CONDYLAR HEIGHT: AGE AND SEX DETERMINATION USING ORTHOPANTOGRAM IN FORENSICS

ABSTRACT

Background:

Since time immemorial, Condyles has been the area of interest for anthropologists, and the condyle size in men is higher than that of women. The condyle measurement is usually studied in two planes, i.e. anteroposterior and mediolateral, which are more gender-alliant. Different conventional X-rays are used for condylar imaging whose panoramic views of both condyles are provided by the OPG. For the creation of biological profiles during mass disasters the skull has remained useful. However, the technical procedures must in most cases be based on fragmented skull bones, when the whole skull is not available.

Materials and methods:

The study samples were retrieved from DIAS of Saveetha Dental College and Hospitals between the retrospective months from November 2020 to February 2021. The study sample consisted of 300 OPG's (150 males and 150 females), which were taken using Genoray Papaya machine, of age ranging from 10 to 24.9 years in which mandibular condylar height was measured using PlanmecaRomexis Software.

Results :

The standard deviation for evaluation of condylar height for female is ±4.38 while for males it is ±4.91.The standard error mean for condylar height for females is 0.35808 and for males is 0.40136 with non-significant p value of 0.893

Conclusion:

By analysing the condylar mandibular height, the results of this study could improve human identification.For validation and comparison purposes, further research may be required in order to expand other associated parameters into a broader sample size.

Keywords :condylar height; forensics; age estimation; sex estimation; orthopantogram

INTRODUCTION

The mandibular condyle is a major growth site for the mandible and plays a vital role in its development. Endochondral ossification, or the sequential formation and degradation of the formed cartilaginous blastema serving as templates for bone formation, is just how the mandibular condyle develops. Appositional growth occurs when the perichondrium's chondrogenic cells emerge, proliferate, synthesise, and lay down new cartilage at the structure's edges. Whether condyles develop by apposition or by appositional combined with interstitial mechanisms is a point of contention. This is vital for bearing the compressive stress that the condyle receives during mandibular movement and development[(1)(2)].

For the creation of biological profiles during mass disasters the skull has remained useful. However, the technical procedures must in most cases be based on fragmented skull bones, when the whole skull is not available. In these cases, the largest and most dimorphic part of the skull, the mandible plays an important role in determining the genitality of the individual remains. Age and gender assessment are one of medical law officers' important duties recently when crimes of a diverse nature are on the rise. In particular, mandibular condyle, ramus or angles are most sexually dimorphic, since they are locations associated with the largest dimorphous morphological channel in general[(3)(4)].

The occlusal status and age of participants are considered to have anatomic changes in the mandible in adults. With age, the mandibular bone undergoes remodelling. Routine radiographs of the jaws are widely used panoramic radiographs. Since the mandible is asymmetrical, the condylar and ramus processes can be used to calculate vertical differences on both sides because they have a bilateral view and are suitable for vertical mandible measurements. Because of the nonlinear variance, various depths can be calculated without fear of the horizontal measurements becoming invalid[(5)(6)]. The aim of the present study is to formulate new regression formula to determine age and sex in South Indian Population.

MATERIALS AND METHODS

The study samples were retrieved from DIAS of Saveetha Dental College and Hospitals between the retrospective months from November 2020 to February 2021.The study sample consisting of 300 OPG's (150 males and 150 females) of age ranging from 10 to 24.9 years are tabulated in Table 1. The OPGs were taken using the Genoray Papaya machine.

Inclusion Criteria includes OPGs of patients within age group 10-24.9 while Exclusion Criteria includes OPGs of patients less than 10 years and above 24 years. Measurement of mandibular condylar height

from OPGs were done using PlanmecaRomexis Software**.** ConH (Condylar Height) was measured for all age groups(Figure 1 and figure 2).Statistical analysis was done using SPSS and regression formula was derived.

Table 1: Sample distribution among the various age groups

GROUPS	AGE(years)	MALE	FEMALE
1	10 to 10.9	10	10
2	11 to 11.9	10	10
3	12 to 12.9	10	10
4	13 to 13.9	10	10
5	14 to 14.9	10	10
6	15 to 15.9	10	10
7	16 to 16.9	10	10
8	17 to 17.9	10	10
9	18 to 18.9	10	10
10	19 to 19.9	10	10
11	20 to 20.9	10	10
12	21 to 21.9	10	10
13	22 to 22.9	10	10
14	23 to 23.9	10	10
15	24 to 24.9	10	10
TOTAL		150	150

RESULTS

Table 2 :Since p values are greater than 0.05 (P>.0.05) there is no significant difference between Age as well as Condylar Height

	Gender	N	Mean	Std. Deviation	Std. Error Mean	t-test/p value
Age	Females	150	17.1924	4.22154	.34469	0.984
	Males	150	17.1828	4.22879	.34528	
Condylar height	Females	150	29.3553	4.38559	.35808	0.893
	Males	150	29.4280	4.91560	.40136	

***Regression formula for identification of an unknown individual**

Females =16.237+0.033 × CH; SD ±4.38 years

Males=17.097+ 0.03 × CH:SD ±4.91 years

Figure 1 :OPG for condylar height measurement of female

Figure 2 : OPG for condylar height measurement of male

DISCUSSION

During endochondral ossification of long bones, several differentiation factors, growth factors and angiogenic mediators played a key role. Similarly, the growth of condyles must be regulated by a host of orchestrated influences of different growth factors and other endogenous regulatory factors in condyles[7][8][9][10]

The present study revealed that the mean of condylar height measurement was slightly higher in males compared to females. The standard deviation for evaluation of condylar height for female is ±4.38 while for males it is ±4.91.The standard error mean for condylar height for females is 0.35808 and for males is 0.40136 with non-significant p value of 0.893(Table 2).The standard error mean for age for females is 0.34469 and for males is 0.34528 with non-significant P value of 0.984(Table 2).The insignificance in the statistical analysis could be due to the limited number of sample size in each age groups.

Population-specific standards need always to be developed for precise gender determination based on ethnicity. In many studies for various populations worldwide measurement standards were therefore developed. Skeletal remains have differential characteristics from one population to another because osteometric standards have been developed for the determination of gender[11][12][13]. Hence, in the present study Indian specific regression formula was formulated to calculate the age of an individual which will be of ease in identifying/estimating age of an unknown individual, which is most important in forensic dentistry.

Since time immemorial, Condyles has been the area of interest for anthropologists, and the condyle size in men is higher than that of women. The condyle measurement is usually studied in two planes, i.e. anteroposterior and mediolateral, which are more gender-alliant. Different conventional X-rays are used for condylar imaging whose panoramic views of both condyles are provided by the OPG. The mandibular condyle is a growing centre, and has a different morphology as a functional joint unit. The age, gender, face type, functional load, occlusal forces, malocclusion type between the right and left sides occur as a normal variation in the morphology of the condylars[14][15][16]

Rajkumari et al.(2019), states that the Condylar height, projected mandible height and coronoid height increase with age, and a slight reduction in the values occurs in the sixth decade.

Several studies have been performed by many researchers, specifically vertical, horizontal and angle measures for the applicability of mandibular metric analysis in forensic odontology. The minimum ramus width and Condylar height, which were significantly lower in sexual prediction that contradicted few other studies with the greatest sexual dimorphism of the minimum ramus breadth and Condylar height[17][18][19]

CONCLUSION

In conclusion , the mandible may be present in numerous morphological forms and measures. Different socio-demographic factors that could contribute to its final appearance may influence those factors. By analysing the condylar mandibular height, the results of this study could improve human identification. For validation and comparison purposes, further research may be required in order to expand other associated parameters into a broader sample size.

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