Original Research Paper

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AGE & GENDER DETERMINATION THROUGH DISTANCE BETWEEN BILATERAL CRANIOMANDIBULAR STRUCTURES USING CONE BEAM COMPUTED TOMOGRAPHY– A RETROSPECTIVE FORENSIC STUDY.

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ABSTRACT **BACKGROUND:** Skull plays important role in forensic for identification of gender and age of victim. Inter-distance of various prominent bilateral craniomandibular structures like zygoma, orbit, mastoid, mandibular condyle, and coronoid process varies among age and gender. Cone beam computed tomography gives accurate measurement of these parameters compared to two dimensional radiographs. **AIM:** To evaluate age and gender using inter-distance of bilateral craniomandibular structures using CBCT and to correlate all the parameters to find which is more accurate in determining age and gender. METHOD: 100 CBCT images of patients between age of 10-60 years were divided in to 5 groups (Group I- Group V) with 20 images in each group with equal gender distribution. Images were assessed with Planmeca Romexis software to evaluate various parameters such as interorbital distance, bizygomatic width, inter mastoid distance, intercondylar distance and inter coronoid distance. The obtained results will be statistically analysed using SPSS software. **Result:** For gender determination, there was highly significant difference ($p<0.0005$) seen in all the five parameters. With respect to age groups, bizygomatic, intercondylar and intercoronoid distance showed highly significant ($p<0.01$) **Conclusion:** All five parameters are highly significant land marks for gender determination. Craniofacial growth by age can be seen in bizygomatic width and intercondylar and intercoronoid distance.

KEYWORDS : forensic odontology, craniomandibular, mandibular condyle, zygomatic bone, mastoid, Cone Beam Computed Tomography

INTRODUCTION

The osteometric studies in forensic helps in establishing the process of evolution, race and demographic profile. [1] Sex can be determined by various bones, especially pelvis and skull (92% accuracy) [2,3] The craniomandibular structures have the advantage of being composed largely of hard tissue, which is relatively indestructible like zygoma, mastoid, orbit and mandible. The bilateral structures in craniofacial region, are source of value for anthropology for tracing population origins, gaining insight into craniofacial growth due to racial and sexual differences, quantifying intraspecific variations and forensic osteology.[4] Cone-beam computed tomography (CBCT) with its 3D technology provides us with an accurate evaluation of the osseous structures in the maxillofacial region with less radiation compared has gained popularity in recent times in forensic odontology. [5] Aim and objective of this study is to determine interorbital distance, bizygomatic width, intermastoid distance , intercoronoid distance and intercondylar distance using CBCT and correlation of above parameters in age and gender determination.

MATERIALS AND METHOD:

A retrospective analysis was performed in 100 CBCT images of patients between 20 and 65 years were acquired from the dental archives of the Department of Oral Medicine and Radiology of Meenakshi Ammal Dental College. This included full skull images of 50 males and 50 females which was taken for various purposes. images with fracture, artifacts or developmental anomaly of orbit, zygoma, mastoid, mandible region were eliminated. The ages were further divided into five groups (Group I–Group V). Each group contains 20 images with equal number of male and female. The images were recorded using PLANMECA PROMAX 3D MID PROFACE CBCT machine in DICOM format and analyzed using Romexis software. Images were standardized and measurement were done as following.

I. INTER ORBITAL DISTANCE

In coronal section tilt the image, vertical line passes through nasal septum and at the lower end of frontal sinus, distance between two medial walls of orbit is measured. [Figure 1]

ii. INTERMASTOID DISTANCE

In coronal section, vertical line passes through middle of foramen magnum and at the maximum lower end of mastoid sinus, intermastoid distance is measured. [Figure 2]

iii. BI ZYGOMATIC WIDTH

In axial section, vertical line passes through nasal septum, Zygomatic protuberances confirmed in axial and sagittal section and distance between two zygoma are measured in axial section[Figure 3]

iv. INTER CORONOID DISTANCE

In **axial section**, at first appearance of bilateral coronoid process is identified and distance between both coronoid process measured. [Figure 4]

v. INTER CONDYLAR DISTANCE

In axial section, at the maximum mediolateral dimension of condyle, distance between most lateral points measured Intercondylar distance. [Figure 5]

Fig 1: Inter orbital distance

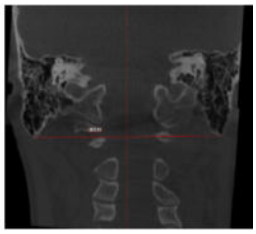

Fig 2: Inter mastoid distance

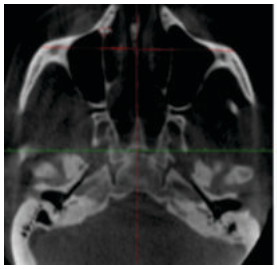

Fig 3: Bizygomatic width

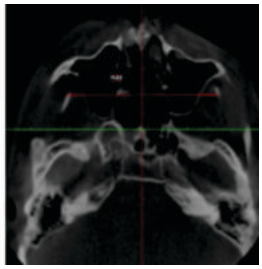

Fig 4: Intercoronoid distance

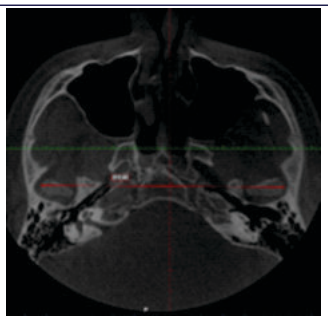

Fig 5: Intercondylar distance

RESULTS

The collected data were analysed with IBM SPSS Statistics for Windows, Version 23.0. (Armonk, NY: IBM Corp). Mean age included in our study was 34.97 years. The mean and standard deviation of the five parameters interorbital distance, bizygomatic width, inter mastoid distance, intercondylar distance and inter coronoid distance values (in mm) are 23.35±1.90, 94.37±6.83, 104.39±4.55, 112.34±6.06, 92.57±4.77 in males and 21.34±1.76, 87.58±4.23, 99.05±3.54, 107.20±5.03, 87.79±4.19 in females respectively. Unpaired sample T test showing all the five variables were statistically significant p<0.01 with respect to gender determination given in Table 1. The changes of the variables with respect to age groups [Group I to Group V] were analysed using one-way Anova test which showed highly significance of p<0.01 for bizygomatic, intercoronoid and intercondylar distance given in Table 2.

Table 1: Unpaired sample T test showed all the five variables were statistically significant p<0.01 in gender determination

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	p-value	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Inter orbital distance (mm)	Equal variances assumed	.102	.750	5.470	98	.0005	2.00300	.36618	1.27633	2.72967
Bi-zygomatic width(mm)	Equal variances not assumed	7.934	.006	5.979	82	.0005	6.79080	1.13578	4.53130	9.05030
Inter-Mastoid distance (mm)	Equal variances not assumed	4.233	.042	6.558	92	.0005	5.34320	.81480	3.72504	6.96136
Inter-condylar distance (mm)	Equal variances assumed	1.341	.250	4.620	98	.0005	5.14700	1.11395	2.93640	7.35760
Inter-coronoid distance (mm)	Equal variances assumed	.129	.720	5.324	98	.0005	4.78320	.89845	3.00026	6.56614

Table 2: one way ANOVA test for significance of different parameters within age groups

ANOVA						
		Sum of Squares	df	Mean Square	F	p-value
Inter orbital distance (mm)	Between Groups	22.463	4	5.616	1.313	.271
Bi-zygomatic width(mm)	Between Groups	702.250	4	175.562	4.619	.002
Inter-Mastoid distance (mm)	Between Groups	86.021	4	21.505	.906	.464
Inter-condylar distance (mm)	Between Groups	1038.430	4	259.608	9.258	.0005
Inter-coronoid distance (mm)	Between Groups	355.506	4	88.876	3.848	.006

P value <0.01- highly significant

DISCUSSION:

Many studies have been conducted in two and three dimensional radiographs with respect to orbital aperture for personal and gender determination in forensic odontology. Our study also proved that interorbital distance higher in males and was significant P<0.01. which was in accordance other radiographic studies like Kanjani et al [6], and Mahalaksmi et al[7], but it was not in accordance Patra et al [8] where no significant gender determination was possible.

Our study showed intermastoid distance had significance in gender determination which was in accordance to CBCT studies by Manivannan et al [9] and Gopal et al [10]. Mastoid develops at age of 1 and completes its formation by age of 2 years hence there was no significant difference in age.

The bizygomatic width is an important measurement in craniometry and in forensic facial reconstruction for determining facial width. In our study bizygomatic width was highly significant with gender (p=0.005) similar to CBCT study by Hemanthkumar et al[11] . This parameter was also significant (p<0.01) with age group and it was in accordance to Cleidy Arboleda et al[12] study of craniofacial growth in Columbian population.

Intercondylar distance had high significance with respect to male and female gender in our study. This was in accordance Sikka et al [13] and Sindhuja et al [14] studies but contrary to M. Shahabi et al study [15] Meanwhile it also increase with age in our study which was in accordance to CBCT study by Gopal et al in 2021[16].

Intercoronoid distance in our study showed that it can be effectively used in best gender determination accordance to dry skull studies by Kadam et al[17] and Supraja et al[18].We also observed that this parameter increases with age which was in accordance to study done by Sindhuja et al[14]. Strength of our study includes, this is one of the first kind of study taking only bilateral land marks in craniofacial region. It gives overall idea of maximum diameter of craniofacial development.

CONCLUSION:

For many years, Anthropometric of craniofacial region has been caried out in dry skull, human subjects but the intervention of digital technology and CBCT helps us to get more accurate measurements maintain and preserve the patient data for future references. Outcome of this study shows the distance between bilateral structures can be used as land mark for gender determination. Craniofacial growth by age can be seen in bizygomatic width and intercondylar and intercoronoid distance.

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