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RESEARCH ARTICLE

MORPHOMETRIC ANALYSIS OF THE MENTAL FORAMEN IN SOUTH INDIAN POPULATION

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Abstract

Introduction: The mental foramen, a critical anatomical landmark on the mandible, transmits the mental nerve and vessels, and its precise location, shape, and size are vital for dental surgical procedures, anesthesia, and forensic applications. Variations in its morphology and the presence of accessory mental foramina can impact clinical outcomes.

Aim & Objectives: This study aimed to evaluate the morphologic and morphometric characteristics of the mental foramen and the incidence of accessory mental foramina in dry human mandibles using stainless steel Vernier calipers.

Materials and Methods: A total of 150 adult dry human mandibles from a South Indian population were examined. Measurements included the shape, size, and position of the mental foramen relative to the symphysis menti, posterior border of ramus of the mandible, alveolar margin, and inferior border of body of the mandible. The presence of accessory mental foramina was also recorded. Statistical analysis was performed to assess bilateral differences using t-tests ($p<0.05$).

Results: The mental foramen was predominantly oval (77.3%) and located in line with the longitudinal axis of the second premolar (type 4, 58.6% on right; 57.3% on left). Mean distances from the symphysis menti to the anterior margin of the mental foramen were 25.12 ± 2.31 mm on the right side and 25.02 ± 2.24 mm on the left side; p=0.359). The mean distance from the posterior margin of the mental foramen to the posterior border of the mandible was 62.54 ± 6.18 mm on the right side and 63.06 ± 5.23 mm on the left side; p=0.213). Vertical distances from the alveolar margin to the upper margin of the mental foramen were 10.81 ± 2.81 mm on the right side and 10.74 ± 2.81 mm on the left side; p=0.407), and from the lower margin to the base of the mandible were 12.48 ± 1.91 mm on the right side and 12.50 ± 1.91 mm on the left side; p=0.451). Accessory mental foramina were observed in 10.56% of mandibles, typically below the first molar.

Conclusion: The study confirms the predominant oval shape and second premolar alignment of the mental foramen, with no significant bilateral differences in morphometric measurements. The incidence of accessory mental foramina underscores the need for careful preoperative assessment. These findings enhance the anatomical knowledge base for dental surgeons, aiding in safer surgical planning and anesthesia administration.

***Keywords*:** Mental Foramen, Accessory Mental Foramen, Mandible, Morphometry, Dental Surgery

INTRODUCTION

The complex array of foramina pervading the craniofacial skeleton is essential passageways for neurovascular structures, and they are responsible for sensory and motor innervation and vascular supply to the

face and cranium[1].

Foramina such as those of the trigeminal nerve are responsible for transmitting nerves and vessels, and locations and diameters are utmost important for surgical and diagnostic interventions[2]. The mental foramen, a very critical anatomical landmark on the anterior surface of the mandible, is of critical clinical significance for dental and surgical treatment. Accurate information about the position and morphometry of the mental foramen is essential for some dental treatments, including dental implant insertion, periodontal surgery, and endodontic procedures, and surgical interventions on the mandible[3].

The mental foramen is an opening resembling a funnel on the anterolateral aspect of the mandibular body, about 11-15 mm above the inferior border. It allows passage for the mental nerve and vessels. The mental nerve is an extension of the inferior alveolar nerve, supplying sensory innervation to the lower lip, vestibule, and gingival mucosa up to the first premolar tooth. The mean diameter of the foramen is 4.6 mm in the horizontal plane and 3.4 mm in the vertical plane. Most mental foramina are posterosuperiorly oriented, either along the longitudinal axis of the second premolar tooth or between the first and second premolars. The orientation of the mental foramen also alters with age - it is anteriorly oriented prior to mandibular fusion during the first few years of life, afterwards becoming posterior following the second or third year. The position of the mental foramen differs between racial groups. In Mongoloid groups, it aligns with the second premolar, whereas in Black groups, it is behind the second premolar. In Caucasians, the mental foramen is in front of the second premolar[4]. The site of the mental foramen depends mostly on age, sex, race, and dental status.

The occurrence of nerve fibers within accessory foramina could be of importance in the efficacy of local anesthesia after a standard inferior alveolar nerve block. Also, blood vessels located in accessory foramina can be a source of intra osseous hemorrhages in implant procedures[5]. Notably, the mental foramen is usually challenging to identify since it is not clinically visible and palpable. Hence, understanding of the mental foramen is necessary to allow diagnostic, surgical, local anesthetic and other invasive oral and maxillofacial procedures, and to avoid injury during surgical and anesthetic techniques which could lead to paresthesia and total loss of sensation. And the research on the mental foramen is necessary not only for surgical and diagnostic purposes, but also for identifying possible variations in various populations.

2. MATERIALS AND METHODS

Our study includes 150 dry human mandibles of unknown sex and age collected from department of Anatomy of Osmania medical college, Hyderabad and various other medical colleges in and around Hyderabad. Random selection of mandibles was done, labeled and measurements were taken. Data collected entered in Microsoft excel sheets, tables and graphs are generated by statistical software XLSAT2017. 'p' and 't' values are generated by using Student's 't' test by SPSS 12.0 statistical software.

The following parameters of mental foramen of each mandible are taken for the study.

A. Non-Metric Parameters.

1. The shape of mental foramen.
2. The position of mental foramen.
3. Presence of accessory mental foramen. (These were recorded by naked eye examination.)

B. Metric Parameters.

1. Size of mental foramen. (Measured with the help of vernier calipers.)
   a. Horizontal diameter of mental foramen.
   b. Vertical diameter of mental foramen.
2. Location of mental foramen in relation to mandibular parameters. (Measured with the help of vernier calipers.)
   a. Distance from symphysis menti to anterior margin of mental foramen.
   b. Distance from posterior border of ramus of mandible to posterior margin of mental foramen.
   c. Distance from alveolar margin to upper margin of mental foramen.
   d. Distance from the lower border of the body to the lower margin of mental foramen.

3.RESULTS

A. Non-Metric Parameters:

3.1. The Shape of Mental Foramen

In our study150 dry human mandibles, shape of mental foramen is observed by naked eye examination. The various shapes found in this study are oval shape, round shape. Oval shape is the most common shape, and round is the next common shape in this study.

On the right side the oval shape is seen in 116 mandibles (77.3%), on the left side oval shape is seen in 119 mandibles (79.3%). On the right side round shape is seen in 34 mandibles (22.6%), on the left side round shape is seen in 31 mandibles (20.6%).

Table 1. The Shape of Mental Foramen

S.NO	SHAPE	RIGHT SIDE	LEFT SIDE
1	Oval	116(77.3%)	119(79.3%)
2	Round	34(22.6%)	31(20.6%)
Total		150(100%)	150(100%)

3.2. Position of Mental Foramen:

In present study position of mental foemen is observed by naked eye examination.

Positioning relations to the roots of mandibular teeth may vary. According to Tebo and Telford positions divided as 6 types (Balakrishnan et al., 2018; Sevmez, Bahşi and Orhan, 2021).

1. between the canine and the first premolar.
2. beneath the first premolar
3. between the premolars
4. beneath the second premolar
5. between the second premolar and first molar
6. beneath the root of the first molar

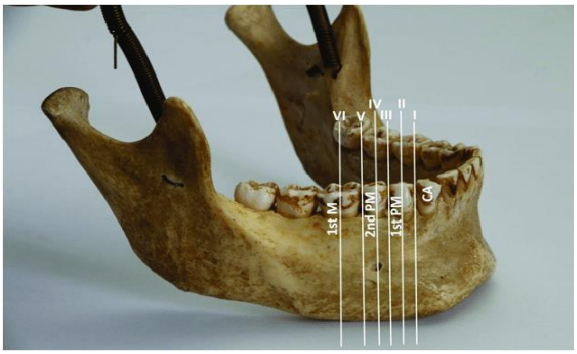

Figure 1. Diagram Showing Position of Mental Foramen in Relation to Mandibular Teeth

Most common position on the right side is type 4 seen in 88 mandibles (58.6%), followed by type 3 seen in 28 mandibles (18.6%), type 5 is seen in 20 mandibles (13.3%), type 6 is seen in 8 mandibles (5.33%). Most common position on the left side is type 4 seen in 86 mandibles (57.3%), followed by type 3 seen in 34 mandibles (22.6%), type 5 is seen in 19 mandibles (12.6%), type 6 is seen in 5 mandibles (3.33%). 6 mandibles are edentulous. Hence, unable to locate the position of mental foramen.

Table 2. Percentage Distribution of Position of Mental Foramen

S.No	Position	Right	Left
1	Type1	-	-
2	Type2	-	-
3	Type3	28(18.6%)	34(22.6%)
4	Type4	88(58.6%)	86(57.3%)
5	Type5	20(13.3%)	19(12.6%)
6	Type6	8(5.33%)	5(3.33%)

3.3. Presence of Accessory Mental Foramen

In our study the presence of accessory mental foramen is observed by naked eye examination. Accessory mental foramen is found on the right side in 9 mandibles (6%) and on left side in 2 mandibles (1.33%).

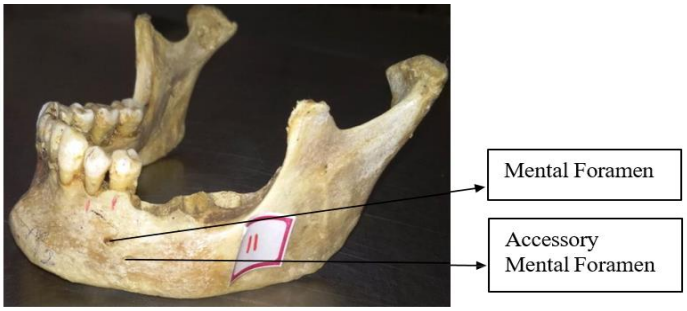

Figure 2. Diagram Showing Presence of Accessory Mental Foramen

S.NO	SIDE	RIGHT	LEFT
1	Number of accessory mental foramen	9(6%)	2(1.33%)

3.4. Size of Mental Foramen

The size of mental foramen is measured by taking horizontal diameter and vertical diameter of mental foramen with help of digital Vernier caliper.

a. Horizontal diameter of mental foramen

In present study horizontal diameter of mental foramen on right side ranges between 1.03-5.12 mm with arithmetic mean of 2.6779 mm with median 2. 65 mm and standard deviation is found to be 0.85681mm. On the left side ranges between 1.01- 4.24 mm with an arithmetic mean of 2.63597 mm with a median of 2.47 mm and standard deviation is found to be 0.8356 mm. t-value is 1.65001, p-value is 0.3345. Statistically there is no significance is seen.

Table 4. Incidence of Horizontal Diameter of Mental Foramen

S.No		Right	Left
1	Minimum	1.03mm	1.01mm
2	Maximum	5.12mm	4.24mm
3	Mean	2.67792mm	2.63597mm
4	Median	2.65mm	2.47mm
5	Standard Deviation	0.85681mm	0.8356mm
6	t-value	1.65001	
7	p-value	0.3345	

b.Vertical diameter of mental foramen: In present study vertical diameter of mental foramen on right side ranges between 1.05-4.67 mm with arithmetic mean 2.05309 mm with median 1.96 mm. Standard deviation found to be 0.63741 mm. On left side ranges between 1.01-4.13 mm with arithmetic mean 2.14866 mm with median 2.04 mm. Standard deviation found to be 0.68416 mm. t-value is 1.65001, p-value is 0.1065. Statistically there is no significance that is present.

Table 5. Incidence Of Vertical Diameter of Mental Foramen

S.NO		RIGHT	LEFT
1	Minimum	1.05mm	1.01mm
2	Maximum	4.67mm	4.13mm
3	Mean	2.05309mm	2.14866mm
4	Median	1.96mm	2.04mm
5	Standard deviation	0.63741mm	0.68416mm
6	t-value	1.65001	
7	p-value	0.1065	

3.5. Location of Mental Foramen with Respect to Mandibular Parameters:

In our study the position of mental foramen with respect to the borders were also measured with help of digital Vernier calipers.

a. **Distance from symphysis menti to anterior margin of mental foramen:**

The distance between symphysis menti to anterior margin of mental foramen ranges between 17.02-30.66 mm on right side with arithmetic mean 25.1187 mm with 25.15 mm median and standard deviation 2.31048 mm. On left side ranges between 18.01-30.56 mm with arithmetic mean of 25.0241 mm median 25.06 mm. Standard deviation 2.23835 mm. t-value is 1.65001, p-value is 0.3598. Statistically there is no difference between right and left sides of this parameter.

Table 6. Incidence Of Distance Between Symphysis Menti to Anterior Margin of Mental Foramen

S.No		Right	Left
1	Minimum	17.02mm	18.01mm
2	Maximum	30.66mm	30.56mm
3	Mean	25.1187mm	25.0241mm
4	Median	25.15mm	25.06mm
5	Standard deviation	2.31048mm	2.23835mm
6	t-value	1.65001	
7	p-value	0.3598	

b. Distance from posterior border of ramus of mandible to posterior margin of mental foramen.

The distance from the posterior margin of mental foramen to posterior border of mandible ranges between 31.88-70.98 mm on right side with an arithmetic mean of 62.537 mm, median 63. 01 mm and standard deviation is 6.18123 mm. On the left side ranges between 31.82-71.47mm with the arithmetic mean of 63.0644mm, median of 63.31 mm and standard deviation of 5. 2323 mm. t-value is 1.65016, p-value is 0. 2136. statistically there is no significance seen.

Table 7. Incidence Of Distance from Posterior Margin of Mental Foramen to Posterior Border of Ramus Mandible.

S.No		Right	Left
1	Minimum	31.88 mm	31.82 mm
2	Maximum	70.98 mm	71.47 mm
3	Mean	62.537 mm	63.06 mm
4	Median	63.01 mm	63.31 mm
5	Standard Deviation	6.18123 mm	5.23 mm
6	t-value	1.65016	
7	p-value	0.2136	

b. Distance from alveolar margin to upper margin of mental foramen

The distance from alveolar margin to upper margin of mental foramen ranges between 3.19-16.34mm on right side with mean 10.814 mm, median 11.33mm and standard deviation 2.80834 mm. On left side ranges between 3.66-18.88mm with mean 10.7376mm, median 11. 18mm and standard deviation 2. 81248 mm. t-value is1.65001, p-values 0. 4073. Statistically there is no significance present.

Table 8. Incidence Of Distance from Alveolar Margin to Upper Margin of Mental Foramen of Mandible

S.No		Right	Left
1	Minimum	3.19 mm	3.66 mm
2	Maximum	16.34 mm	18.88 mm
3	Mean	10.814 mm	10.7376 mm
4	Median	11.33 mm	11.18 mm
5	Standard Deviation	2.80834 mm	2.81248 mm
6	t-value	1.65001	
7	p-value	0.4073	

c. Distance from the lower border of the body to the lower margin of mental foramen: The distance from lower margin of mental foramen to base of mandible ranges between 6.63-16.98 mm on right side with mean 12.4752 mm, median 12.56 mm. Standard deviation 1.90751 mm. On left side, ranges present between 6.35-16.98 mm with mean 12.5022 mm, median 12.65 mm. Standard deviation 1.91399 mm. t-value is1.65001, p-value is 0.4515. Statistically there is no significance that is present.

Table 9. Incidence of Distance from Lower Margin of Mental Foramen to Base of Mandible

S.No		Right	Left
1	Minimum	6.63mm	6.35mm
2	Maximum	16.98mm	16.98mm
3	Mean	12.4752mm	12.5022mm
4	Median	12.56mm	12.65mm
5	Standard Deviation	1.90751mm	1.91399mm
6	t-value	1.65001	
7	p-value	0.4515	

DISCISSION

A. Non-Metric Parameters:

4.1. Shape of the Mental Foramen:

According to standard textbooks, mental foramen shape is an oval shaped opening located at anterolateral aspect of the body of the mandible. According to the data assessed in the study Most common shape is oval shape seen on right side in 116 mandibles (77.3%), on left side is seen in 119 mandibles (79.3%). And the next common shape is round seen on the right side in 34 mandibles (22 .3%), on left side round shape is seen in 31 mandibles (20.6%).

The findings of the present study are consistent with these prior observations. Specifically, several studies have found the oval shape to be predominant, accounting for 83.3% to 88.6% of cases bilaterally [6-8]. The round shape was less common, reported in 11.4% to 16.7% of cases[6,8]. These results from the literature align with the findings of the current investigation. Variations in the reported prevalence of oval and round shapes across studies may be attributed to differences in sample size and population characteristics. Overall, the available evidence suggests that the oval shape is the most frequently encountered morphology of the mental foramen. The importance of shape of mental foramen is, it is widely variable in different individuals, helpful in racial identification.

4.2. Position of the Mental Foramen:

Position in relation to the roots of mandibular teeth may vary. According to Tebo and Telford positions are divided into 6 types. Type1- between the canine and the first premolar, type 2- beneath the first premolar, type 3 - between the premolars, type 4- beneath the second premolar, type 5- between the second premolar and first molar, and type 6 - beneath the root of the first molar.

In our study the most common position of mental foramen in relation to the mandibular teeth is type 4 seen in 88 mandibles (58.6%) on right side, on left side 86 mandibles (57.3%). Type 3 is seen in 28 mandibles (18.6%) on the right side, 34 on the left side (22.6%), type 5 seen in 20 mandibles (13.3%) on the right side,19 mandibles (12.6%) on left side. Type6 is seen in 8 mandibles (5.33%) on the right side, on the left side 5 mandibles (3.33%). The positional distribution of mental foramen, particularly the prevalence of type 4 and the least common positional types, has been extensively studied, with findings revealing both consistencies and variations when compared to the present study. Oliveira Junior et al. (2009)[9] reported a bilateral prevalence of type 4 at 45.17%, which is notably lower than the prevalence observed in the present study. Additionally, their identification of type 6 as the least common position, with 3.22% on the right side and 1.52% on the left side, similarly reflects lower values compared to the current findings. These differences may suggest variations in sample populations or methodological approaches, such as imaging techniques or classification criteria. In contrast, Devi K Sankar et al. (2011)[10] reported a higher bilateral prevalence of type 4 at 73.2%, slightly exceeding the present study's findings. However, their observation of type 5 as the least common position (7.8% bilaterally) diverges from the current study, indicating potential discrepancies in anatomical distribution or diagnostic criteria across study populations.

Rakhi Rastogi et al. (2012)[11] and Virendra Budhiraja et al. (2012)[7] both corroborate the present study's identification of type 4 as the most common position, with prevalences of 52.8% on the right side and 54% on the left side in the former, and 61% on the right side and 59% on the left side in the latter. However, their findings on the least common types differ, with Rastogi et al. identifying type 2 (3.4% bilaterally) and Budhiraja et al.[7] identifying type 6 (0.9% right, 1.9% left). Ajay Parmar et al. (2013)[12] and K Udhaya et al. (2013)[13] further support the predominance of type 4, with prevalences of 64.7% on the right side and 66.7% on the left side in the former, and 52.22% on the right side and 51.11% on the left side in the latter, aligning closely with the present study. However, while Parmar et al.'s identification of type 6 as the least common (3.9% right, 2% left) is consistent with the current findings, Udhaya et al.'s report of type 2 (4.44% bilaterally) as the least common does not align, underscoring variability in less prevalent positional types. Rahul Rai et al[14]. (2014) reported a notably higher bilateral prevalence of type 4 at 81.52%, surpassing the present study's findings. Their identification of type 6 as the least common (7.9%) aligns with the current study, suggesting consistency in the lower prevalence of this type. Similarly, Kasat PA et al. (2016)[16] and Muna Kadel et al.[17] (2016) reported type 4 as the most common position (46.5% bilaterally and 58% right/69% left, respectively) and type 6 as the least common (2% bilaterally and 2% right/3% left, respectively), both of which are consistent with the present study's findings.

The consistent identification of type 4 as the most prevalent position across all reviewed studies underscores its anatomical significance.

However, the variability in prevalence rates and the least common positional types suggests potential influences from factors such as sample size, population demographics, or methodological differences in classification or imaging techniques. Additionally, population-specific anatomical variations, possibly influenced by genetic or environmental factors, could account for the observed differences. Clinical importance of position of mental foramen: mental foramen is difficult to localize as there are no absolute anatomical landmarks for reference. The mental foramen cannot be visualized or palpated clinically; hence it is localized in relation to the lower teeth. So, knowledge of the most common position of the mental foramen in relation to lower teeth is important for dental surgeons both while administering regional anesthesia and performing periapical surgeries of mandible.

4.3. Presence of Accessory Mental Foramen:

In our study accessory mental foramen on the right side are present in 9 mandibles (6%), and on the left side 2 (1.33%) mandibles. The incidence of accessory mental foramen has been investigated in several studies, with findings demonstrating both alignment and variability when compared to the present study. Alma Soljevica et al. (2006) reported an accessory mental foramen incidence of 2.7%, which is lower than the prevalence observed in the present study. Similarly, K Udhaya et al. (2013)[13], Ronak Zarei et al[17]. (2014), Vimala et al. (2014)[18], Muna Kadel et al.[16] (2016), Kasat et al.[15] (2016), and Raja Sekhar Katikireddi et al. (2016)[19] reported lower accessory mental foramen incidences, ranging from 1.5% to 3.33% across right and left sides. Specifically, Udhaya et al.[13] (2013) found incidences of 2.22% on the right side and 3.33% on the left side, Zarei et al. (2014)[17] reported 2% on the right side and 3% on the left side, Vimala et al.[18] (2014) observed 2.6% bilaterally, Kadel et al.[16] (2016) noted 3% bilaterally, Kasat et al.[15] (2016) reported 1.5% on the right side, and Katikireddi et al.[19] (2016) found 2% on the right side. These consistently lower incidences compared to the present study may reflect variations in sample populations, imaging techniques, or diagnostic criteria used to identify accessory mental foramen.

In contrast, Devi K Sankar et al.[10] (2011) reported a higher accessory mental foramen incidence of 8.9%, surpassing the findings of the present study. This discrepancy may be attributed to differences in methodological approaches, such as the use of advanced imaging modalities or broader inclusion criteria for identifying accessory mental foramen, which could increase detection rates. Studies by Rajani Singh et al. (2010)[20], Virendra Budhiraja et al. (2012)[7], and Ritika Patel et al.[21] (2015) reported accessory mental foramen incidences that align closely with the present study. Singh et al. (2010) found incidences of 5% on the right side and 8% on the left side, Budhiraja et al.[7] (2012) reported 6.6% bilaterally, and Patel et al.[21] (2015) observed 6.45% on the right side and 1.61% on the left side. The congruence of these findings with the present study suggests a degree of consistency in accessory mental foramen prevalence within certain populations or methodological frameworks. Significance of accessory mental foramen: The presence of nerve fibers in accessory foramina may be significant in the effectiveness of local anesthesia following a routine inferior alveolar nerve block. Blood vessels present in accessory foramina can be a cause of intraosseous hemorrhages during implant procedures.

B. **Metric Parameters:**

4.4. Size of Mental Foramen:

In present study horizontal diameter of mental foramen on the right side ranges from1.03-5.12 mm and on the left side 1.01- 4.24 mm and the vertical diameter of mental foramen on the right side ranges 1.05- 4.67 mm and on the left side 1.01- 4.13 mm. The mean, standard deviation, median and p-value are presented in table numbers 4 & 5. Alma Voljevica et al.[6] (2006) reported mean vertical diameters of 1.71 mm on the right side and 1.69 mm on the left side and mean horizontal diameters of 2.56 mm on the right side and 2.41 mm on the left side. These values align closely with the present study, suggesting consistency in the morphometric profile of the mental foramen across comparable populations or methodologies. Similarly, Deepa Rani Agrwal et al.[22] (2011) found mean horizontal diameters of 3.33 mm on the right side and 3.25 mm on the left side and mean vertical diameters of 2.15 mm on the right side and 2.13 mm on the left side, which also corroborate the present study's findings. The agreement between these studies and the current results may reflect standardized measurement techniques or similar population characteristics.

In contrast, Virendra Budhiraja et al.[7] (2012) reported higher mean values, with vertical diameters of 2.61 ± 0.17 mm on the right side and 2.53 ± 0.14 mm on the left side, and horizontal diameters of 5.19 ± 0.24 mm on the right side and 5.12 ± 0.28 mm on the left side. These values exceed those observed in the present study, potentially due to differences in imaging modalities, such as the use of cone-beam computed tomography versus conventional radiography, which may offer greater precision in detecting foramen boundaries. Similarly, Hussain Sahib Shaik et al. (2012) reported mean horizontal and vertical diameters of 3.91 mm and 2.50 mm, respectively, with

standard deviations of 0.82 mm and 0.61 mm, which are higher than the present study's findings but show comparable variability, as indicated by the standard deviations aligning with the current results. K Udhaya et al. (2013) reported mean vertical and horizontal diameters on the left side of 2.52 ± 0.87 mm and 2.95 ± 0.68 mm, respectively, and on the right side of 2.86 ± 0.83 mm and 2.28 ± 0.71 mm, respectively. Priya P Roy et al. (2014) found the mean horizontal diameters of 3.01 mm on the right side and 3.22 mm on the left side and mean vertical diameters of 2.24 mm on the right side and 2.11 mm on the left side, with the vertical diameter findings aligned with the present study, while the horizontal diameters are slightly higher. Rahul Rai et al. (2014) reported mean horizontal diameters of 2.63 ± 0.85 mm on the right side and 2.61 ± 0.85 mm on the left side, and vertical diameters of 2.33 ± 0.64 mm on the right side and 2.29 ± 0.60 mm on the left side, which closely match the present study, further supporting consistency in certain morphometric parameters across studies.

4.5. Location of mental foramen in relation to mandibular parameters.

The Location of the mental foramen position relative to mandibular parameters, including the symphysis menti, posterior border of the mandible, alveolar margin, and base of the mandible.

a. Distance from Symphysis Menti to Anterior Margin of Mental Foramen:

Several studies align closely with the present study's findings on the mean distance from the symphysis menti to the anterior margin of the mental foramen. Alma Voljevica et al.[6] (2006), Deepa Rani Agarwal et al.[22] (2011), Rakhi Rastogi et al.[11] (2012), Hussain Sahib Shaik et al.[24] (2012), K Udhaya et al.[13] (2013), Ritika Patel et al.[21] (2015), Rakesh Kumar Shukla et al. [8](2015), Muna Kadel et al.[16] (2016), and Samreen Siraj Bala et al. (2017)[23] reported mean distances ranging from [24].19–26.71 mm, closely matching the present study. Conversely, Singh et al.[20] (2010) and Devi K Sankar et al. (2011)[10] reported higher values (29.3–30.6 mm and 27.2–27.7 mm, respectively), while Ajay Parmar et al.[12] (2013) and Rahul Rai[14] et al. (2014) reported lower values (22.23–23.30 mm). These differences may reflect variations in population demographics or measurement techniques, such as radiographic modalities.

b. Distance from Posterior Margin of Mental Foramen to Posterior Border of Mandible:

The present study found mean distances of 62.54 mm on the right side and 63.06 mm on the left side, with no statistically significant difference (p=0.213). Studies by Rakhi Rastogi et al. (2012), Ajay Parmar et al. (2013), K Udhaya et al.[13] (2013), Rahul Rai et al. (2014), Ritika Patel[11] et al. (2014), Rakesh Kumar Shukla et al.[8] (2015), and Muna Kadel et al.[16] (2016) reported mean distances (61.3–66.68 mm) that align with the present study. In contrast, Alma Voljevica et al.[6] (2006) reported lower values (58.68–59.34 mm), and Devi K Sankar et al.[10](2011) reported higher values (70.7 mm bilaterally). Standard deviations in most studies (4.06–5.38 mm) are comparable to the present study's (5.23–6.18 mm), suggesting similar measurement variability.

c. Distance from Alveolar Margin to Upper Margin of Mental Foramen:

The present study observed mean distances of 10.81 mm on the right side and 10.74 mm on the left side, with no significant difference (p=0.4073). Rakhi Rastogi et al.[11] (2012), Ajay Parmar et al.[12] (2013), Rahul Rai et al.[14] (2014), Rakesh Kumar Shukla et al.[8] (2015), and Samreen Siraj Bala et al.[23] (2017) reported similar values (10.26–11.48 mm), while Oliveira Junior et al.[9] (2009), Hussain Saheb Shaik et al.[24] (2012), and K Udhaya et al.[13] (2013) reported slightly higher values (12.02–13.84 mm). Devi K Sankar et al.[10] (2011) and Alma Voljevica et al.[6] (2006) reported notably higher values (13.7–16.4 mm), possibly due to differences in imaging resolution or anatomical variations.

d. Distance from Lower Margin of Mental Foramen to Base of Mandible:

The present study found mean distances of 12.48 mm on the right side and 12.50 mm on the left side, with no significant difference (p=0.4515). Alma Voljevica et al. [6](2006), Oliveira Junior et al.[9] (2009), Deepa Rani Agarwal et al. [22](2011), Hussain Saheb Shaik et al.[24] (2012), K Udhaya et al. [13](2013), Rahul Rai et al.[14] (2014), Ritika Patel et al.[21] (2015), Rakesh Kumar Shukla et al.[8] (2015), Muna Kadel et al.[16] (2016), and Samreen Siraj Bala et al.[23] (2017) reported values (10.69–13.38 mm) that closely align with the present study. Devi K Sankar et al.[10] (2011) and Rakhi Rastogi et al. [11](2012) reported higher values (14.3–16.5 mm), while Ajay Parmar et al. [12](2013) reported lower values (10.7 mm bilaterally). Standard deviations (1.23–4.83 mm) are generally consistent with the present study's (1.91–1.91 mm).

CONCLUSION

Our study reinforces the critical importance of a thorough understanding of the mental foramen's anatomy, including its location and the potential presence of accessory mental foramina. This knowledge is indispensable for clinicians performing anesthetic blocks in the lower anterior teeth region and for surgeons aiming to preserve the integrity of the mental nerve during surgical interventions. Accurate localization of the mental foramen is essential to prevent nerve damage, which can lead to temporary or permanent sensory alterations, including thermal and tactile changes. The high prevalence of oval-shaped mental foramina observed in our study suggests that this is a common anatomical feature in south-indian population. This information is valuable for surgeons as they plan their approaches to the mental region of the mandible. The presence of accessory mental foramina, although less frequent, is also a significant consideration, as these structures can potentially house additional nerve branches that may be at risk during surgical procedures. We recommend that future studies expand on this research by including larger sample sizes and investigating the influence of age, sex, and ethnicity on the mental foramen's morphometry.

DECLARATIONS

Ethical approval and consent to participate
Not Applicable
Availability of data and material
All data generated or analyzed during this study are included in the published article.
Competing interest
The authors declare that there are no competing interests.
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