Morphometric Study of Mental Foramina in Dentate and Edentulous Human Mandible in Gujarat Region

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Abstracts: Background & Objectives: will be useful for anatomists, anthropologists, aneasthetist, orthopedics and experts in the field of forensic medicine. The aim of the study was to examine the different morphometric variations of the human mandibles and comparing between dentate and edentulous mandibles is done. Methods: This study included only bone who exhibited no obvious bone pathology. All measurements were done bilaterally, performed with a stainless steel metric digital calliper with 0.01 mm precision. The relative position of the Mental foramena (MF)as analyzed with measurements made from nferior wall of mandible to the mandibular base, from anterior wall of mandible to the mandibular skeletal midline, from his posterior wall to the posterior mandibular rim. To determine this relation, the standard horizontal plane defined by Morrant was used. Briefly, the mandible was placed on a horizontal surface, to which the lower border of the mandible comes into greatest contact when vertical pressure is applied to the second molar teeth. Results: The most common location for the MF is a position aligned between second premolar and first molar (Rt. side 30% & Lt. Side 31%). Comparison of measurements of dentate and edentulous mandible is significnat on both sides. Conclusion: The knowledge of the distances from surgically encountered anatomical landmarks in the present study provide valuable information to dental surgeons that will facilitate effective localization of the neurovascular bundle passing through mental foramen thus avoiding complications from local anesthetic, surgical and other invasive procedures. [Vadgama J et al NJIRM 2012; 3(3) : 47-51]

Key Words: Mental foramina, Mandible, Dentate and Edentulous mandible, Mental Block.

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Introduction: Precise knowledge of the location of reference points in the oral and maxillofacial area provides important data in local anaesthesia and in maxillofacial operations. The important maxillofacial anatomical entities are neurovascular bundles passing through different foramina.

According to reference 12, mandible shows certain changes in external features as age advances. For example (1) At birth mental foramen lies close to lower border of the body of mandible, it gradually shifts upwards and in the adult it lies midway between upper and lower border of the body and in the old age it lies nearer to the upper border (2) While angle of mandible is wide in childhood, becomes more acute in the adult (110-120 degree) and again becomes wide in the old age (140 degree)[12]

The mental foramen (MF) marks the termination of the mandibular canal in the mandible, through which the inferior alveolar nerve and vessels pass. At this point, the mandibular canal bifurcates and forms the mental and incisive canals.

The mental bundle passes through the MF and supplies sensory innervation and blood supply to the soft tissues of the chin, lower lip, and gingiva on the ipsilateral side of the mandible[3]. ommonly, three branches of the mental nerve emerge from the MF. One of these innervates skin of the mental area while the others spread to the skin of the lower lip, mucous membrane, and gingiva as far posterior as the second mandibular premolar tooth. The MF is normally single; however, double or even multiple foramina have been reported.

These additional foramina are termed accessory mental foramina by most authorities. The buccal cortical plate of the mandible most often is sufficiently dense to preclude effective infiltration of local anaesthetic agents in its vicinity. Therefore,

the clinician must rely on block anaesthesia procedures for effectively anesthetizing mandibular anterior teeth. One of these procedures is the mental block.

One oral region that causes considerable concern during periapical surgery is the mandibular premolar region because of the proximity of the mental nerve. Generally, the MF is difficult to locate[5]. There are no absolute anatomical landmarks for reference, and the foramen cannot be clinically visualized or palpated. Knowing the site of the MF allows for accurate delivery of local anesthesia for dental procedures and the avoidance of damage to the nerve in surgical procedures[7]. It also aids in interpreting anatomical landmarks in oral pathology and forensics. The mental nerve injury can cause transitory or permanent sensitive, thermal, and tactile changes. The location of the MF has been studied by means of direct measurement on dry mandibles or by using radiographs of dry mandibles or patients according to the ethnic group studied. The literature shows studies conducted on Africans[13] ,and Caucasians[11].

Material and Methods: Present study was conducted after taking permission from the institutional review board(IRB), Govt. Medical College, Bhavnagar. The material for the present study consists of 140 adult Mandible of unknown sex. These were collected from Govt. Medical college-Bhavnagar, P.D.U. Medical College, Rajkot and K.J.Mehta Dental College, Amargadh, Bhavnagar.

1) 140 dry mandible were collected from Department of Anatomy, Govt. Medical College, Bhavnagar , PDU Medical College, Rajkot, K.J.Mehta Dental College, Amargadh, Bhavnagar
2) Vernier callipers of 0.02mm accuracy.
3) Digital camera.
4) Pencil

Exclusion criteria

1. Bones having any fractures or any pathology.
2. Macerated bones.

Morphometric Methods: This sample included only bone who exhibited no obvious bone pathology. All measurements were done bilaterally, performed with a stainless steel metric digital caliper with 0.01 mm precision. Millimetre ruler (0.1 mm precision) was also utilized.

The relative position of the MF was analyzed with measurements made from mandibular inferior wall to the mandibular base, from his anterior wall to the mandibular skeletal midline, from his posterior wall to the posterior mandibular rim.

To determine this relation, the standard horizontal plane defined by Morrant[1] was used. Briefly, the mandible was placed on a horizontal surface, to which the lower border of the mandible comes into greatest contact when vertical pressure is applied to the second molar teeth. Each MF was assessed for its horizontal relationship to the facial cusp of the nearest teeth. A ruler was held along tile long axis of the facial surface of the crown of the nearest tooth. If the ruler crossed the MF, it was said to be “in line” with that tooth. If it fell entirely between rulers positioned on two adjacent teeth, it was said to be “between” those teeth. The position of the MF was graded by one of six positions in relation to the roots of the mandibular teeth: (1) between the canine and the first premolar, (2) below the first premolar, (3) between the premolars, (4) below the second premolar, (5) between the second premolar and first molar, and (6) below the mesial root of the first molar. The vertical relationship of the MF was measured in millimeters as the vertical distance from the superior border of the foramen to the alveolar ridge. The number of mandibles with mental foramina in the same position on both sides (symmetric) versus those in different positions (asymmetric) was also assessed.

The relation of the MF to the symphysis menti and the posterior border of the mandibular ramus were determined as previously described[2].

At first, a line between the anterior wall of the MF and the point at the mandibular midline on the symphysis menti was set parallel to the standard horizontal plane. Another line was made by extending the *A* line horizontally to the posterior

border of the mandibular ramus. The distance between the anterior wall of the MF and the point at the mandibular midline on the symphysis menti was measured by the real distance measured with the digital caliper at the dry mandible.(As in Figure)

Result: The MF(mental foramen) was found in all specimens included in this study. The most common location for the MF is a position aligned between second premolar and first molar (Rt side 30% & Lt. Side 31%,), Other locations more frequently found were between the premolars (Rt side 25% & Lt. Side 24%,), between the second premolar ((Rt side 18% & Lt. Side 16%,), below the mesial root of the first molar (Rt side 10% & Lt. Side.12%,) and 12% on both side was found between the canine and the first premolar as shown in Table I.

The data concerning all other measurements and comparison between the measurements of dentate and edentulous are summarized in Table II and Table III When comparing the influence of dental status on the measurements made.

Table I:- Position of mental foramen in dentate mandibles

	POSITION OF MF	Right(%)	Left(%)
1	Ca-1PM	12.00	12.00
2	1PM	10.00	12.00
3	1PM-2PM	25.00	24.00
4	2PM	18.00	16.00
5	2PM-1M	30.00	31.00
6	1M	5.00	5.00
	TOTAL	100.00	100.00

Discussion: The precise identification of position of the mental foramen is important in both diagnostic and clinical procedures of the mandible. Clinically, mental nerve bundle emerging from the mental foramen may get injured during surgical procedures with resulting paresthesia or anesthesia along its sensory distribution[3]. It is an important factor when considering the mental and incisive anesthetic block and surgeries in the outer premolar mandibular region.

Table II: Comparison in measurements between dentate and edentulous mandibles(right sided)

Sr no	parameters	Right side		
		Danta-te	edentulous	P value
1	Mental foramen (inferior wall) to inferior mandibular rim	11.26 ±1.69	12.93 ±0.77	<0.001
2	Mental foramen (anterior wall) to mandibular midline lateral view	24.11 ±2.64	24.91 ±0.45	0.015
3	Mental foramen (posterior wall) to posterior mandibular rim	58.01 ±8.30	62.20 ±3.87	0.048
4	Distance from the alveolar bone crest across the MF to the lower border of the mandible	24.54 ±4.04	21.36 ±1.75	<0.001

The MF can be estimated at the position about 24.08 mm rt side and 25.17mm on left side mm lateral to the symphysis menti in dentate and edentulous mandibles, respectively, The dentate mandibles showed lower mean distance than edentulous mandibles, which can be related to the mechanic forces of mastication and the consequent osseous deposition response for consolidation of the mandibular symphysis region, as the factors associated to the alveolar osseous growth that follows the anterior teeth eruption[7]. Therefore, the atrophic processes that took part in the edentulous mandibles with alveolar bone

resorption may be responsible for the lower measures observed in these specimens.

Table III: Comparison in measurements between dentate and edentulous mandibles (left sided)

Sr no	parameters	Left side		
		dantate	edentulous	P value
1	Mental foramen (inferior wall) to inferior mandibular rim	11.59 ±1.86	12.66 ±1.18	<0.001
2	Mental foramen (anterior wall) to mandibular midline lateral view	24.08 ±2.58	25.17 ±0.88	NS 0.112
3	Mental foramen (posterior wall) to posterior mandibular rim	58.72 ±6.72	66.94 ±3.98	<0.001
4	Distance from the alveolar bone crest across the MF to the lower border of the mandible	24.65 ±4.01	20.40 ±0.96	

It has been shown The comparison of the mean distances of the MF from the midline in various series yielded mean values ranging from 24.11 to 25.17 mm[3]. Between dentate and edentulous mandibles were made in these previous studies.

the MF to be located at precisely the same level on most human mandibles (20–24.54 mm superior to the inferior border of the mandible). Since it is known that the presence or absence of teeth can affect bone height in the mandible, this factor may have an influence on the distance from the MF to inferior rim[8]. Although this could be attributed to variable length of roots in the population sample, age is a major contributing factors. It is a generally accepted view that in children before tooth eruption, the MF is somewhat closer to the alveolar margin.

It is clear from some work[9,14] that the location of the foramen is not a reliable landmark for distinguishing race; However, in the present study, the mean distances from this foramen to the inferior mandibular rim mean distance in the edentulous mandibles was significantly higher from that of dentate mandibles (P <0.001).

The comparison of these mean distances in various series yielded different mean values in other studies, ranging from 12 to 15.5 mm[3]. Of these previous studies, only one 3 compared the difference in the mean values between the genders (15.5 mm in males and 14.0 mm in females). Other two studies 30,31 compared the differences between the sides and statistically significant differences.

The MF was found 24.65mm and 20.20mm distance between the lower border of the mandible and the alveolar bone crest in dentate mandibles and edentulous mandibles respectively. The differences between dentate and edentulous mandibles were statistically significant (P=<0.001) and distance from posterior rim was also different 58.72 mm and 66.94 mm in dentate mandibles and edentulous mandibles respectively. The differences between dentate and edentulous mandibles were statistically significant (P=<0.001).

Conclusion: The present study reveals valuable insights on the information concerning the morphology of mental foramen in Gujarat population. The knowledge of the distances from anatomical landmarks in the present study provide valuable information to dental surgeons that will facilitate effective localization of the neurovascular

bundle passing through mental foramen thus avoiding complications from local anesthetic, surgical and other invasive procedures.

The results of this research showed that the presence or absence of the teeth can alter mandibular shape and raises the intriguing possibility that mandibular edentulism may be associated with specific shape changes in the mandible. The dental status has a higher influence on the mandibular anatomy..

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