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Study of Various Osteometric Parameters of Human Mandible in Adult and Elderly Age Groups

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Abstract

The cardinal points of identity establishment can be met out with the help of mandibular anthropometry, when the bone is available for examination. A number of metric and non- metric parameters help in estimating the age from the mandible; which accurately differentiates various stages of life cycle

The main aim of this study is to study the various osteometric parameters of human mandible in adult and elderly age groups; and to determine their significance and utility for the purpose of identification in forensic sample.

For the purpose, 200 mandibles were measured anthropometrically. The data was collected in master chart and statistically analysed.

Height of the mandibular body, thickness of the mandibular body and maximum ramus height were found to be statistically significant parameters. Hence, these parameters could be used for allocation of a mandible to adult or elderly age group. It is also recommended to include other morphometric parameters of mandibles in the study to increase the accuracy and precision.

Key words: *osteometric, statistically significant, maximum ramus height*

Introduction

Estimation of age is extremely important in the identification of human remains. Chronological age assessment is an important part of medico- legal practice. The procedures for age estimation are complex and require the consideration of many factors. Bones undergo a series of changes from pre- natal to post- natal life; and changes in their composition and structure continue into old age and even after death. Hence, these form a reliable source of information regarding growth and growth changes. Mandible is the largest and strongest bone of the face. Presence of a dense layer of compact bone makes it very durable and hence, remains well preserved than many other bones. In this study, age at the time of death was considered for study on mandible.

Mandibular dentition can help in estimating the age of an individual depending upon the eruption of mandibular teeth. This coupled with various subjective and morpho- metric parameters, help in arriving at the closest and accurate age range of the available forensic sample. A number of metric and non- metric parameters help in estimating the age from the mandible; which accurately differentiates various stages of life cycle

The main aim of this study is to study the various osteometric parameters of human mandible in adult and elderly age groups; and to determine their significance

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and utility for the purpose of identification in forensic sample.

Material and Method

This prospective study was carried out on 200 mandible specimens in the Department of Forensic Medicine and Toxicology, Gandhi Medical College Bhopal. All the pathological, deformed and fractured mandibles were excluded from the study.

The criteria to decide the age of group of mandible were:

1. Dental examination and number of sockets present on the alveolar margin as it is known that age of eruption of third molar is 17 – 25 years.

2. Body – It is thick and elongated in adults and shallow and big in elderly.

3. Ramus – stunted and acute angled in adult and long and oblique in elderly.

4. Condyloid process- open midway between the upper and lower border of body in adult and in elderly placed at near/ upper border of body.

5. Mental foramen – present midway between alveolar margin and inferior border of corpus of the body in adult and present near alveolar margin in elderly.

Mandibles were allocated to adult and elderly age group by forensic medicine experts and forensic anthropologists of the institute.

Osteometric parameters measured were as follows:

1. Height of the mandibular body was the direct distance from the alveolar process between 1st and 2nd molar to the inferior border of the mandible perpendicular to the base; measured with the help of sliding caliper.

2. Thickness of the mandibular body was measured at the level of 2nd molar perpemdicular to the vertical axis of the body, using sliding caliper.

3. Maximum ramus height was measured between ^condylion superior and *gonion by Sliding caliper/ mandibulometer.

4. Length of the mandibular body was the distance between #gnathion and gonion, measured using mandibulometer,

Landmarks

^Condylion superior-The most superior point of the mandibular angle.

***Gonion-**The most lateral and external point at the junction of the horizontal end of rami of the lower jaw.

#Gnathion-The middle point of the lower border of the mandible in the sagittal plane**.**

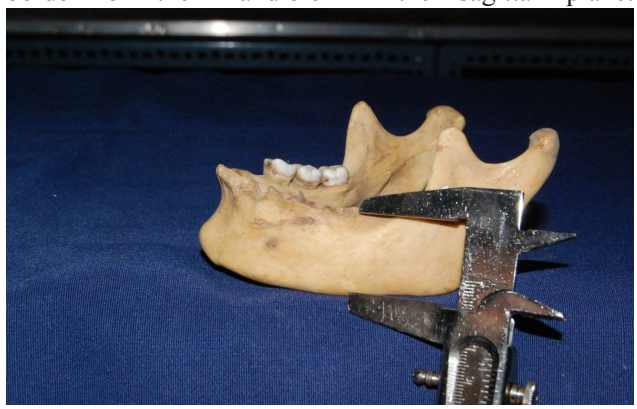

Fig-I: Measurement of height of mandibular body using sliding caliper

The data was collected in pre designed proforma and statistically analyzed using t test to find out the level of significance.

Findings

On statistical analysis, the results obtained were as follows:

I.HEIGHT OF THE MANDIBULAR BODY:

Table – 1 Depicts mean and standard deviation of height of the mandibular body in male mandibles on both right and left side

Male			
Right		**Left**	
Adult	**Elderly**	**Adult**	**Elderly**
*90	*40	*90	*40
#29.9964	#24.9277	#29.9662	#24.9277
^4.07456	^3.1980	^4.07341	^3.16610

P<0.001

Table-2 Depicts mean and standard deviation of height of the mandibular body in female mandibles on both right and left side

Female			
Right		**Left**	
Adult	**Elderly**	**Adult**	**Elderly**
*52	*18	*52	*18
#30.9096	#21.7656	#30.9100	#21.7667
^3.41612	^2.61973	^3.41510	^2.62007

P<0.01

Corici et al (2009)[3] in his study carried out on 80 mandibles, also found this parameter to be significant.

Also, in a study conducted on OPGs of 113 edentulous patients aged 55-76 years, by Balwant Rai[2] in the year 2007, when the means +_ SDs are compared for each age groups in male and female subjects, the difference is not found to be significant.

II. THICKNESS OF THE MANDIBULAR BODY:

Table-3 depicts mean and standard deviation of thickness of the mandibular body in male mandibles on both right and left side

Male			
Right		**Left**	
Adult	**Elderly**	**Adult**	**Elderly**
*90	*40	*90	*40
#25.8613	#20.2702	#25.8617	#20.2697
^4.8944	^3.2912	^4.8939	^3.2915

P<0.001

Table-4 depicts mean and standard deviation of thickness of the mandibular body in female mandibles on both right and left side

Female			
Right		**Left**	
Adult	**Elderly**	**Adult**	**Elderly**
*52	*18	*52	*18
#24.7462	#15.6033	#24.7463	#15.6033
^1.6973	^1.0915	^1.0915	^1.0909

P<0.001

This parameter was not very widely studied by the past investigators

III. Maximum Ramus Height:

Table-5 Depicts mean and standard deviation of maximum ramus height in male mandibles on both right and left side

Male			
Right		**Left**	
Adult	**Elderly**	**Adult**	**Elderly**
*90	*40	*90	*40
#65.6632	#60.9537	#65.6644	#60.9545
^5.3636	^6.5116	^5.3645	^6.5123

P<0.001

Table-6 Depicts mean and standard deviation of maximum ramus height in female mandibles on both right and left side

Female			
Right		**Left**	
Adult	**Elderly**	**Adult**	**Elderly**
*52	*18	*52	*18
#67.7635	#64.6039	#67.7646	#64.6056
^3.8160	^8.5498	^3.8160	^8.5494

P<0.05

NOTE- Index for tables 1-6

*n= no of specimens

#M= mean

^ SD= standard deviation

Ionescu et al[5] in his study in the year 2007 also described maximum ramus height as statistically significant. Dayal et al 2008[4] found mandibular ramus height to be best parameter with an accuracy of 75.8 %. Similarly, Badiu et al (2010)[1] in their study found this parameter to be statistically significant (p< 0.05) . Saini et al[8] in their study in the year 2011 on mandibular ramus flexure also found this parameter to have probability level of p< 0.001 and thus statistically significant.

IV. Length of the Mandibular Body

For this parameter, the mean +_ standard deviation for male on right side is 92.4818 +_5.6516 in adults & 92.2720 +_3.6925 in elderly and ; on left side, 91.4936+_ 5.4349 and 92.2738+_ 3.6928 for adult and elderly age group respectively; *P=0.59* which is statistically insignificant. For females, on right side, the mean is 90.1219 with a standard deviation of 4.5758 for adult & for elderly it is 91.0450 with a SD of 3.6896 ; on left side, the mean and standard deviation are 90.1238and 4.5763 respectively for adult & for elderly, the mean is 90.6022 with a SD of 3.2550; *P=0.85* making it statistically insignificant.

Comparison of means and standard deviations of elderly and adult samples is found to be statistically significant in case of height of the mandibular body, thickness of the mandibular body and maximum ramus height..Mandibular length was found to be statistically insignificant in this study.

Conclusion

In the study conducted on 142 adult and 58 elderly

mandible specimens, the level of significance was found to be high, in case of height of the mandibular body, thickness of the mandibular body and maximum ramus height. Hence, these parameters can be used for allocation of a mandible to adult or elderly age group.

Similar finding was obtained by Mohite et al[6]in their study in the year 2011. They stated that, "A reduction in the height of the body of the mandible was observed with increase in age." and 'The width of cortex at the mental region (MI) and antegonial region (AI) shows a decrease in values with increasing age'; also, an increase in the size of the gonial angle was observed in this study.

Rai et al (2008)[7]in his study on 120 lateral cephalograms found the maximum ramus height to be a significant parameter ($p< 0.05$) for this purpose.

It is recommended to evaluate the utility of other morphometric parameters of mandibles for the purpose of age estimation to increase the accuracy and precision.

Conflict of Interest – Nil

Source of Funding- self with assistance from institute.

Ethical Clearance – The study protocol was approved by Institutional Ethics Committee of Gandhi Medical College, Bhopal.

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