthy with an accuracy of 85%. [8]

The mandibular ramus demonstrated greatest univariates sexual dimorphism in terms of minimum ramus breadth, condylar height, followed by projective height of ramus. [21]

Table: 1 Group Statistics

	SEX	N	Mean	Std. Deviation	Std. Error Mean
BIGONIAL WIDTH	MALE	57	178.5365	9.77727	1.29503
	FEMALE	43	169.5765	8.81238	1.34387
BICONDYLAR BREADTH	MALE	57	190.1260	8.07261	1.06924
	FEMALE	43	180.3772	8.71134	1.32847
BIMENTAL BREADTH	MALE	57	55.1795	9.37137	1.24127
	FEMALE	43	55.1523	8.37205	1.27673
HEIGHT OF RAMUS	MALE	57	54.8107	4.86583	.64450
	FEMALE	43	49.2042	4.37555	.66726
BODY HEIGHT	MALE	57	31.9174	2.96616	.39288
	FEMALE	43	29.5974	3.87608	.59110

Table: 2 Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
BIGONIAL WIDTH	Equal variances assumed	.628	.430	4.731	98	.000	8.95998	1.89383	5.20173	12.71823
	Equal variances not assumed			4.801	94.867	.000	8.95998	1.86631	5.25482	12.66514
BICONDYLAR BREADTH	Equal variances assumed	.527	.470	5.778	98	.000	9.74876	1.68708	6.40080	13.09672
	Equal variances not assumed			5.717	86.741	.000	9.74876	1.70532	6.35911	13.13840
BIMENTAL BREADTH	Equal variances assumed	.179	.673	.015	98	.988	.02715	1.80917	-3.56309	3.61738
	Equal variances not assumed			.015	95.159	.988	.02715	1.78067	-3.50785	3.56214
HEIGHT OF RAMUS	Equal variances assumed	3.115	.081	5.954	98	.000	5.60652	.94168	3.73778	7.47525
	Equal variances not assumed			6.043	94.944	.000	5.60652	.92769	3.76480	7.44824
BODY HEIGHT	Equal variances assumed	.196	.659	3.392	98	.001	2.31993	.68398	.96260	3.67725
	Equal variances not assumed			3.269	76.158	.002	2.31993	.70975	.90638	3.73347

Table: 3 Descriptive

		N	Mean	Std. Deviation	Std. Error	95% Confidence interval for Mean Lower Bound	Upper Bound	Minimum	Maximum
BIGONIAL WIDTH	MALE	57	178.5365	9.77727	1.29503	175.9422	181.1307	148.44	196.16
	FEMALE	43	169.5765	8.81238	1.34387	166.8645	172.2886	149.37	192.93
	Total	100	174.6857	10.33902	1.03390	172.6322	176.7392	148.44	196.16
BICONDYLAR BREADTH	MALE	57	190.1260	8.07261	1.06924	187.9840	192.2679	165.75	207.02
	FEMALE	43	180.3772	8.71134	1.32847	177.6963	183.0582	161.97	201.11
	Total	100	185.9340	9.62216	.96222	184.0248	187.8432	161.97	207.02
BIMENTAL BREADTH	MALE	57	55.1795	9.37137	1.24127	52.6929	57.6660	33.23	79.44
	FEMALE	43	55.1523	8.37205	1.27673	52.5758	57.7289	37.46	77.02
	Total	100	55.1678	8.91141	.89114	53.3996	56.9360	33.23	79.44
HEIGHT OF RAMUS	MALE	57	54.8107	4.86583	.64450	53.5196	56.1018	45.71	65.45
	FEMALE	43	49.2042	4.37555	.66726	47.8576	50.5508	43.63	67.76
	Total	100	52.3999	5.41267	.54127	51.3259	53.4739	43.63	67.76
BODY HEIGHT	MALE	57	31.9174	2.96616	.39288	31.1303	32.7044	24.79	36.85
	FEMALE	43	29.5974	3.87608	.59110	28.4046	30.7903	23.57	49.80
	Total	100	30.9198	3.56132	.35613	30.2132	31.6264	23.57	49.80

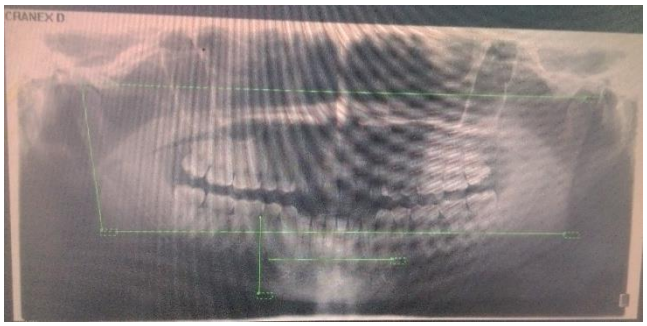

Figure 1: Parameters like bigonial width, height of ramus, bicondylar breadth, body height and bimental breadth.

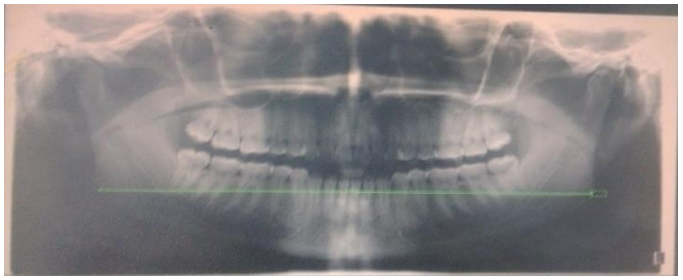

Figure 2: Bigonial width

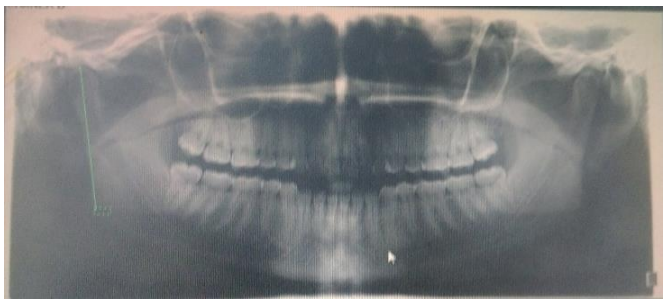

Figure 3: Height of Ramus

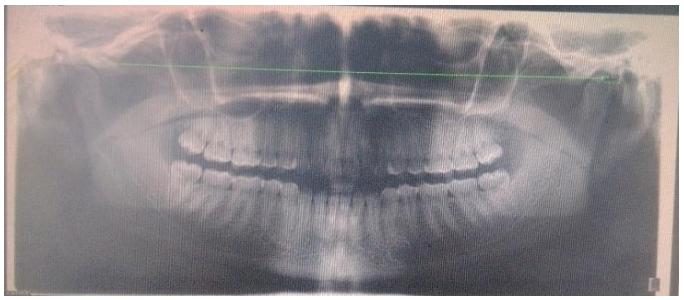

Figure 4: Bicondylar breadth

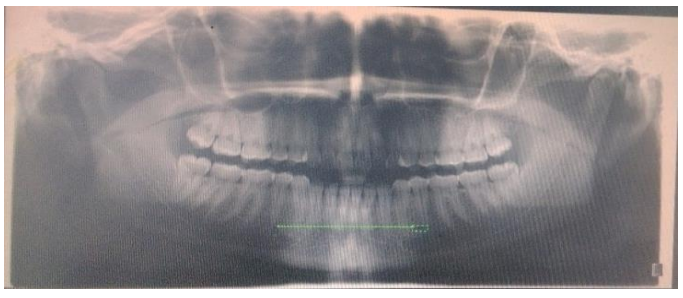

Figure 5: Bimental breadth

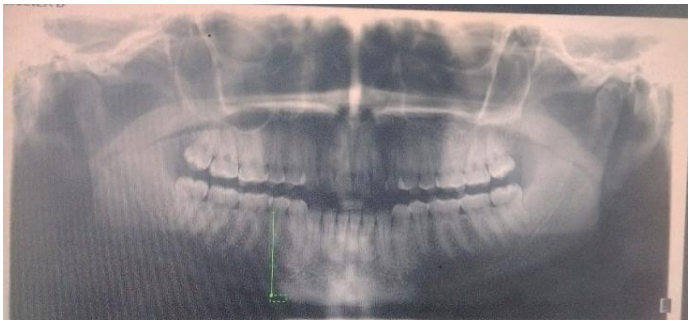

Figure 6: Body height

Conclusion

In this study, using 5 mandibular parameters like bigonial width, height of the ramus, bicondylar width, Bimental breadth and body height, the sex of 100 South Indian population has been determined.Hence by the application of these metrical parameters along with morphological features,the sex of an individual can be determined.Studies involving larger samples may help to correlate gender determination using metric parameters or morphology among South Indian population with higher accuracy.

Reference

1. AnupamDatta, A Study of Sex Determination from Human Mandible Using Various Morphometrical Parameters- Indian Journal of Forensic and Community Medicine, July - September 2015;2(3):158-166
2. Abha Rani, Varsha Kanjani, Deepak Kanjani, Rajeshwari G. AnnigeriMorphometric assessment of mental foramen for gender prediction using panoramic radiographs in the West Bengal population – A retrospective digital study.*Journal of Advanced Clinical & Research Insights* (2019), 6, 63–66
3. Sandeepa NC, Atheer Abdulhade Ganem,Wala Abdullah Alqhtani Mandibular Indices for Gender Prediction: A Retrospective Radiographic Study in Saudi Population - Journal of Dental and Oral Health Volume 3 • Issue 9 • 095 www.scientonline.org J Dent Oral Health,November 2017.
4. Pillai Devu Radhakrishnan, Nilambur Kovilakam Sapna Varma, VallikatVelath AjithDilemma of gonial angle measurement: Panoramic radiograph or lateral cephalogram. Imaging Science in Dentistry 2017; 47: 93-7 https://doi.org/10.5624/isd.2017.47.2.93
5. Tejavathi Nagaraj, Bhavana T. Veerabasvaiah, Use of non-metric characteristics of mandible in sex determination - *Journal of Medicine, Radiology, Pathology* &*Surgery* (2016), 2, 1–4
6. Dayal MR, Spocter MA, Bidmos MA. An assessment of sex using the skull of black South Africans by discriminant function analysis. *Homo.* 2008;59 (3):209-221.
7. Vodanovic M, Dumancic J, Demo Z, Mihelic D. Determination of sex by discriminant function analysis of mandibles from two Croatian archeological sites. *Acta Stomatol Croat.* 2006;40(3):263-277.
8. Giles E. Sex determination by discriminant function analysis of the mandible. *Am J Phys Anthropol.* 1964; 22:129-135.
9. J.D. Raj & S. Ramesh– Sexual Dimorphism in Mandibular Ramus of South Indian Population,December 2013.
10. Tedeshi. Radiological examination sex determination of skull. Forensic medicine Journal 1977; 2:1119-23.
11. M. Punarjeevan Kumar, S. Lokanadham Sex determination & morphometric parameters of human mandible, International Journal of Research in Medical Sciences Kumar MP et al. Int J Res Med Sci. 2013 May;1(2):93-96
12. Gapert R, Black S, Last J. Sex determination from the foramen magnum: discriminant function analysis in an

eighteenth and nineteenth century British sample. Int J Legal Med 2009; 123:25-33.

13. Kranioti EF, Iscan MY, Michalodimitrakis M. Craniometric analysis of modern Cretan population. Forensic Sci Int 2008; 180:110.
14. Franklin D, O'Higgins P, Oxnard CE, Dadour I. Discriminant function sexing of the mandible of indigenous South Africans. Forensic Sci Int 2008; 179:84.
15. Celbis O, Iscan MY, Soysal Z, Cagdir S. Sexual diagnosis of the glabellar region. Legal Med (Tokyo) 2001;3:162-70.
16. Kemkes A, Gobel T. Metric assessment of the ''mastoid triangle'' for sex determination: a validation study. J Forensic Sci 2006; 51:985-9.
17. Suazo GIC, Zavando MDA, Smith RL. Sex determination using mastoid process measurements in Brazilian skulls. Int J Morphol 2008; 26:941-4.
18. Wescott DJ, Moore-Jansen PH. Metric variation in the human occipital bone: forensic anthropological applications. J Forensic Sci 2001; 46:1159-63.
19. Gulekon IN, Turgut HB. The external occipital protuberance: can it be used as a criterion in the determination of sex? J Forensic Sci 2003; 48:513-6.
20. Hema Nidugala Sexual dimorphism of the craniofacial region in a South Indian population Singapore Med J 2013; 54(8): 458-462.
21. Indira, *et al*.: Mandibular ramus: An indicator for sex determination – A digital radiographic study Journal of Forensic Dental Sciences / July-December 2012 / Vol 4 / Issue 2