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Morphology and Morphometry of Mental Foramen in Dry Human Mandibles and its Clinical Implications.

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INTRODUCTION: Mental foramen is a round or an oval structure located on the anterior surface halfway between the superior and inferior border of the mandible. This study has been conducted to evaluate the size, shape and position of mental foramen with respect to various anatomical landmarks.**MATERIALS AND METHODS :**A total of 30 dry adult human mandibles with full dentition and intact alveolar margin of unknown sex and age were collected from the department of Anatomy, Sheri Kashmir institute of medical sciences Bemina Srinagar Kashmir to conduct the study. The mandibles used in the study were legally permitted for the purpose of education and research and the required permission was taken from the Head of the Department of Anatomy of Sheri Kashmir institute of medical sciences Bemina Srinagar Kashmir. The size, shape and position of mental foramen was observed on the right and left side of mandible. The measurements were calculated using sliding Vernier Calliper.The horizontal and vertical dimensions of each mental foramen were measured.

The data for the present study was entered in the Microsoft Excel 2010 and was analyzed using the Statistical Package for the Social Sciences(SPSS) statistical software 19.0 Version. The descriptive statistics included mean and standard deviation. The level of the significance for the present study was fixed at $p<0.05\%$.**RESULTS:-** A total of 30 dry adult human mandibles with full dentition and intact alveolar margin of unknown sex and age were ascertained for the anthropometric measurement of mental foramen. The shape of the mental foramen was evaluated by visual method. Out of 30 mandibles (60 sides) 70% were oval and 30% were round in shape on the left side. On the right side 73% were oval in shape and 27% were round in shape. The position of mental foramen with respect to mandibular dentition was evaluated. In this study position 4 was found to be the most common position of mental foramen while position 3 was the next common position on both left and right sides of mandible.The dimensions of mental foramen were evaluated by measuring their vertical diameter(VD) and horizontal diameter(HD).The average VD of MF was 3.8±0.8mm on right side and 3.1±1.2mm on the left side. The average HD of MF was 3mm±1mm on right side and 3.8±1.1mm on left side. **CONCLUSION** The present study analyses variations in shape, size and position of mental foramen. The variability of the location of mental foramen should be considered by the dental surgeons while planning surgery in order to avoid neural damage and enable the efficacy of mental nerve anaesthetic block during the closed endodontic and periodontal surgeries. In the present study it has been found that majority of mandibles had oval shaped foramina lying in position 4. Nonetheless differences do exist in the shape and location in various different populations.The anthropometric information of mental foramen illustrated in this article can be of use to anatomists, surgeons, orthodontists and forensic odontologists to determine the location of mental foramen in order to conduct various clinical procedures.

KEY WORDS: Mental foramen, Alveolar margin,Nerve block

I. INTRODUCTION

Mental foramen is a round or an oval structure located on the anterior surface halfway between the superior and inferior border of the mandible.[1] It is usually present below or between the apex of first and second premolar.[2] The mental nerve and vessels exit through the mental foramen and innervate lower lip, gingival tissues and lower face.[2] It is a significant landmark as it helps in undergoing various surgical procedures, local anaesthetic nerve blocks and various other

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procedures which are invasive in nature.[3] Substantial amount of knowledge needs to be considered prior to the surgery in order to prevent the neurovascular damage.[3] The variability of the position of the mental foramen has been documented in literature and it is seen to be present more posteriorly in blacks than in whites.[1] The position of mental foramen can be studied by measuring it on dry mandible or by the use of radiographs.[2] This study has been conducted to evaluate the size, shape and position of mental foramen with respect to various anatomical landmarks.

II. MATERIALS AND METHODS

1.1 Sample Size

A total of 30 dry adult human mandibles with full dentition and intact alveolar margin of unknown sex and age were collected from the department of Anatomy, Sheri Kashmir institute of medical sciences Bemina Srinagar Kashmir to conduct the study. The mandibles used in the study were legally permitted for the purpose of education and research and the required permission was taken from the Head of the Department of Anatomy of Sheri Kashmir institute of medical sciences Bemina Srinagar Kashmir. The size, shape and position of mental foramen was observed on the right and left side of mandible. The measurements were calculated using sliding Vernier Calliper.The horizontal and vertical dimensions of each mental foramen were measured. The positions of the mental foramen with respect to the mandibular dentition were determined as under:

Position 1: Ahead of first premolar
Position 2: In line with first premolar
Position 3: In the middle of first and second premolar
Position 4: In line with second premolar
Position 5: Between the second premolar and first molar
Position 6 : In line with first molar

The size of mental foramen was ascertained by calculating the distance of MF from numerous landmarks like lower border of mandible, alveolar crest,posterior border of ramus and symphysis menti. The measurements included the following:

1. **AC:** Distance from alveolar crest to upper margin of mental foramen.
2. **BD:**Distance from lower border of mandible to lower margin of mental foramen.
3. **AB:**Distance from alveolar crest to lower border of mandible.
4. **WX:**Distance from symphysis menti to posterior border of ramus.
5. **WY:**Distance from symphysis menti to medial margin of mental foramen
6. **XZ:**Distance from posterior border of ramus to lateral margin of mental foramen.

Fig 1Location of mental foramen with reference to various parameters of mandible.

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III. STATISTICAL ANALYSIS

The data for the present study was entered in the Microsoft Excel 2010 and was analyzed using the Statistical Package for the Social Sciences(SPSS) statistical software 19.0 Version. The descriptive statistics included mean and standard deviation. The level of the significance for the present study was fixed at p<0.05%.

IV. RESULTS:-

A total of 30 dry adult human mandibles with full dentition and intact alveolar margin of unknown sex and age were ascertained for the anthropometric measurement of mental foramen. The shape of the mental foramen was evaluated by visual method. Out of 30 mandibles (60 sides) 70% were oval and 30% were round in shape on the left side. On the right side 73% were oval in shape and 27% were round in shape.(Table1).

TABLE 1: SHAPE OF MENTAL FORAMEN

	RIGHT SIDE	RIGHT SIDE
SHAPE	FREQUENCY	PERCENTAGE
OVAL	22	73%
ROUND	8	27%
	LEFT SIDE	LEFT SIDE
SHAPE	FREQUENCY	PERCENTAGE
OVAL	21	70%
ROUND	9	30%

TABLE 2: Comparison of shape of mental foramen between present study and other study

AUTHOR	OVAL	ROUND
Singh and Srivastav	6%	94%
Gershenson et al	65.5%	34.5%
Agarwal and Gupta	92%	8%
Mbajiorgu et al	56.3%	43.8%
Present study	73%	30%

The position of mental foramen with respect to mandibular dentition was evaluated. In this study position 4 was found to be the most common position of mental foramen while position 3 was the next common position on both left and right sides of mandible.

TABLE 3: Frequency distribution of Position of Mental Foramen

	RIGHT SIDE	RIGHT SIDE	LEFT SIDE	LEFT SIDE
POSITION	FREQUENCY	PERCENTAGE	FREQUENCY	PERCENTAGE
1	0	0%	0	0%
2	2	6.6%	2	6.6%
3	5	16.6%	5	16.6%
4	23	76.6%	23	76.6%
5	0	0%	0	0%
6	0	0%	0	0%

The dimensions of mental foramen were evaluated by measuring their vertical diameter(VD) and horizontal diameter(HD).The average VD of MF was 3.8±0.8mm on right side and 3.1±1.2mm on the left side. The average HD of MF was 3mm±1mm on right side and 3.8±1.1mm on left side. The Mental foramina were positioned at mean BD of 12.8±1.4mm and mean AC of 14.5±2.5mm on the left side.The mean BD of 12.9±1.5mm and mean AC of 14.7±2.5mm on the right side.The

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mean WY was 25±2.5mm on the left side and 25±2.8mm on the right side. The mean XZ on the left side was 64±4.1mm and mean XZ was 64±4mm on right side.The mean XW was 95.4±5.1mm on left side and 95.3±5.3mm.

TABLE 4: DIMENSIONS OF MENTAL FORAMEN

	RIGHT SIDE	RIGHT SIDE	LEFT SIDE	LEFT SIDE
DIMENSIONS(mm)	**HD**	**VD**	**HD**	**VD**
MINIMUM	2.5	3.2	3.2	2.1
MAXIMUM	3.5	4.5	4.5	4.1
AVERAGE	3	3.8	3.8	3.1

V. DISCUSSION

SHAPE Mental foramen is situated midway between the superior and inferior border of body of mandible according to Marzola (1989) and Picosse (1982).[4] Mental foramen has been found to be oval in shape among various populations.[2] Budhiraja V et al (2013) observed oval contour of mental foramen in 74.3% mandibles and a round shaped mental foramen in 25.7% which is similar to that of present study.[5] A study conducted by Akhilandeswari et al (2016)[6] amongst south Indian population also depicted more prevalence of oval contour of mental foramen which is also in accordance to the present study.[6]

POSITION The position of mental foramen is a significant parameter in terms of the anaesthetic blocks and surgery.[5] There are important differences observed in the position of mental foramen amongst various racial groups.[2] Igbigbi and lebona[7] in Malawians and Mbajiorgu et al[8] in Zimbabwean mandibles reported position III as the commonest one followed by position IV. Santini and Land[9] in British and Green[10] in Chinese mandibles observed position II being the most common followed by position III. In the present study it was observed that position 4 was found to be the most common position of mental foramen while position 3 was the next common position on both left and right sides of mandible.

DIMENSIONS The size of the mental foramen was also measured in the present study. The dimensions of mental foramen were ascertained by measuring their vertical diameter(VD) and horizontal diameter(HD). The average VD of MF was 3.8±0.8mm on right side and 3.1±1.2mm on the left side. The average HD of MF was 3mm±1mm on right side and 3.8±1.1mm on left side. In a study conducted by Singh and SrIvastav[4], only the horizontal diameter was measured and the results depicted the mean HD of 2.79 mm on right side and 2.57 mm on the left side which is lesser than the present study.

VI. CONCLUSION

The present study analyses variations in shape, size and position of mental foramen. The variability of the location of mental foramen should be considered by the dental surgeons while planning surgery in order to avoid neural damage and enable the efficacy of mental nerve anaesthetic block during the closed endodontic and periodontal surgeries. In the present study it has been found that majority of mandibles had oval shaped foramina lying in position 4. Nonetheless differences do exist in the shape and location in various different populations.The anthropometric information of mental foramen illustrated in this article can be of use to anatomists, surgeons, orthodontists and forensic odontologists to determine the location of mental foramen in order to conduct various clinical procedures.

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