

Morphometric Analysis of Mandibular and Mental Foramen

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Abstract: Mandibular foramen is an irregular foramen located a little above the center of the mandibular ramus on its medial surface. Inferior alveolar nerve and vessels pass through it, traverse the mandibular canal and supply the mandibular teeth. Mental foramen is located in the anterior surface of the body of the mandible. Mental nerve and vessels pass through it. Anatomy of mandibular and mental foramen is important for dental surgeons in inferior alveolar and mental nerve block, surgical procedures like apical curettage of mandibular premolars, amalgam filling, periodontal surgery etc. to avoid to the neurovascular bundle passing through the foramen. The present study was carried out on 65 dry mandibles from the Department of Anatomy, VMKVMC, Salem, Tamil Nadu, to analyse the morphometry of mandibular and mental foramen using computer assisted "Image tool" software (UTHSCSA Image tool for windows version 3.0, San Antonio, TX,US). Distance of the mandibular foramen and the frequency of different shapes of mental foramen is calculated and the mean of mental foramen length and also the breadth obtained is compared with the same parameters available in the literature. Vernier caliper has been used for taking measurements from dry mandible in most of the studies. In our study, morphometric analysis of mental and mandibular foramen is done with the help of a computer software known as "Image tool". The proposed computer aided system is user friendly and doesn't require too much time to estimate the measures.

Keywords: Image Tool, Mandible, Morphometry

I. Introduction

Mandibular foramen is an irregular foramen located a little above the center of the mandibular ramus on its medial surface. Inferior alveolar nerve and vessels pass through it, traverse the mandibular canal and supply the mandibular teeth. Mental foramen is located in the anterior surface of the body of the mandible. Mental nerve and vessels pass through it.

Anatomy of mandibular and mental foramen is important for dental surgeons in inferior alveolar and mental nerve block, surgical procedures like apical curettage of mandibular premolars, amalgam filling, implant treatment, mandibular osteotomies and periodontal surgery etc. to avoid injury to the neurovascular bundle passing through the foramen.

Detailed knowledge of the morphometry of mandibular and mental foramen is essential in clinical dentistry when administering regional anaesthesia and performing peripheral surgery in the mental region of the mandible.

Analysis of morphometry of mandibular and mental foramen using computer assisted "Image tool". So, this study was conducted to observe the variations in position of mandibular and mental foramen and to observe the variations in the shape and size of mental foramen.

II. Materials

Study period- 3 months

Study population- dry mandibles from the Department of Anatomy, VMKVMC, Salem Sample size - 65 dry mandibles, Type of sample- dry bone

III. Methods

Mandibular and mental foramen were photographed using a 12.5 megapixel digital camera. The digital images of mandible were calibrated with computer software (UTHSCSA Image Tool for Windows version 3.0, San Antonio, TX, US). The length and breadth of mental foramen and the position of mandibular and mental foramen were measured in the calibrated digital images.

1. Position of the mandibular foramen (MF) is measured from-
 - a) the lowest point of the MF to the centre of mandibular notch [Fig-1]
 - b) the lowest point of the MF to the anterior border of mandibular ramus [Fig-2]
 - c) the lowest point of the MF to the posterior border of mandibular ramus [Fig-3]

d) the lowest point of the MF to the gonion point [Fig-4]



Fig 1 - Distance from the lowest point of MF to the centre of the mandibular notch.



Fig 2 - Distance from the lowest point of MF to the to anterior border of mandibular ramus.



Fig 3 - Distance from the lowest point of MF to the posterior border of mandibular ramus.



Fig 4 - Distance from the lowest point of MF to the gonion point.

2. Mental Foramen Length (MFL) was measured by drawing the measuring line along the maximum internal length.[Fig-5]



Fig-5 Mental Foramen Length

3. Mental foramen breadth (MFB) was measured by drawing the measuring line along the maximum internal width along the transverse plane. [Fig-6]



Fig-6 Mental Foramen Breadth

4. Position of mental foramen is measured from the mental foramen to the lower border of mandible and to the alveolar margin. [Fig-7]



Fig-7 Position Of Mental Foramen

5. Shape of mental foramen [Fig-8 & Fig-9]



Fig-8 Oval shaped



Fig-9 Round shaped

IV. Results And Observations

Position of Mandibular Foramen:

- D1- distance from the lowest point of the mandibular foramen to the centre of mandibular notch,
- D2- distance from the lowest point of the mandibular foramen to the anterior border of mandibular ramus,
- D3- distance from the lowest point of the mandibular foramen to the posterior border of mandibular ramus,
- D4- distance from the lowest point of the mandibular foramen to the gonion point

Distance	Right	Left
D1	4.10cm	3.80cm
D2	2.79cm	2.77cm
D3	2.62cm	2.40cm
D4	3.15cm	3.23cm

Position of Mental Foramen:

D1= mean of distance between mental foramen and alveolar margin,
 D2= mean of distance between mental foramen and lower border of mandible

Distance	Right	Left
D1	2.09cm	2.16cm
D2	1.89cm	1.91cm

Shape of Mental Foramen:

Shape	Right	Left
Oval	16.9%	11.7%
Round	24.75	29.9%

Size of Mental Foramen:

MFB= mean horizontal diameter (Mental foramen breadth)

MFL= mean vertical diameter (Mental foramen length)

Diameter	Right	Left
MFB	0.45cm	0.47cm
MFL	0.35cm	0.38cm

V. Discussion

Mental Foramen represents the termination of the mental canal. Inferior alveolar nerve and vessels, after traversing the mandibular canal, exit through the mental foramen as the mental nerves and vessels. These form important innervations for the lower jaw, cheek, teeth and lip.¹

There are discrepancies in studies regarding the shape, size, position and number of mental foramen in human mandibles.² These discrepancies result from naturally occurring differences in facial structure, jaw skeleton size and feeding habit induced bone remodelling in mandibles of different human races.

Round shape mental foramen was reported in 26.2% and 28.7% of mandibles on right and left sides respectively and oval shaped in 73.8% on right side and 71.3% on left side.³ In the present study, round shaped mental foramen was found in 24.75% and 29.9% on right and left side respectively and oval shaped in 16.9% and 11.7% on right and left side respectively.

A study in Turkish population over 34 dry mandibles shows 2.93 mm horizontal dimension of mental foramen on right side and 3.14 mm on left side.⁴ In the present study, the horizontal dimension of mental foramen is 4.5mm on the right side and 4.7mm on the left side. These measurements are more as compared to the previous studies conducted showing different sizes in different human race.

In dry mandibles of east Indian ethnic origin, the mandibular foramen was found to be located at the anteroposterior midpoint of ramus halfway between the lower surface of mandible & the mandibular notch.⁵ A computer aided method was used in 2006 to estimate mandibular cortical thickness.⁶

The distance from mental foramen to the alveolar margin was found to be 14.89 in males and 14.21 in females. Distance from mental foramen to the base of the mandible was found to be 16.16 in males and 15.66 in females.⁷ In the present study, the distance between mental foramen to the alveolar margin is 20.9mm on the right and 21.6mm on the left and distance between mental foramen and lower border of mandible is 18.8mm on the right and 19.1mm on the left. The most frequent technique failure in anaesthesia of the inferior alveolar nerve block lies in the inappropriate setting of the needle, due to the inaccurate location of mandibular foramen.⁸ The risks of undesirable mandibular fractures might decrease when the mandibular foramen is taken as anatomic repairs in osteotomies.⁹

A few studies have demonstrated that mandibular foramen maintains its location after skeleton maturation, even if the mandibular ramus suffers morphological alteration associated with tooth losses.¹⁰ In south Indian mandibles, the average distance of MF was 16mm, 13mm and 20-25mm from the anterior and the posterior border of ramus & from the mandibular notch.¹¹

VI. Conclusion

Vernier calliper has been used for taking measurements from dry mandible in most of the studies. The proposed computer aided system is user friendly and doesn't require too much time to estimate the measures. There are references in literature for very few studies conducted in the west in which computer aided digital measurements of mandible have been taken. In our study, morphometric analysis of mental and mandibular foramen is done with the help of a computer software known as "Image tool".

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