Original Research Article

A morphometric study of Mandibular Foramen in dry skulls and its clinical implications

Jyothi Lakshmi G.L[1], Vishma B.K[2], Asharani S.K.[3*]

[1]Associate Professor, Department of Anatomy, Rajarajeswari Medical College and Hospital, Bengaluru, Karnataka, India

[2]Assistant Professor, Department of Community Medicine, Chamrajnagar Institute of Medical Sciences, Chamrajanagar, Karnataka, India

[3]Associate Professor, Department of Anatomy, Adichunchunagiri Institute of Medical Sciences, B G Nagara, Karnataka, India

Received: 12-11-2021 / Revised: 18-12-2021 / Accepted: 15-01-2022

Abstract

Introduction

The mandibular foramen (MF) is an opening which is found in the medial surface of the ramus of the mandible. It leads to mandibular canal which contains neurovascular structures such as Inferior alveolar nerve and vessels. **Aims & Objective:** To determine the location of mandibular foramen in relation to surrounding important reference points in dry adult human mandibles of South Indian population. **Material & Methods:** The study was conducted in 100 adult dry human mandibles of unknown sex obtained from the Department of Anatomy of a private medical college in Bangalore. Inclusion criteria: Intact mandibles with sockets for third molar teeth were included in the study. Damaged mandibles, mandibles with pathological abnormalities were excluded from the study. The position of Mandibular Foramen was determined using the distances of the mandibular foramen to the (a) base of mandible (MF-MB), (b) mandibular notch (MF-MN), (c) anterior border of the ramus (MF-AB) (d) posterior border of the ramus (MF-PB). The measurements were done on both sides with the help of a sliding vernier caliper. **Observation & Results:** The mean distance between the mandibular foramen and the base of the mandible was noted as 23.42 mm on the right side and 24.16 mm on the left side. The mean distance between the mandibular foramen and the mandibular notch was noted as 22.42 mm on the right side and 22.38 mm on the left side. There were no significant difference observed in the location of mandibular foramen in relation to the surrounding reference points between both the sides. **Conclusion:** The present study provides the location of the mandibular foramen in relation to surrounding important reference points in dry adult human mandibles of South Indian population.

Keywords: Mandibular foramen, dry skulls, Inferior alveolar nerve.

Introduction

The mandibular foramen (MF) is an opening which is found in the medial surface of the ramus of the mandible[1]. It leads to mandibular canal which contains neurovascular structures such as Inferior alveolar nerve and vessels.Location of mandibular Foramen has an important implication in procedures such as inferior alveolar nerve block .The success of Inferior alveolar nerve block depends on precise localization of mandibular foramen[2,3,4,5,6]. This study aims to study the location of Mandibular Foramen in relation to surrounding important reference points.

Aim of the study

To determine the location of mandibular foramen in relation to surrounding important reference points in dry adult human mandibles of South Indian population.

Materials and Methods

The study was conducted in 100 adult dry human mandibles of unknown sex obtained from the Department of Anatomy of a private medical college in Bangalore. Inclusion criteria: Intact mandibles with sockets for third molar teeth were included in the study. Damaged mandibles, mandibles with pathological abnormalities were excluded from the study.

*Correspondence

Dr. Asharani S.K.

Associate Professor, Department of Anatomy, Adichunchunagiri Institute of Medical Sciences, B G Nagara, Karnataka, India.

E-mail: ashakshetty@gmail.com

To precisely locate the mandibular foramen, the following parameters were measured on both sides of the mandible with a sliding vernier callipers of 0.1 mm accuracy.The position of Mandibular Foramen was determined using the distances of the mandibular foramen to the (a) base of mandible (MF-MB), (b) mandibular notch (MF-MN), (c) anterior border of the ramus (MF-AB) (d) posterior border of the ramus (MF-PB). The measurements were done on both sides with the help of a sliding vernier caliper. A comparison of the mean values between the sides was done using t-test for independent samples.P-value < 0.05 was considered as statistically significant.The following measurements were taken:

1. MF-BM: mandibular foramen to base of mandible;
2. MF-MN: mandibular foramen to mandibular notch;
3. MF-AB: mandibular foramen to anterior border of ramus;
4. MF-PB: mandibular foramen to posterior border of ramus.

Fallowing measurements were noted:

1. MF- AB:A distance from the centre of the anterior limit of the mandibular foramen (MF)to the nearest point on anterior border of ramus (AB).
2. MF-PB: A distance from the centre of the anterior limit of the mandibular foramen (MF) to the nearest point on posterior border of ramus (PB).
3. MF-MN: A distance from the centre of the anterior limit of the mandibular foramen (MF) to the nearest point on mandibular notch (MN). limit of the mandibular foramen (MF) to the nearest point on angle of mandible

Following measurements were noted:

1. MF- AB:A distance from the centre of the anterior limit of the mandibular foramen (MF)to the nearest point on anterior border of ramus (AB).
2. MF-PB: A distance from the centre of the anterior limit of the mandibular foramen (MF) to the nearest point on posterior border of ramus (PB)
3. MF-MN: A distance from the centre of the anterior limit of the mandibular foramen (MF) to the nearest point on mandibular notch (MN).limit of the mandibular foramen (MF) to the nearest point on angle of mandible

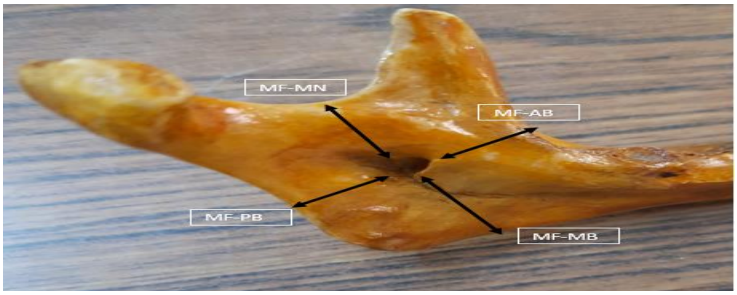

Fig 1: Measurements taken from Mandibular Foramen (MF) to surrounding reference points. MF-BM: mandibular foramen to base of mandible; MF-MN: mandibular foramen to mandibular notch; MF-AB: mandibular foramen to anterior border of ramus; MF-PB: mandibular foramen to posterior border of ramus.

Results

The observations of the present study is shown in Table 1.

Table1: Observations of the present study. MF-MB: mandibular foramen to base of mandible; MF-MN: mandibular foramen to mandibular notch; MF-AB: mandibular foramen to anterior border of ramus; MF-PB: mandibular foramen to posterior border of ramus.

Reference points	Side	Present study (N=100)	P value
MF-MB	R	23.42 ± 2.04	p > 0.05
	L	24.16±3.66	
MF-MN	R	22.42 ±3.24	p > 0.05
	L	22.38 ±2.38	
MF-AB	R	18.3 ± 1.34	p > 0.05
	L	18.58 ± 6.24	
MF-PB	R	13.28 ± 2.14	p > 0.05
	L	13.68 ± 1.32	

The mandibular foramen is more nearer to the posterior border than the anterior border of ramus the mandibular foramen is more nearer to the posterior border than the anterior border of ramus the mandibular foramen is more nearer to the posterior border than the anterior border of ramus. From the observations of the present study, the mandibular foramen is found to be nearer to the posterior border than the anterior border. The mandibular foramen is nearer to the mandibular notch than the base of the mandible. There were no significant difference observed in the location of mandibular foramen in relation to the surrounding reference points between both the sides.

Discussion

The mandibular foramen (MF) is a superior opening which is found in the medial surface of the ramus of the mandible. It has an important role to be a passage of mandibular canal which contains neurovascular structures such as inferior alveolar nerve, which is a branch of posterior trunk of trigeminal nerve that is sensory to the mucosa and skin around the lower lip and chin, and inferior alveolar artery, which is a branch of maxillary artery that goes through mental foramen[1].

Several studies have been conducted on localization of mandibular foramen[7-12]. The results of the present study is compared with other studies as shown in Table 2.

Table 2: Comparison of the present study with other studies

Reference points	Sides	Mean distance (mm)		
		Muche et al[7] (N=130)	Shalini et al[8] (N=204)	Present study(N=100)
MF-MB	R	29.98	22.33±3.32	23.42 ± 2.04
	L	29.52	25.35±4.5	24.16±3.66
MF-MN	R	21.82	21.74±2.74	22.42 ±3.24
	L	21.65	21.92±3.33	22.38 ±2.38
MF-AB	R	23.81	17.11±2.74	18.3 ± 1.34
	L	24.73	17.41±3.05	18.58 ± 6.24
MF-PB	R	16.99	10.47±2.11	13.28 ± 2.14
	L	16.23	9.68 ±2.03	13.68 ± 1.32

Shalini et al[8]. noted out that the prevalence of accessory MF in the South Indian population as unilateral foramen 22.05%, bilateral foramen 10.30%. While Galdames et al[13]. observed the prevalence as unilateral foramen 23.40%, bilateral foramen 19.10%, in total 42.60%. Accessory mandibular foramen were not observed in the present study.

For extraction of teeth in infected sites or endodontics, mandibular block is more effective than local infiltration in molars[2]. Unfortunately, mandibular block has one of the highest failure incidences among dental anaesthetic techniques[3]. An important factor for failure of anaesthetic techniques include the absence of indisputable anatomical landmarks[6]. The other reasons of failure of mandibular block noted are anatomical variations and poor anaesthetic technique[5,6].

Kilarkaje et al. from their study have reported that the mandibular foramen maintains bilateral symmetry in dry mandibles in all ages and the foramen was found to be within 25 mm from the third molar, anterior border of ramus (AB) and mandibular notch[14, 15]. This

finding is similar to our study where significant difference between dimensions of both sides were not observed. Tunis et al. studied that anatomical structure of mandible is significantly correlated to cross-sectional area of muscles of mastication which may be a factor in the anatomical variations observed in various population groups[16].

In advanced surgical techniques for the correction of craniofacial anomalies, the knowledge of location of mandibular foramen is necessary.

Conclusion

The present study provides the location of the mandibular foramen in relation to surrounding important reference points in dry adult human mandibles of South Indian population.

References

1. Drake RL, Vogl AW, Mitchell AWM. Gray's anatomy for students. 2nd ed. Elsevier; Philadelphia: 2010.
2. Oulis CJ, Vadiakas GP, Vasilopoulou A. The effectiveness of mandibular infiltration compared to mandibular block anesthesia in treating primary molars in children. Pediatr Dent. 1996;18:301–305.
3. Lin K, Uzbelger Feldman D, Barbe MF. Transverse cervical nerve: implications for dental anesthesia. Clin Anat. 2013;26:688–692.
4. Ezoddini Ardakani F, Bahrololoumi Z, Zangouie Booshehri M, Navab Azam A, Ayatollahi F. The position of lingula as an index for inferior alveolar nerve block injection in 7–11-year-old children. J Dent Res Dent Clin Dent Prospects. 2010;4:47–51.
5. Thangavelu K, Kannan R, Kumar NS, Rethish E, Sabitha S, Sayeeganesh N. Significance of localization of mandibular foramen in an inferior alveolar nerve block. J Nat Sci Biol Med. 2012;3:156–160.
6. Malamed SF. Is the mandibular nerve block passé? J Am Dent Assoc. 2011;142(Suppl 3):3S–7S.
7. Muche A, Saniotis A. Position of mandibular foramen and its clinical implications. Ital J Anat Embryol . 2020;124(3):319-28.
8. Shalini R, RaviVarman C, Manoranjitham R, Veeramuthu M. Morphometric study on mandibular foramen and incidence of accessory mandibular foramen in mandibles of south Indian population and its clinical implications in inferior alveolar nerve block. Anat Cell Biol. 2016 Dec;49(4):241-248.
9. Vilas, Chimurkar & Swapnil, Patond & Varsha, Pande & Anjankar, vaibhav. (2021). The Study of Location of Mandibular Foramen in Dry Adult Human Mandible. Medico-Legal Update. 20. 1117-1122.
10. M. Lipski, I. M. Tomaszewska, W. Lipska, G. J. Lis, K.A. Tomaszewski. The mandible and its foramen: anatomy, anthropology, embryology and resulting clinical implications. Folia Morphol 2013;72(4):285-292.
11. Sandhya K, Singh B, Lugun N, Prasad R. Localization of mandibular foramen relative to landmarks in East Indian mandibles. Indian J Dent Res 2015;26:571-5.
12. Sakshi M, Puneet J. An Anatomico-Radiological Study of Inter-Relationship between the Mandibular Foramen and Accessory Mandibular Foramina in Population of Rajasthan State 2018; 3(3):1-7.
13. Galdames ICS, Matamala DAZ, Smith RL. Is the conduct of Serres an anatomical variation in adults? Int J Morphol. 2009;27:43–7.
14. Kilarkaje N, Nayak SR, Narayan P, Prabhu LV. The location of the mandibular foramen maintains absolute bilateral symmetry in mandibles of different age-groups. Hong Kong Dent J. 2005;2:35–37.
15. Narayana K, Soubhagya RN, Prashanthi N, Latha VP. The location of the mandibular foramen maintains absolute bilateral symmetry in mandibles of different age groups. Hong Kong Dent J. 2005;2:35–7.
16. Sella-Tunis T, Pokhojaev A, Sarig R, O'Higgins P, May H. Human mandibular shape is associated with masticatory muscle force. Sci Rep. 2018;8:6042.

Conflict of Interest: Nil Source of support: Nil