ORIGINAL ARTICLE

Age Estimation by Position of Mental Foramen in Haryana Population: A Radiographic Study

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ABSTRACT:

Age determination of unknown human skeletal remains has played a very significant role in the field of anthropology. Present study is aimed to determine age on the basis of change in vertical position of mental foramen (MF) by using panoramic radiographs of 100 individuals in Haryana population. Study sample was divided into five age groups as Group I, Group II, Group III, Group IV and Group V showing age 11-20, 21-30, 31-40, 41-50 and 51-60 years respectively. Three measurements were made on the mental foramen of left side only by using tracing paper and HB pencil. Collected data was analyzed statistically. One way ANOVA and Post hoc Tukey tests were used for analysis. Statistically significant results were noticed in different age groups (p <0.05).

Key words: Age estimation, Panoramic radiographs, Mental foramen, Forensic anthropology, Haryana population etc.

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INTRODUCTION

In the field of forensic anthropology and forensic dentistry, age determination of badly decomposed and unknown skeletal remains plays a very crucial role for purpose of identification. Age can be determined by many parts of the skeleton. Mandible is one of them. Mandible forms the lower jaw and holds the lower teeth in place.[1,2] Stronger structure and durable nature of this bone make it suitable tool for age estimation. Mandible persists in a well-preserved state longer than any other bone due to presence of a dense layer of compact bone.[3,4] Therefore, forensic anthropologists and forensic dentists most commonly uses morphological features of the mandible for age determination. There are many parameters of mandible that can be used for age determination of unknown skeleton. One of the mandibular feature that can prove very helpful for age determination is mental foramen.

It is suited on the body of mandible laterally to the mental prominence. It is usually present below the root of the lower first and second premolars. In new born, it is present near the lower border of body of mandible whereas in adults it migrates in the mid way between the superior and lower border mandible and in old age it moves towards the superior border of body of mandible.[5] Mental foramen can be easily depicted in a panoramic radiographs of living being as shown in Fig 2.

Figure 1: Mandible showing mental foramen (red arrow)

Figure 2: Radiographic view of mental foramen (Black arrow)

AIMS AND OBJECTIVES

The objectives are as follows:-

- To measure the distance between superior border of body of mandible and inferior border of the body of mandible.
- To measure the distance between superior border of body of mandible and the superior margin of mental foramen.

To measure the distance between the inferior margin of the mental foramen and the lower border of body of mandible.

- To assess the sensitivity of these parameters for the purpose of age determination.

METHODOLOGY

Samples

100 panoramic radiographs were collected from the Department of Oral Diagnosis, Medicine and Radiology of PDM Dental College and private dental clinics of Haryana after clinical examination of the subjects. Single panoramic radiographic machine (PaX-I Vatech global, Korea) was used for taking radiographs. Written consent was taken from each individual who participated in this study. In this study only one (left side) mental foramen was evaluated. The age of the persons included in the study ranged from 11 to 60 years. The study samples were divided into 5 age groups as Group I, Group II, Group III, Group IV and Group V showing age 11-20, 21-30, 41-50 and 51-60 years respectively. Each age group consist of 20 samples.

A) Exposing the panoramic films

Panoramic machine VATECH PaX-i 2D with provision for automatic exposure was used for exposing the films due to its high resolution property. Kodak green sensitive films with cassette and Kodak lanex intensifying screen were used. The Kodak cassette with Kodak lanex screen was loaded with green sensitive Kodak film in dark room as per the guidelines of the manufacturer.

Figure 3: Panoramic Machine VATECH PaX-i 2D imaging system, VATECH Global, Korea

B) Processing of films

All films were processed in the automatic x-ray pprocessor immediately after the exposure.

C) Interpretation of the panoramic radiographs

Interpretation of panoramic radiograph was done in the dark room using radiographic view box. Measurements were made on the tracing paper with 0.5 mm HB lead pencil and measured with stainless steel ruler. Left side of the radiographs were used for performing all the measurements. All measurements were expressed in millimeters (mm).Three measurements were made:-

1) From superior border of body of mandible to the inferior border of body of mandible (shown by red line in fig 4)

2) From superior border of body of mandible to the superior border of mental foramen (shown by green line in fig 4).

3) From inferior border of mental foramen to the inferior border of body of mandible as (shown by yellow line in fig 4).
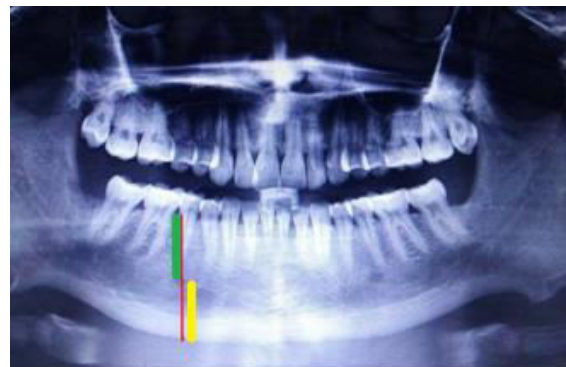

Figure 4: Showing all the three parameters including in this study

RESULTS

The data obtained after measurements was subjected to statistical analysis. In the present study, for the analysis of data ANOVA (Analysis of Variance) and post hoc tukey tests were used. ANOVA was used to compare variables between different groups and post hoc test was used to confirm the differences that occurred between groups and for pairwise comparison. Post-hoc tests also control the experiments wise error rate.

Table 1 shows the comparison of vertical distance between superior border of body of mandible and inferior border of body of mandible in different age groups. . Age group of 21-30 years was found to be having the highest mean value among all the age groups i.e 40.7±3.3. However participants of age group of 11-20 years showed the lowest mean value of 37.0±2.5

.**Table 2** describes the comparison of vertical distance between superior border of body of mandible and inferior border of body of mandible in different age groups. On the basis of Post-hoc Tukey test, age group of 11-20 years can be significantly distinguished from all the rest age groups as all other age groups showed a comparatively higher value as compared to this age group.

Table 3: Very highly significant differences were observed while comparing the vertical distance between

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superior border of body of mandible and superior border of mental foramen in different age groups. Age group 21-30 was found to be having a highest mean value for this measurement i.e. 21.7±2.3. However 41-50 years age group subjects were reported with mean value of 17.9±2.5.

Table 4 shows comparison of distance between superior border of body of mandible and superior border of mental foramen. Significant differences were observed especially in 21-30 years age group and 31-40 years age group.

Table 5 shows the comparison of vertical distance between inferior border of mental foramen and inferior border of body of mandible in different age groups on basis of One Way ANOVA. In 51-60 years age group mean value was 15.80±1.51which is the highest one among all age groups.

Table 6 shows the comparison of vertical distance between inferior border of mental foramen and inferior border of body of mandible in different age groups on basis of Post-hoc Tukey test. No significant results were observed while considering this parameter.

Table 1 Comparison of vertical distance between superior border of body of mandible and inferior border of mandible in different age groups included in the study on the basis of One way ANOVA test

Age groups	Mean	Std. Deviation	F-value	P-value
Group I	37.05	2.50		
Group II	40.70	3.29		
Group III	40.55	2.93	5.767	0.000***
Group IV	39.75	3.18		
Group V	39.85	1.39		
One-way ANOVA test				
*** Very Highly Significant difference (p-value≤0.001)				

Table 2: Comparison of vertical distance between superior border of body of mandible and inferior border of mandible in different age groups included in the study on the basis in different age groups on the basis of Post-hoc Tukey test

(I) Age groups	(J) Age groups	Mean Difference (I-J)	p-value
Group I	21-30 years	-3.650	0.001***
	31-40 years	-3.500	0.001***
	41-50 years	-2.700	0.020*
	51-60 years	-2.800	0.015*
Group II	31-40 years	0.150	1.000#
	41-50 years	0.950	0.809#
	51-60 years	0.850	0.864#
Group III	41-50 years	0.800	0.888#
	51-60 years	0.700	0.928#
Group V	51-60 years	-0.100	1.000#
Post-hoc Tukey test *** Very Highly Significant difference (p-value≤0.001) * Significant difference (p-value≤0.05) # Non-Significant difference (p-value>0.05)			

Table 3: Comparison of vertical distance between superior border of body of mandible and superior border of mental foramen in different age groups on the basis of One-way ANOVA test

Age groups	Mean	Std. Deviation	F-value	P-value
Group I	18.60	2.01		
Group II	21.75	2.34		
Group III	20.65	2.35	10.672	0.000***
Group IV	17.90	2.55		
Group V	18.40	2.04		
One-way ANOVA test				
*** Very Highly Significant difference (p-value≤0.001)				

Table:-4 Comparison of vertical distance between superior border of body of mandible and superior border of mental foramen in different age groups on basis of Post-hoc Tukey test

(I) Age groups	(J) Age groups	Mean Difference (I-J)	p-value
Group I	21-30 years	-3.150	0.000***
	31-40 years	-2.050	0.041*
	41-50 years	0.700	0.865#
	51-60 years	0.200	0.999#
Group II	31-40 years	1.100	0.542#
	41-50 years	3.850	0.000***
	51-60 years	3.350	0.000***
Group III	41-50 years	2.750	0.002**
	51-60 years	2.250	0.019*
Group IV	51-60 years	-0.500	0.956#
Post-hoc Tukey test ***** Very Highly Significant difference (p-value≤0.001)** **** Highly Significant difference (p-value≤0.01)** *** Significant difference (p-value≤0.05)** **# Non-Significant difference (p-value>0.05)**			

Table:-5 Comparison of vertical distance between inferior border of mental foramen and inferior border of body of mandible in different age groups on basis of One-way ANOVA test

Age groups	Mean	Std. Deviation	F-value	P-value
Group I	14.10	1.45		
Group II	15.40	2.14		
Group III	15.25	1.86	2.962	0.024*
Group IV	14.90	1.21		
Group V	15.80	1.51		
One-way ANOVA test *** Significant difference (p-value≤0.05)**				

Table 6: Comparison of vertical distance between inferior border of mental foramen and inferior border of body of mandible in different age groups on basis of Post-hoc Tukey test

| (I) Age groups	(J) Age groups	Mean Difference (I-J)	p-value
Group I	21-30 years	-1.300	0.106#
	31-40 years	-1.150	0.195#
	41-50 years	-0.800	0.553#
	51-60 years	-1.700	0.014*
Group II	31-40 years	0.150	0.999#
	41-50 years	0.500	0.877#
	51-60 years	-0.400	0.941#
Group III	41-50 years	0.350	0.963#
	51-60 years	-0.550	0.834#
Group IV	51-60 years	-0.900	0.433#
Post-hoc Tukey test *** Significant difference (p-value≤0.05)** **# Non-Significant difference (p-value>0.05)**			
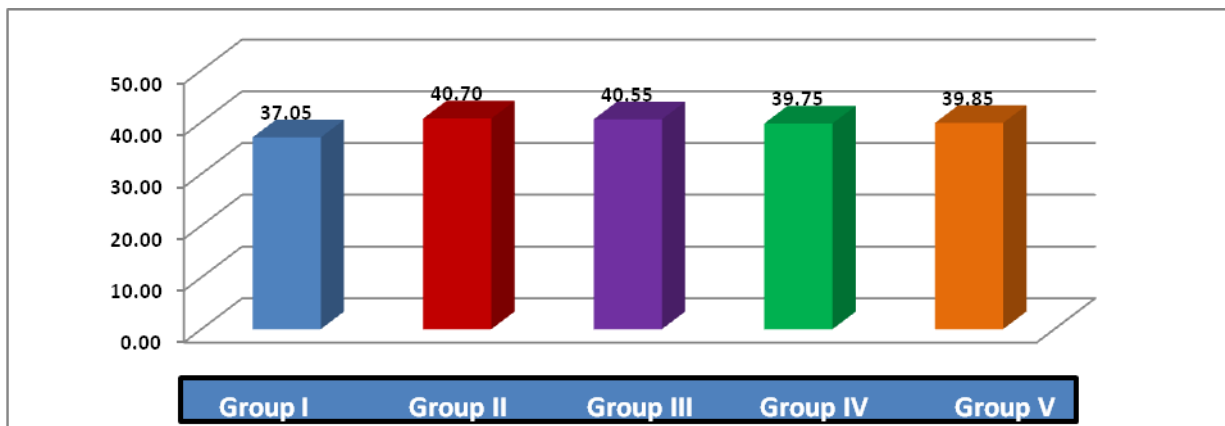
Figure 5: Comparison of vertical distance between superior border of body of mandible and the inferior border of body of mandible in different age groups.
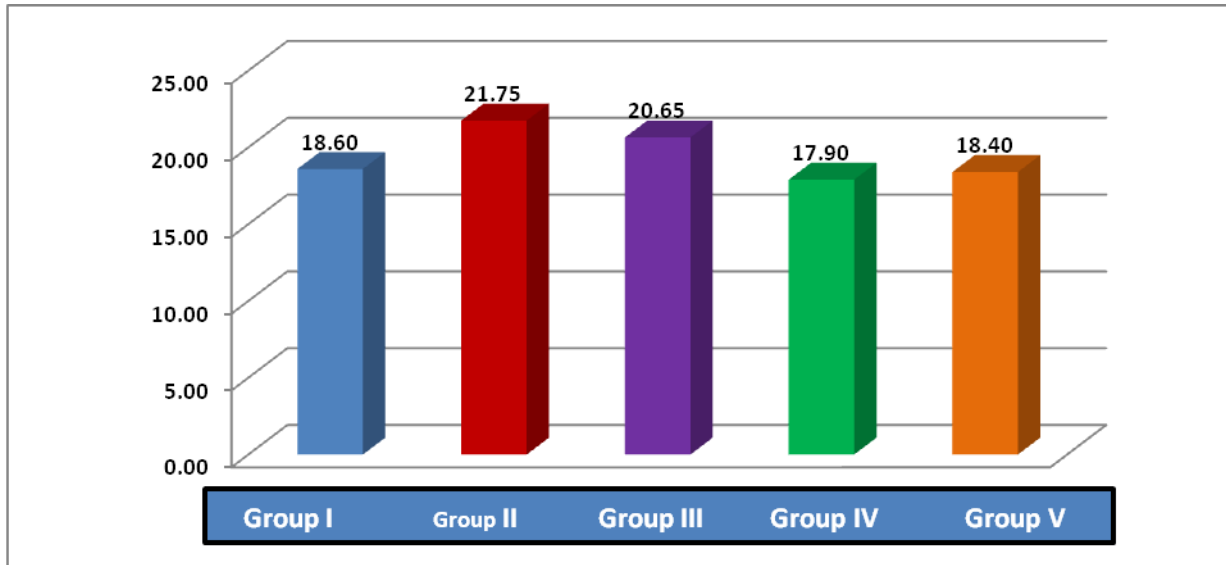
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Figure 6: Comparison of vertical distance between the superior border of body of mandible and superior border of mental foramen in different age groups.
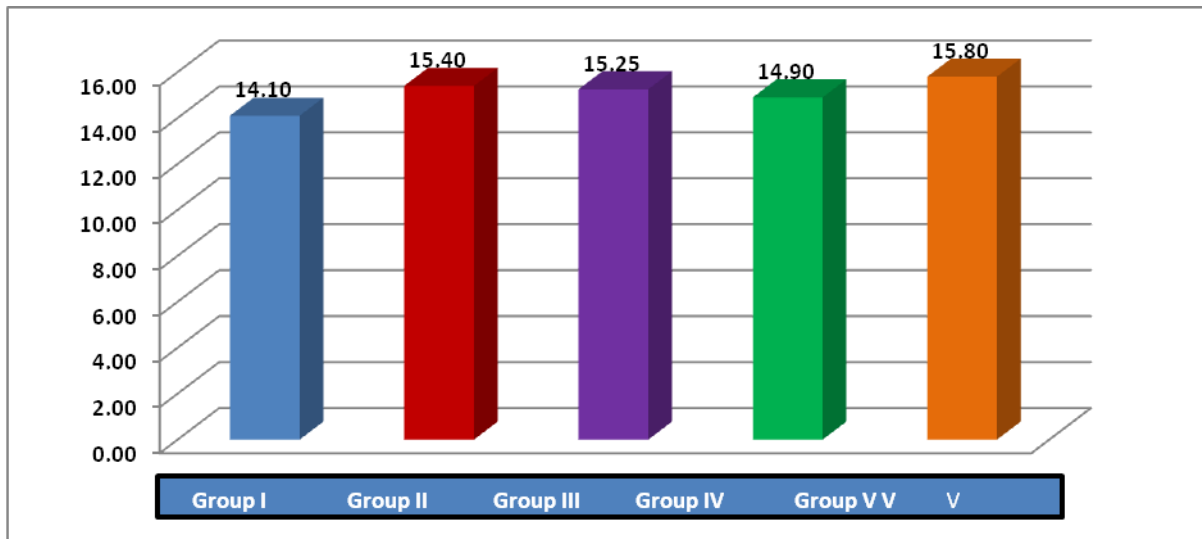

Figure 7: Comparison of Vertical distance between inferior border of mental foramen and inferior border of body of mandible in different age groups.

DISCUSSION

Mandible or lower jaw is the largest and strongest bone of face. Mental foramen is one of the stable landmarks of mandible.[6] It is located on lateral surface of body of mandible below the apices of first and second premolars. Wical and Swoope (1974) reported that there is no effect of alveolar bone resorption on the distance between mental foramen and lower border of the mandible. It remains relatively constant throughout life.[7] Lindh *et al*. (1995) and Guler *et al*. (2005) also agreed with the results suggested by Wical and Swoope.[8,9] All these studies demonstrated that linear measurements on radiographs can be a sound indicator of the alveolar bone resorption with age. Chandra *et al*. (2014) again pointed out that basal bone is relatively stable in nature and that's

why mental foramen can be used as landmark for age determination.[10]

In the present study, panoramic radiographs were used as sample because of better view as compared to other dental radiographs. Philips *et al*. (1992) reported that panoramic radiographs showed much better and larger view of mental foramen than that of other radiographs.[11] Yosue *et al*. (1989) also described the consistency of mental foramen on a panoramic radiograph in their study.[12]

For age estimation of unknown samples, vertical distance between superior border of body of mandible and inferior border of the mandible plays a significant role. This distance shows a greater value especially in 21-30 and 31-40 years age group (shown by fig.5). In 21-30 age group distance between superior border of body of mandible

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and superior border of mental foramen is highest among all age groups (shown by fig.6). Non significant differences were observed in vertical distance between inferior border of mental foramen and inferior border of body of mandible in all age groups (fig.7). According to this study the vertical distance between inferior border of mental foramen and inferior border of mandible should not to be studied further as it is showing non significant values. This distance is of least importance for determination of age.

CONCLUSION

From this study, we can conclude that for determining age two parameters can be used significantly one is vertical distance between superior border of body of mandible and lower border of body of mandible and the other one is vertical distance between superior border of body of mandible and superior border of mental foramen. Third parameter is of least significance for determination of age.

The present study would suggest an extension of this work whereby anatomic measurements of mental foramen should be used instead of the panoramic radiographs as they give accurate measurements because radiographs may show some magnification and angulation issues while taking images that will lead to fluctuated results.

As only three parameters of mental foramen had been assessed in this study, comprehensive assessment of various other parameters of mental foramen may be required for more definitive and confirmatory results for gender and age determination. To achieve high level of significance of results one should choose a large population which will also provide minimum number of errors and less biased results.

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