ORIGINAL ARTICLE

Location of mental foramen using digital panoramic Radiography

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Abstract

Objective: Comparative evaluation of the location of mental foramen in different age groups. Determine the variation in position of mental foramen with gender using digital panoramic radiography. **Materials and Methods:** Digital panoramic radiographs of 250 patients were reviewed. The study population was divided into five age groups with 50 patients each. Radiographic position of mental foramen was evaluated in each radiograph based on three parameters. Measurements were taken in each radiograph using Planmeca Dimaxis pro version 4.4.0 (Helsinki, Finland). The collected data were subjected to statistical analysis using paired Student's *t*-test. **Results:** The mean distance of position of mental foramen showed a significant variation within the five age groups. In the first group, female patients showed an increase in mean distance of mental foramen position in relation to three parameters. From the second to fifth groups, male patient showed an increase in the mean distance of mental foramen position. The first and fifth group showed a reduced mean distance of mental foramen position when compared to other age groups. **Conclusion:** This study concluded that the position of mental foramen varies with age. There was a gender-related variation in position of mental foramen within the population too.

Key words: Age group mental foramen, panoramic radiography, population

Introduction

Usually, the mental foramen is difficult to locate. There are no absolute anatomical landmarks for reference and the foramen cannot be clinically visualized or palpated.[1] Prior to surgery, knowledge of the exact location ensures effective mental block anesthesia.[2] One of the inadvertent complications that occur during implant placement in anterior mandible is a neurosensory alteration in the chin and lower lip due to improper identification and protection of the mental foramen and anterior mental loop.[3]

On radiograph the mental foramen presents as a single circular or elliptical radiolucent area bilaterally in the premolar region.[4] Several studies comparing different radiographic methods to assess the location of the mental foramen have suggested that digital panoramic radiographs show least error in the imaging of the mental foramen.[5,6] Green *et al*. demonstrated clear racial differences in the position of the mental foramen.[7] In the present study, the change in position of mental foramen in different age groups and gender related variations were evaluated using digital panoramic radiography.

Access this article online	
Website: www.jfds.org	Quick Response Code
DOI: 10.4103/0975-1475.186365	

How to cite this article: Mohamed A, Nataraj K, Mathew VB, Varma B, Mohamed S, Valappila NJ, *et al*. Location of mental foramen using digital panoramic radiography. J Forensic Dent Sci 2016;8:79-82.

Materials and Methods

The study group comprised a total of 250 patients who required panoramic radiography for various dental treatments. The study population was divided into five age groups with 50 patients each. The age groups were 6-12 years, 13-18 years, 19-30 years, 31-50 years, and above 50 years. Each age group was divided into two subgroups based on gender having 25 subjects in each subgroup.

Digital panoramic radiographs were taken using the digital panoramic radiography machine, Planmeca Promax (Helsinki, Finland) with a total filtration of 2.5 mm Aluminium (Al) equivalent. Each radiograph was standardized while taking the radiograph by tilting the patient's head 5° downward with reference to Frankfurt's horizontal plane as suggested by Dharma *et al*.[2] Digital panoramic radiographs were viewed using Planmeca Dimaxis software (Helsinki, Finland).

Position of mental foramen (X) was fixed in relation to three reference points [Figure 1]:

- Alveolar bone crest (A)
- Base of mandible (B)
- A midline reference point (C) (a line is drawn from the anterior nasal spine to the most inferior portion of mentis).

Measurements in millimeters were taken on both sides of the mandible according to the following parameters:

- Distance from the reference line to mental foramen
- Distance from the alveolar crest to mental foramen
- Distance from the base of mandible to mental foramen.

There was no statistical difference between the positions of the mental foramen on either side of a patient and so the mean was taken as a single measurement per sample. The data collected were subjected to statistical analysis using paired Student's *t*-test.

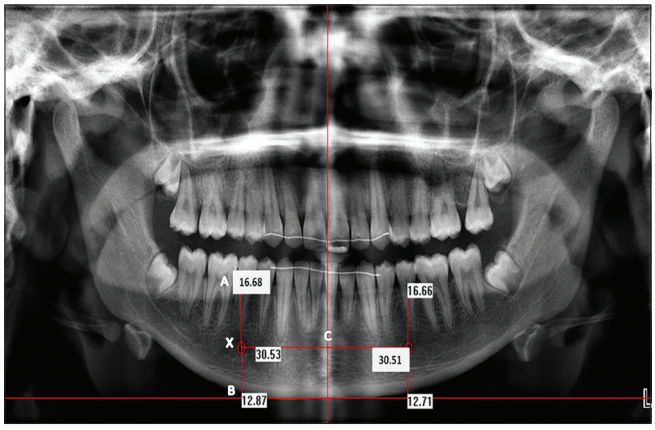

Figure 1: Parameters measured in the study: alveolar crest (A), base of mandible (B), median reference line (C), and position of mental foramen (X)

Results

The mean distance of position of mental foramen from reference line, alveolar bone crest, and the base of mandible of each age group are shown in Figure 2. Comparisons between male and female patients for each age group are given in Tables 1-5.

Table 1: Comparison between males and females in the age group 6-12 years

Parameters	1 (MF-RL)		2 (MF-ABC)		3 (MF-BM)	
Sex	Males	Females	Males	Females	Males	Females
Mean distance (mm)	29.24	30.34	14.36	14.48	8.58	9.70
Std. deviation	±3.56	±1.39	±2.13	±1.35	±1.24	±1.58
P (*T*≤*t*)	0.05		0.89		0.00	

Table 2: Comparison between males and females in the age group 13-18 years

Parameters	1 (MF-RL)		2 (MF-ABC)		3 (MF-BM)	
Sex	Males	Females	Males	Females	Males	Females
Mean distance (mm)	32.82	32.04	15.58	16.16	13.12	12.70
Std. deviation	±1.93	±2.50	±1.74	±1.82	±1.79	±1.09
P (*T*≤*t*)	0.00		0.00		0.00	

Table 3: Comparison between males and females in the age group 19-30 years

Parameters	1 (MF-RL)		2 (MF-ABC)		3 (MF-BM)	
Sex	Males	Females	Males	Females	Males	Females
Mean distance (mm)	33.78	31.22	16.84	16.34	14.74	12.98
Std. deviation	3.09	2.31	2.09	1.99	1.37	1.36
P (*T*≤*t*)	0.00		0.00		0.00	

Table 4: Comparison between males and females in the age group 31-50 years

Parameters	1 (MF-RL)		2 (MF-ABC)		3 (MF-BM)	
Sex	Males	Females	Males	Females	Males	Females
Mean distance (mm)	32.26	30.48	17.48	15.32	14.46	13.24
Std. deviation	3.08	2.56	1.90	2.00	1.25	1.20
P (*T*≤*t*)	0.00		0.00		0.00	

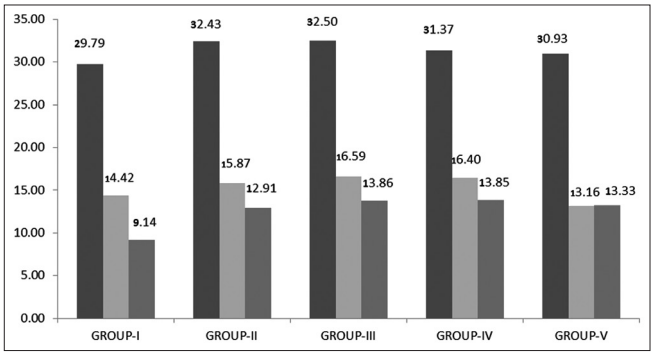

Figure 2: Graph showing the mean distance of mental foramen position in each age group

Table 5: Comparison between males and females in the age group above 50 years

Parameters	1 (MF-RL)		2 (MF-ABC)		3 (MF-BM)	
Sex	Males	Females	Males	Females	Males	Females
Mean distance (mm)	31.16	30.70	13.84	12.48	13.90	12.76
Std. deviation	2.11	2.76	2.01	2.94	1.07	1.15
P ($T \leq t$)	0.00		0.00		0.50	

In the 6-12 years age group: Statistical correlation showed a highly significant increase in the distance of mental foramen from base of mandible in female patients ($P < 0.01$), and a marginally statistically significant increase in the mean distance of mental foramen from reference line in the female patients ($P < 0.05$) when compared with the male patients.

In the 13-18 years, 19-30 years, and 31-50 years age group: Statistical correlation showed a significant increase in the distance of mental foramen from base of the mandible, reference line, and alveolar crest in the male patients ($P < 0.01$) when compared with the female patients.

In the above 50 years age group: Statistical correlation showed a significant increase in the distance of mental foramen from reference line and alveolar crest in the male patients ($P < 0.01$) when compared with the female patients. Both male and females patients showed no statistically significant difference in the distance of the mental foramen from the base of mandible ($P \leq 0.5$).

Discussion

Anatomically the mental foramen lies midway between the free alveolar border and the border of the mandible closer to the latter.[8] It varies in position according to the age and sex as substantiated in several previous studies.[9-11] The aim of our study was to determine the radiographic position of mental foramen in relation to anatomical structures in different age groups in males and females. The age groups were determined according to different stages of growth and development as prepubertal, pubertal, adolescent, middle aged, and elderly people.

Panoramic radiographs have advantages like bilateral visualization of anatomical structures, broader visualization of hard tissue areas, and the ability to visualize adjacent areas, thus allowing for a more standardized localization of mental foramen.[12] Mental foramen position may not be revealed in a periapical radiographic film, if the position of mental foramen falls below the edge of the film,[1,13] previous studies comparing digital panoramic images and conventional panoramic images showed that the measurement errors was less in the former.[6]

The variation in position of the mental foramen between females and males in group 1 may be attributed to the hormonal changes induced in growth spurts. In 1927, Hellman identified gender differences in the timing, extent, velocity, and intensity of facial growth and recognized that these changes result in an increase in size and a change in the proportions of the face.[14] The pubertal growth spurt is a marked adolescent acceleration in the rate of growth. This spurt in the peak of incremental growth has been found to occur approximately 2 years earlier in females than males, at mean ages of 12 years and 14 years, respectively.[15] The study by Ochoa and Nanda *et al*. showed that the female subjects tended to have the greatest skeletal changes between 10 years and 14 years of age. The male patients had the greatest changes between 12 years and 16 years of age and even up to 18 years of age.[16]

In groups 2-5, male patients showed a statistically significant increase in the mean distance of mental foramen position from the midline and alveolar crest. This change in the mean distance of mental foramen position could be due to the growth spurt favoring males after the age of 12 and lag of growth spurt in females. The female patients demonstrated a relative slow down of growth after 14 years of age in mandibular length, whereas in the male patients jaws continued to grow significantly until 16 years of age.[17-19]

The first and fifth groups showed a reduced mean distance of mental foramen position when compared to second, third, and fourth groups. In the fifth age group, the mean distance of mental foramen position from the alveolar bone crest showed the least value when compared to other groups. This may be due to bone remodeling as age advances.[20]

In a study conducted by Gershenson in 1986, he found that in children before tooth eruption, the mental foramen is somewhat closer to the alveolar margin; during the eruption period, the mental foramen descends to half way between the margins and in adults with the teeth preserved, the mental foramen is somewhat closer to the inferior border. With loss of teeth and bone resorption, the mental foramen moves upward closer to the alveolar border.[21]

Conclusion

The mental foramen position is not constant and changes as age advances. Apart from this, there is a gender-related variation in the position of mental foramen in each age group we have studied. These variations in the position of the mental foramen have been reported to exhibit a clear trend in the pattern of their occurrence in relation to both age and gender.

An accurate assessment of position of mental foramen is very useful for the prevention of postsurgical neurovascular complications and also holds the potential of contributing as an aid for forensic identification. Multicenter studies within different populations would help in establishing its role in forensic odontology.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

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