

**Research Article**

**Position, shape and direction of the mental foramen in mandibles in South-Eastern Nigeria**

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**Abstract**

**Objectives:** The mental foramen is an important anatomical and clinical landmark for undertaking a successful mental nerve anesthetic block during clinical and surgical procedures in the mandibular and mental region. This study was aimed at studying and documenting the position, shape and direction of opening of the mental foramen in dry mandibles in South-Eastern Nigeria.

**Methods:** 66 dry adult human mandibles obtained from the region of study were used and the parameters visually examined. The position was determined in relation to the mandibular teeth, the shape was determined with the aid of a hand lens and the direction with the aid of a thin office pin inserted into the foramen.

**Results:** The most prevalent position of the mental foramen was shown to be in line with the longitudinal axis of the second premolar teeth (58.33%) followed by the position between the second premolar and the first molar (25.76%). Round shaped foramen was more prevalent (75.76%) than the oval shaped foramen (25.24%) and the foramen pointed posterosuperiorly in 73.48% and anterosuperiorly in 21.21% of the mandibles. It was also observed that there were symmetrical occurrences in majority of the mandibles.

**Conclusion:** The present study showed the average morphology of the mental foramen in the population studied. It may be useful in population diagnosis, clinical practices and in forensic medicine.

**Keywords:** Mandibles, mental foramen, South-Eastern Nigeria

**1. Introduction**

The mental foramen is located on the anterolateral aspect of the body of mandible<sup>1</sup>, somewhat midway between the superior (alveolar) and inferior borders<sup>2</sup>. It transmits the mental nerve and vessels<sup>3</sup>. The size, shape, location and direction of the opening of the mental foramen have many variations and these variations are largely influenced by individual, gender, age, race, accessing technique used and degree of edentulous alveolar bone atrophy<sup>4</sup>. Knowledge of the morphology of the mental foramen is important when administering regional anaesthesia, performing periapical surgery and dental implant surgery and endodontic treatments in the mandible<sup>5</sup>. It would also be useful in preserving and avoiding injury to the mental nerve and vessels during surgical procedures and in interpreting anatomical landmarks in oral pathology and forensics<sup>6</sup>. Reports from various studies have shown the position, shape and direction of the mental foramen in different population groups. While some showed the most prevalent position to be between the premolars<sup>5,7-10</sup>, others reported it to be in line with the long axis of the second premolar<sup>1,6,9,13-20</sup>. Owing to the importance of the mental foramen in clinical procedures and the variation of its parameters in different population groups, the present study is aimed at analyzing the position, shape and direction of mental foramen in the South-Eastern region of Nigeria.

## 2. Materials and Method

66 dry adult human mandibles obtained from the region of study were used for the study. Fishel *et al*<sup>21</sup> proposed the most popular method for identification of mental foramen. The horizontal position of the mental foramen was recorded as either in line with the longitudinal axis of a tooth or as lying between two teeth. In this study, the position of the mental foramen was measured using the Vernier caliper or ruler to trace, with reference to the 1<sup>st</sup> and 2<sup>nd</sup> premolar teeth and first molar teeth. The different positions observed were classified as follows:

- Position 1- Between the first and second premolar (P1)
- Position 2 - In line with the long axis of the second premolar (P2)
- Position 3- Between the second premolar and the first molar (P3)

**Fig. 1: Mental foramen in position 3**



**Fig.2: Mental foramen in position 2**



The shape of the mental foramen was observed and determined with the aid of a hand lens. The two shapes observed were oval and round.

The direction of the mental foramen was measured by inserting an office pin into the foramen from the lateral part of the mandible. The direction to which the office pin pointed was visually inspected. The results of the different directions or courses of the foramina were then grouped into 5 as follows:

- Direction 1 (D1) – Anteriorly
- Direction 2 (D2) - Antero-superiorly
- Direction 3 (D3) – Posteriorly
- Direction 4 (D4) – Postero-superiorly
- Direction 5 (D5) – Superiorly

## 3. Observation

### 3.1 Position of mental foramen

The most prevalent position of the mental foramen was found to be in line with the long axis of the second premolar teeth (58.33%) and 33 pairs were found to be bilateral out of a total 55 bilateral pairs. The position between the premolars was least prevalent with 15.91% and had 10 bilateral pairs. Total bilateral occurrence was 83.33% showing that the position of the mental foramen is often symmetric.

**Table 1: Analysis of positions of the mental foramen**

Position	Freq.	Percentage (%)	Bilateral	Unilateral	
				Right	Left
P1	21	15.91	10	1	0
P2	77	58.33	33	1	10
P3	34	25.76	12	9	1
Total	132	100	55	11	11

### 3.2 Shape of mental foramen

The results for the round-shaped and oval-shaped foramina are shown in Table 2. Total bilateral occurrence was at 84.85% showing that same shape mostly occurs on both sides of the mandible.

**Table 2: Analysis of the shapes of mental foramen**

Shape	Freq.	Percentage (%)	Bilateral	Unilateral	
				Right	Left
Round	100	75.76	45	7	3
Oval	32	24.24	11	3	7
Total	132	100	56	10	10

### 3.3 Direction of mental foramen

Mental foramen pointing postero-superiorly (D4) was found to be more prevalent than those of all other directions while D1 and D3 had the least prevalence with less than 1% each. The results in detail are found in Table 3. Most of the occurrences were symmetric since the data showed 83.33% bilateral occurrence.

**Table 3: Analysis of directions of the mental foramen**

Direction	Freq.	Percentage (%)	Bilateral	Unilateral	
				Right	Left
D1	1	0.76	0	0	1
D2	28	21.21	9	6	4
D3	1	0.76	0	0	1
D4	97	73.48	44	4	5
D5	5	3.79	2	1	0
Total	132	100	55	11	11

## 4. Discussion

Significant differences have been reported in the position of the mental foramen among various ethnic groups and populations. In the present study in South-Eastern Nigerians, it was showed that the most prevalent position of the mental foramen was found to be in line with the long axis of the second premolar (58.33%) followed by the position between the second premolar and the first molar (25.76%). This agreed with studies by Adejuwon *et al*<sup>12</sup> on the Yoruba ethnic group of Nigeria, Fabian<sup>13</sup> in Tanzanians, Igbigbi and Lebona<sup>14</sup> in Malawians, Mwaniki and Hassanali<sup>15</sup> in Kenyans, Mbajiorgu *et al*<sup>16</sup> in Zimbabweans, and Chkoura and El Wady<sup>17</sup> in Moroccan population, as they all showed the commonest position of the mental foramen to be in line with the long axis of the second premolar followed by the position between the second premolar and the first molar. It indicates that most African populations have the same mental foramen position. In Northern Nigerians, however, it was reported that the most common position was in line with the interdental space between the first and second premolars<sup>7</sup>. This report shows that the position of the mental foramen varies in Northern and Southern Nigerians. Similar results to this present study were also obtained by Budhiraja<sup>1</sup> in North Indian subjects, Neo<sup>6</sup> in Singaporean Malays and Indians, Al Jasser and Nwoku<sup>18</sup> in Saudi population, Ngeow and Yuzawati<sup>19</sup> in Malay population, and Agarwal and Gupta<sup>20</sup> in South Gujarat (Indian) subjects. Koppe<sup>11</sup> in comparison of three population groups found the modal position to be in line with the long axis of the second premolar in the Chinese and between the first and second premolar in the European and Indian. This was similar to the comparison of Santini and Land<sup>10</sup>. Gungor *et al*<sup>5</sup> reported that in the Turkish population, the most common position of the mental foramen was between the first and second premolars. It can therefore be deduced from studies<sup>5,10,11</sup> that the most common position of the mental foramen in the European population is between the first and second premolars just like that of North Americans<sup>9</sup>. This agrees with statement in some Anatomy textbooks<sup>22</sup> but disagrees with the present study and that of other population groups in Africa and Asia. When compared broadly, it can be established that Asian populations have a similar mental foramen position with African populations while the Europeans and Americans

are positioned similarly. It also agreed with the notion that the mental foramen was positioned more anteriorly in whites than in blacks<sup>23</sup>. The essence of these studies is to get the clinicians informed on what to expect when attending to patients from any particular population group and to ensure that the integrity of the mental vessels is preserved and a successful mental nerve block achieved.

**Table 4: Comparing the position of the MF in different populations**

Authors	Population	Most Prevalent	2 <sup>nd</sup> Most Prevalent
Gungor <i>et al.</i> (2006)	Turkish (Europe)	Between the 1 <sup>st</sup> and 2 <sup>nd</sup> PM	In line with the 2 <sup>nd</sup> PM
Moiseiwitsch (1998)	North Americans	Between 1 <sup>st</sup> and 2 <sup>nd</sup> PM	In line with the 2 <sup>nd</sup> PM
Haghanifar and Rokouei (2009)	Iranians (Middle East)	Between the 1 <sup>st</sup> and 2 <sup>nd</sup> PM	In line with the 2 <sup>nd</sup> PM
Budhiraja <i>et al.</i> (2013)	Indians (Asia)	In line with the 2 <sup>nd</sup> PM	Between 1 <sup>st</sup> and 2 <sup>nd</sup> PM
Fabian (2007)	Tanzanians (Africa)	In line with the 2 <sup>nd</sup> PM	Between 2 <sup>nd</sup> PM and 1 <sup>st</sup> molar
Olasoji <i>et al.</i> (2004)	Northern Nigerians	Between the 1 <sup>st</sup> and 2 <sup>nd</sup> PM	In line with the 2 <sup>nd</sup> PM
Present study (2013)	South-Eastern Nigerians	In line with the 2 <sup>nd</sup> PM	Between the 2 <sup>nd</sup> PM and 1 <sup>st</sup> M

In the present study, results show a round-shaped MF in 75.76% of the mandibles and an oval-shaped MF in 24.24%. This was similar to the reports of Singh and Srivastav<sup>24</sup> in Indians, and Al-khateeb *et al*<sup>25</sup> in Northern Jordanian population. Conversely, Mbajiorgu *et al*<sup>16</sup> in Zimbabweans, Budhiraja *et al*<sup>1</sup> in North Indians and Oliveira, *et al*<sup>26</sup> all reported that the oval-shaped mental foramen was more prevalent than the round-shaped MF in their subjects. Comparison between the results of the present study and previous ones is presented in Table 5 below.

**Table 5: Comparison of studies on shapes of mental foramen**

Authors	Shapes of Mental Foramen	
	Oval	Round
Mbajiorgu, <i>et al.</i> (1998)	56.3%	43.7%
Al-khateeb, <i>et al.</i> (2007)	Minority	Majority
Oliveira, <i>et al.</i> (2009)	72.55%	27.45%
Singh and Srivastav (2010)	9.5%	90.5%
Budhiraja, <i>et al.</i> (2013)	74.3%	25.7%
Present study (2013)	24.24%	75.76%

The direction of opening of the mental foramen influences the direction in which a needle is advanced for a mental nerve block<sup>26</sup>. In this study, it was posterosuperiorly in majority of the subjects (73.48%). This was in agreement with previous studies by Boonpiruk<sup>27</sup> in Thais; Agarwal and Gupta<sup>20</sup> in South Gujarat; Mwaniki & Hassanali<sup>15</sup> in Kenyans; Igbigbi and Lebona<sup>14</sup> in Malawians and Fabian<sup>13</sup> in Tanzanians.

## 5. Conclusion

It is important to be aware of the variations that occur in the mental foramen among different population groups. This will help to avoid injury or paralysis of the mental nerve which is one of the principal complications of surgery in the mandibular or mental regions. The notion that the mental foramen lies between the premolars as stated in old and some new textbooks can no longer be generally accepted. In the present study, the position of the mental foramen has been shown to be in line with the long axis of the second premolar and the shape and direction showed to be oval and posterosuperior respectively in majority of the subjects. This study has provided information on the morphology of the mental foramen in mandibles of South-eastern Nigerians and we hope it will be useful in achieving a successful mental nerve block while avoiding injury to the nerve. It is therefore suggested that clinicians should carefully identify this anatomical landmark using radiographs prior to the surgical procedures.

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