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# Radiographical and Anatomical Assessment of Mandibular Mental Foramen Variations for a Sample of Yemeni Patients Undergoing Dental Implant Placement

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## ABSTRACT

**Aim:** To assess the prevalence, the diameter and location of mental foramen MF, and Accessory mental foramen AMF, by cone-beam computed tomography (CBCT) for a Sample of Yemeni Patients.

**Methodology:** The study was an analytical retrospective cross-sectional study conducted on 420 CBCT images of mandibles referred from general practitioners, surgery departments and surgeons for implant demands. The data collection took from April 2018 to July 2018. The sample size was divided according to gender, age, side, and dental condition. The images were analyzed and the measurements were done using the tools given in the software (Ez3D plus with Ez3D-I software).

**Results:** MF was found in all patients (51.4% males and 48.6% females). The means of the MF diameter, MF-H, MF-V, MF-M1, MF-M2, AMF-HMD and AMF-VMD were 2.60 mm, 3.74 mm, 3.08 mm, 7.61 mm, 10.99 mm, 1.88 mm and 1.63 mm, respectively. Most of the cases were located under the apex of the 2nd premolar was found in only 4 (1%) of all cases.

**Conclusion:** The most prevalent location of the MF was under the long axis of the 2nd premolar. The round shape of the MF was more prevalent than the oval shape.

**Key Words:** Radiographical Assessment, MF, AL, IC, CBCT, Yemeni Patients

## INTRODUCTION

Mental foramen (MF) is a single foramen, found in the buccal bone plate, but any multiple or any duplication in number of mental foramen in the same side is considered accessory mental foramen (AMF).[1] So, AMF defined as "a nutrient foramen formed in a prenatal stage". Moreover, the sub mental, lower lip, buccal arteries and direct branches of the facial artery distribute from the buccal foramen into the mandibular cancellous bone.[2] Precise knowledge on the variation in the position, number, size, and shape of the MF and the presence of the AMF would be great to surgeons because it leads to disruption into the Inferior Alveolar Nerve block.[3]

Currently, high resolution CBCT is the most promising and accurate technology available for quantitatively determining the position and size of MF and the presence of AMF.[4] It represents high resolution cross-sectional images,[5] and makes a multiple continuous sectional view in different dimensions (Sagittal, Axial, and Transverse) to give the best view for each soft and hard tissue.[6]

Good pre-surgical knowledge of the exacted location and size of the MF is crucial for preventing any surgical complications in the inter-foraminal area during the local mental nerve block, periapical surgery, orthographic surgery or placement of endoosseous implant.[7] Furthermore, because no pervious study – up to the researchers knowledge – has been conducted to study the prevalence, size, and location of the MF and AMF on the Yemeni population, the outcomes of this study can be used as a primary guideline for surgeons and dentists who are interested to do any surgical procedures of dental implant installations in the anterior mandibular regions for Yemeni patients.

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## MATERIALS AND METHODS

### Study sample:

An analytical retrospective cross-sectional study. It included 1000 mandibular arch CBCT images of patients who were referred from maxillofacial surgery departments and surgeons or periodontologist for implant demands to a private radiology center at Sana'a city during the period from January 2016 to December 2018. The data were collected using a data collection sheet.

By using the G*Power 3, the study sample size calculated was 400 CBCT images of mandibles that were selected randomly. The final sample size became 210 CBCT images. Each mandible was considered two cases according to a study conducted by.[5] Consequently, the cases became 420. The sample size was divided according to gender (male – female), age (>40 year-old – ≤40 year-old) , side (right – left), and dental condition (edentulous – non-edentulous).

### Inclusion & Exclusion criteria

Inclusion criteria include dentate or edentulous patients; ages between 18 and 70 years; and CBCT images from the distal of 1st molar in the right side to the distal of 1st molar in the other side. Whereas exclusion criteria include images with any syndromic or congenital disorders; images with history of trauma, pathology to the mandible or surgical intervention in the inter-foraminal region; any radiographic signs of mandibular pathology or pervious surgery in the study region of mandible; inadequate quality of CBCT images (i.e.: patient movement, operation errors, etc.); any impacted teeth in the in interforaminal area; fracture of the lower jaw in the midline of mandible or in the mental foramina area; and ongoing orthodontic treatment .

### Ethical approval

Prior to the study, ethical approval to carry out this study was granted from the ethical committee of the Faculty of Medicine and Health Sciences, University of Science & Technology (MECA No.: EAC/UST165).

### Technique and reconstruction parameters

All images were taken by a CBCT system unit (PaX-Flex3D P2, Vatech, Korea) using the following exposure parameters: kVP = 77 - 90, mA = 4.7–5.7, t =15–24 seconds, field of view = (12×8.5) cm and with a voxel size of 0.160–0.20 mm for full views and 0.06–0.02 mm for other field of views (FOVs). Moreover, the images were analyzed and the measurements were done using the tools given in the software (Ez3D plus with Ez3D-I software). A single operator worked with all the files from a personal laptop (Dell – Core(TM) i7-3520M CPU @ 2.90GHz with a Ram of 16 GB with a serial No.: 115570-0000045).

The images of each case were managed and analyzed through three steps: First step in which the axial sections were generated in a way to exhibit the right and left MF together at the same time and in the same level; Second step in which the panoramic curve was drawn from the right MF to the left MF on the axial section; Third step in which multiple serial cross-sections from the panoramic view were obtained.

### Study variables:

The current study investigated the location of mental foramen MF by CBCT method to attain the location, shape, and size of MF in a group of Yemeni population. The horizontal and vertical lines were determined in the panoramic reconstructing view by a straight ruler of the Ez3D software so as to determine the Location of MF which was assessed according to the line drawn as a long axis passing through the apex of the tooth based on the classification "proposed by[8] which is as follows: position I is in line with the long axis of the 1st premolar ; position II is between the 1st and 2nd premolars ; position III in line with the long axis of the 2nd premolar ; Position IV Between the 2nd premolar and the 1st molar ; and Position V Distal to the 1st molar. Because the MF in some cases was located distal to the canine due to the extraction to the 1st premolar, and was located distal to the 1st premolar in some others due to the extraction of 2nd premolar, it was also assessed in two additional positions which are: Position VI distal to canine with extraction to 1st premolar and Position VII distal to 1st premolar with extraction of 2nd premolar.

The shape of MF was assessed according to the classification "proposed by Zhang et al. (2015) depending on the ratio of two diameters (H: V), since H represented as a horizontal diameter of MF and V represented as a vertical diameter of MF, into one of three Types (Fig. I):Type I (Oval horizontal form, H: V > 1.24); Type II (Oval vertical form, H: V< 0.76) ; and Type III (Round form, $0.76 \leq H: V \leq 1.24$).

Measurements of MF: CBCT images were measured according to the following:[9] The vertical distance from the superior margin of MF to the alveolar ridge was represented in this study as (M1) ; The vertical distance from the inferior margin of MF to the inferior border of the mandibular was represented in this study as (M2) ; The horizontal diameter of MF (HMD) was the inner horizontal distance mesial to the distal side of the foramen ; and The vertical diameter of MF (VMD) was the inner vertical distance superior to the inferior side of the foramen (Fig. I and II).

Accessory Mental Foramen (AMF) was measured by the panoramic reconstructing view as single or double in one side or in both sides of the mandible. Besides, the shape of AMF was simultaneously determined with those of MF (Oval horizontal form, Oval vertical form, and Round form ) (Figure III, IV, and V).

### Statistical analysis

Data were analyzed by the Statistical Package for Social Sciences (SPSS) version 24. Descriptive statistics (mean, variance, standard deviation, and minimum and maximum values) were used in the data analysis. The mean differences in the measurements of MF, AL, and IC were analyzed by T-test in which p-value less than 0.05 was considered statistically significant. The data were represented using tables and figures.

### Study reliability

Thirty cases were examined as a pilot study. The measurements were evaluated twice by the researcher himself as an intra-observer. The two measurement results were analyzed using the Cohen's Kappa statistic. Findings showed 'substantial' agreement between the two measurements'. After that, the same pilot study cases were measured by two inter-observers: (AA) assistant Professor of Oral and Maxillofacial Surgery and (LA) assistant Prof. of Oral Diagnosis and Radiology. Findings also showed mean 'substantial' agreement between the measurements' was 86.8.

## RESULTS

A total of 420 cases from CBCT images of 210 patients (51.4% males and 48.6% females) were analyzed according to gender, age, side and dental condition (Table I). The 1st group was ≤40 years consisting of 98 (23.3%) the 2nd group was the non-edentulous consisting of 314 (74.8%). The data shows that there are significant of the mean diameters of the MF regarding the gender and dental condition, males 2.71 mm and 2.63 mm in the non-edentulous compared to others.

The mean of the MF-H and MF-V was 3.74 mm and 3.08 mm respectively. Moreover, the maximum width of the MF-H and MF-V was 8.30 mm and 8.20 mm, respectively (Table II).the mean and SD of the MF diameter were 2.60 mm. The mean of M1 was 7.61 and M2 10.99 mm.

Table III showed significant differences of MF-H and MF-V according to gender males were 3.94 mm and females were 3.52 mm ($p = 0.000$), the mean in males/females were 3.18 mm and 2.96 mm ($p = 0.005$), respectively. Also there is significant differences of MF-V according dental condition edentulous/non-edentulous 2.92 and 3.13, respectively.

Regarding the mental foramen length, there was a significant difference in only the mean lengths of MF-M2 regarding gender ($p = 0.000$), the mean lengths of both MF-M1 ($p = 0.000$) and MF-M2 ($p = 0.023$) (Table IV).

Table V showed the location of MF, 124 (39.5%) representing the majority of cases showed MF under the apex of the 2nd premolar (male = 43.13%, female = 35.71%), In the ≤40 year-old group, 30 (33.7%) cases showed MF under the apex of the 2nd premolar and 28 (31.5%) between the 1st and 2nd premolar, while in the >40 year-old group, 94 (41.8%) cases showed MF under the apex of the 2nd premolar.

Accessory Mental Foramen AMF was found only in 4 (1%) cases as a duplication of the AMF in 2 CBCT images. The shape of the AMF, 2 (50%) of AMF cases in the left side had the oval horizontal shape, whereas 1 (25%) in the right side and 1 (25%) in the left side had the round shape. However, no AMFs having the oval vertical shape in both sides. The diameter of the AMF was measured for its horizontal width AMF-HMD ranged from 1.20 mm as a minimum width to 2.80 mm as a maximum width with a mean of 1.88 mm, whereas the AMF-VMD ranged from 1.10 mm as a minimum height to 2.20 mm as a maximum height with a mean of 1.63 mm (Table VI).

Regarding the frequency of accessory mental foramen, all the 4 (100%) AMFs were found in males, in the >40 year-old group, and in the non-edentulous group. With respect to side, 3 (75%) AMFs were found in the left side.

## DISCUSSION

Preventing any postoperative complications in the inter-foraminal area during any dental implant surgery depends mainly on dentists' good pre-surgical knowledge of the exacted location and size of the MF and AMF that can be accurately identified by several methods; including manual palpation, cadaveric dissection, peri-apical radiographs, panoramic radiographs, MDCT, CBCT or MRI.

There are many previous studies aimed to study the prevalence, size, and location of the MF AMF by using different conventional methods including panoramic radiography, human dry mandible technique,[3,9-12] and spiral CT imaging method .

On the other hand, CBCT imaging method, as the most promising and accurate method available for determining the position and size of MF and AMF, and the presence of AL[4] was used in many other previous studies.[1,8,13-15]

The current study was conducted to determine the prevalence of the MF and AMF, the position and diameter of the MF and AMF by using CBCT imaging among a group of Yemeni adults. Moreover, the study results cannot be generalized among Yemeni population because the study sample was taken from one city, Sana'a, due to the lack of CBCT radiological centers in other cities.

Nevertheless, this study is considered, according to the researchers' knowledge, the first study investigating all the measurements of the three variables; MF altogether in literature and also the first study identifying the shape and location of AMF in literature. Besides, it is also considered, based on

the National Information Center, Yemen, the first study determining and measuring the MF, AL and IC in Yemen.

Additionally, the results of this study are compared to the results of the previous studies that used CBCT imaging method for detecting and measuring the MF and AMF. MF was found in all patients on both sides representing 100%, representing 51.4%, and in 204 females representing 48.6%, while in the right and left sides the MF was equally found representing 50%.

The mean of the MF horizontal width (MF-H) was 3.74 mm which is relatively similar to that of[13] (3.7 mm), less than those of **Zhang et al., 2015,** and[16] (5.14 mm, 6.8 mm, and 5.325 mm, respectively), and more than those of[17,18] (3.5 mm, 3.2 mm, and 2.97 mm,, respectively).

Furthermore, the mean of the MF vertical height (MF-V) was 3.08 mm which is relatively equal to that of Von Arx et al., 2013 (3.0 mm), less than those of [2,13,16] (3.92 mm, 3.4 mm, and 5.9 mm, respectively), and more than those of [15-19](2.6 mm, 2.11 mm, and 1.9 mm, respectively).

The study demonstrated that the horizontal and vertical sizes of the MF on CBCT were significantly greater in males than in females ($p = 0.000$ horizontally and $p = 0.005$ vertically). This result is similar to that of[13] in which p-value $< 0.005$. Moreover, the study also showed that the vertical sizes of the MF on CBCT were significantly greater in the non-edentulous cases than in the edentulous ($p = 0.020$).

The mean diameter of the MF was 2.60 mm which is less than that of Sheikhi and Kheir, 2016 (3.59 mm), and more than that of [20] (2.26 mm among Americans and 2.13 mm among Taiwanese). Besides, the study indicated that the diameter of the MF on CBCT was significantly greater in males than in females and in the non-edentulous cases than in the edentulous ($p = 0.000$).

The mean distance from the MF to the teeth apex or to the crest of alveolar ridge (MF-M1) was 7.61 mm which is less than those reported by,[20] (12.6 mm, 11.88 mm and 14.3 mm, respectively) and more than that reported by [13] (4.0 mm). However, the mean distance from the MF to the inferior border of the mandibular bone (MF-M2) was 10.99 mm which is less than those reported by [13](13.8 mm, 13.56 mm, 13.2 mm and 12.6 mm, respectively).

Furthermore, the study showed that MF-M1 on CBCT was significantly greater in the non-edentulous cases than in the edentulous ($p = 0.000$). In addition, MF-M2 on CBCT was significantly greater in males than in females ($p = 0.000$).

Regarding the shape of the MF, most of the cases were round, followed by oval horizontal, then oval vertical (52.9%, 45.2%, 1.9%, respectively). However, most of the cases reported by[10] were round, followed by oval vertical, then oval horizontal (61.60%, 27.30%, 11.15%, respectively), those reported by[15] (were mostly oval horizontal, followed by round, then oval vertical (56.3%, 39.03%, and 4.675%, respectively), and those reported by **Zhang et al, 2015,** were mostly oval horizontal (67%), followed by round (33%), and no oval vertical cases were found (0%).

The MF location in the current study depended on the apex of the adjacent teeth of only the non-edentulous cases of which 39.5% were located under the apex of the 2nd premolar, 14.3% distal to the 1st premolar with the extraction of 2nd premolar, 18.8% between the 1st and 2nd premolar, 8.0% distal to the canine and extraction to the 1st premolar, 7.3% between the 2nd premolar and the 1st molar, 6.4% under the apex of the 1st premolar, and only 1.0% were located under the 1st molar.

In the research literature, the most common location of the mental foramen is the region of the second premolar in the completely developed mandible,[1] but individual variations may occur occasionally.[21]

In the current study, most of the cases were located under the apex of the 2nd premolar. This result agrees with those reported by,[5] but it does not agree with those of ,[22] and [10] who reported that most of the cases were located between the 1st and 2nd premolars.

The MF prevalence rates according to its location varies from a study to another because some studies assessed the MF location according to the classification proposed by,[3] some assessed it only in two locations,[17] and,[18] and some others assessed it only in three locations.[10] However, the current study assessed it in seven locations.

AMF is "a rare anatomical variation with particular importance in local anesthesia and surgical procedures, especially the placement of dental implants,[23]

Most of the AMFs were found in the 1st permanent molars area.[11,12,14]

In the current study, the AMF was found in only 4 (1%) of all cases as a duplication of the AMF in 2 CBCT images. These 4 AMFs were found in the non-edentulous males aged >40 years. Besides, 1 (25%) of these AMFs was found in the right side and was round in shape. However, the remaining 3 AMFs were in the left side; 2 (50%) of which were oval horizontal and 1 (25%) was round.

The AMF prevalence rate was 1% which is less than those of,[13,8,5] who reported that AMF was found in 11.33%, 6.5%, 7.54%, and 2.53%, respectively.

The mean of the AMF horizontal width (AMF-HMD) was 1.88 mm which is more than those reported by [13] (1.6 mm, 1.6 mm, and 1.49 mm, respectively). While, the mean of the AMF vertical height (AMF-VMD) was 1.63 mm which is more than those reported by [13] (1.2 mm and 1.4 mm), and less that reported [8] (1.83 mm).

"In patients who had accessory innervation due to the presence of AMF, anesthetic failure is expected to occur in 10-20% of cases if only the inferior alveolar nerve is blocked,[24] during surgical placement of dental implant, reports of neurosensory disturbances were not rare.[23] If the inferior alveolar nerve, mental nerve or its accessory branches are damaged, the sensory dysfunction due to the nerve damage can occur.[25]

In addition, an AMF and its potential variations may give way to important neurovascular anatomic structures, and their detection is fundamental to safe and successful surgical installation of dental implant".[23]

New information about MF and AMF present in this study can help the surgeons to decrease of the nerve damage during any dental implant surgery. Because this study is the first study conducted on a group of Yemeni population by using the CBCT images.

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**Table I: Descriptive results of sample according to demographic variables and the mean diameter of MF according to the study variables**

| Variables | | Frequency | Percent | Mean diameter of MF | SD | P-value |
|---|---|---|---|---|---|---|
| Gender | Male | 216 | 51.4 | 2.71 | 0.50 | 0.000 |
| | Female | 204 | 48.6 | 2.49 | 0.50 | |
| | Total | 420 | 100.0 | | | |
| Age | ≤40 years | 98 | 23.3 | 2.60 | 0.41 | 0.832 |
| | >40 years | 322 | 76.7 | 2.61 | 0.54 | |
| | Total | 420 | 100.0 | | | |
| Sides | Right | 210 | 50.0 | 2.59 | 0.50 | 0.362 |
| | Left | 210 | 50.0 | 2.62 | 0.53 | |
| | Total | 420 | 100.0 | | | |
| Dental dentation | Edentulous | 106 | 25.2 | 2.53 | 0.44 | 0.000 |
| | Non-edentulous | 314 | 74.8 | 2.63 | 0.54 | |

**Table II: Descriptive results of the measurements of horizontal height MF-H, vertical width MF-V, and diameter of mental foramen**

| MF measurement | N | Mean | SD | Maximum | Minimum |
|---|---|---|---|---|---|
| MF-H | 420 | 3.74 | 0.93 | 8.30 | 1.50 |
| MF-V | | 3.08 | 0.82 | 8.20 | 1.30 |
| MF Diameter | | 2.60 | 0.52 | 1.30 | 5.00 |
| MF-M1 | | 7.61 | 4.37 | 0.10 | 19.40 |
| MF-M2 | | 10.99 | 2.18 | 3.80 | 21.70 |

MF-H: MF horizontal height, MF-V: MF vertical width.
MF-M1: distance from MF to teeth apex or to crest of alveolar ridge.
MF-M2: distance from MF to inferior border of mandibular bone.

**Table III: Measurements of the MF-H and MF-V according to independent variables**

| MF Measurements | Male (n=216) | Female (n=204) | Total (n=420) | P-value |
|---|---|---|---|---|
| MF-H | 3.94±0.90 | 3.52±0.92 | 3.74 | 0.000 |
| MF-V | 3.18±0.81 | 2.96±0.81 | 3.08±0.82 | 0.005 |
| | ≤40 years (n=98) | >40 years (n=322) | | |
| MF-H | 3.63±0.67 | 3.77±1.00 | 3.74±0.93 | 0.191 |
| MF-V | 3.17±0.74 | 3.05±0.84 | 3.08±0.82 | 0.212 |
| | Right (n=210) | Left (n=210) | | |
| MF-H | 3.70±0.90 | 3.77±0.97 | 3.74±0.93 | 0.462 |
| MF-V | 3.07±0.80 | 3.09±0.84 | 3.08±0.82 | 0.802 |
| | Edentulous (n=106) | Non-Edentulous (n=314) | | |
| MF-H | 3.69±0.93 | 3.75±0.94 | 3.74±0.93 | 0.532 |
| MF-V | 2.92±0.60 | 3.13±0.87 | 3.08±0.82 | 0.020 |

MF-H: MF horizontal height, MF-V: MF vertical width.

**Table IV: MF length measurements according to other demographic variables**

| Variable | | | N | Mean | SD | P-value |
|---|---|---|---|---|---|---|
| Gender | MF-M1 | Male | 216 | 7.57 | 4.37 | 0.848 |
| | | Female | 204 | 7.66 | 4.39 | |
| | MF-M2 | Male | 216 | 11.87 | 1.99 | 0.000 |
| | | Female | 204 | 10.06 | 1.97 | |
| Age group | MF-M1 | ≤40 years | 98 | 7.87 | 4.51 | 0.506 |
| | | >40 years | 322 | 7.54 | 4.33 | |
| | MF-M2 | ≤40 years | 98 | 10.65 | 2.38 | 0.075 |
| | | >40 years | 322 | 11.10 | 2.10 | |
| Side | MF-M1 | Right | 210 | 7.49 | 4.34 | 0.562 |
| | | Left | 210 | 7.74 | 4.41 | |
| | MF-M2 | Right | 210 | 10.91 | 2.23 | 0.460 |
| | | Left | 210 | 11.07 | 2.13 | |
| Dental condition | MF-M1 | Edentulous | 106 | 5.76 | 3.89 | 0.000 |
| | | Non-Edentulous | 314 | 8.24 | 4.35 | |
| | MF-M2 | Edentulous | 106 | 10.58 | 2.08 | 0.023 |
| | | Non-Edentulous | 314 | 11.13 | 2.19 | |

MF-M1: distance from MF to teeth apex or to crest of alveolar ridge.
MF-M2: distance from MF to inferior border of mandibular bone.

**Table V: MF location according to gender, age, and side with respect to adjacent teeth**

| MF Location | Gender | | | | | | Age | | | | | | Side | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | | Female | | Total | | ≤40 years | | >40 years | | Total | | Right | | Left | | Total | |
| | Freq. | % | Freq. | % | Freq. | % | Freq. | % | Freq. | % | Freq. | % | Freq. | % | Freq. | % | Freq. | % |
| Under Apex of 1st Premolar | 11 | 6.9% | 9 | 5.8% | 20 | 6.4% | 6 | 6.7% | 14 | 6.2% | 20 | 6.4% | 12 | 7.5% | 8 | 5.2% | 20 | 6.4% |
| Under Apex of 2nd Premolar | 69 | 43.1% | 55 | 35.7% | 124 | 39.5% | 30 | 33.7% | 94 | 41.8% | 124 | 39.5% | 67 | 42.1% | 57 | 36.8% | 124 | 39.5% |
| Between 1st & 2nd Premolar | 36 | 22.5% | 23 | 14.9% | 59 | 18.8% | 28 | 31.5% | 31 | 13.8% | 59 | 18.8% | 26 | 16.4% | 33 | 21.3% | 59 | 18.8% |
| Between 2nd Premolar & 1st Molar | 10 | 6.3% | 13 | 8.4% | 23 | 7.3% | 5 | 5.6% | 18 | 8.0% | 23 | 7.3% | 14 | 8.8% | 9 | 5.8% | 23 | 7.3% |
| Under 1st Molar | 2 | 1.3% | 1 | 0.6% | 3 | 1.0% | 2 | 2.2% | 1 | 0.4% | 3 | 1.0% | 1 | 0.6% | 2 | 1.3% | 3 | 1.0% |
| Distal to Canine with extraction to 1st Premolar | 10 | 6.3% | 15 | 9.7% | 25 | 8.0% | 4 | 4.5% | 21 | 9.3% | 25 | 8.0% | 11 | 6.9% | 14 | 9.0% | 25 | 8.0% |
| Distal to 1st Premolar with extraction of 2nd Premolar | 22 | 13.8% | 38 | 24.7% | 60 | 19.1% | 14 | 15.7% | 46 | 20.4% | 60 | 19.1% | 28 | 17.6% | 32 | 20.6% | 60 | 19.1% |
| Total | 160 | 100% | 154 | 100% | 314 | 100% | 89 | 100% | 225 | 100% | 314 | 100% | 159 | 100% | 155 | 100% | 314 | 100% |

**Table VI: description of Prevalence and shape of Accessory Mental Foramen**

| MF | Accessory MF | | | | Total | |
|---|---|---|---|---|---|---|
| | No Accessory MF | | Accessory MF | | | |
| | N | % | N | % | N | % |
| MF-Found | 416 | 99.0% | 4 | 1.0% | 420 | 100% |
| AMF Shape | Right | | Left | | | |
| Oval horizontal shape of MF | 0 | 0.0% | 2 | 50.0% | 2 | 50.0% |
| Oval vertical shape of MF | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% |
| Round Shape of MF | 1 | 25.0% | 1 | 25.0% | 2 | 50.0% |
| Total | 1 | 25.0% | 3 | 75.0% | 4 | 100% |
| AMF measurements | N | Mean | Minimum | Maximum | | |
| AMF-HMD | 4 | 1.88 | 1.20 | 2.80 | | |
| AMF-VMD | 4 | 1.63 | 1.10 | 2.20 | | |
| AMF-M1 | 4 | 9.95 | 6.50 | 14.20 | | |
| AMF-M2 | 4 | 11.03 | 10.10 | 12.50 | | |
| Total | 416 | 99.0% | 4 | 1.0% | 420 | 100% |

AMF-HMD: AMF horizontal width.
AMF-VMD: AMF vertical height.
AMF-M1: distance from AMF to teeth apex or to crest of alveolar ridge.
AMF-M2: distance from AMF to inferior border of mandibular bone.

**Table VII: Frequency of AMFs according to gender, Age, side, and dental condition**

| | Accessory MF | | | | Total | |
|---|---|---|---|---|---|---|
| | No Accessory MF | | Accessory MF | | | |
| | N | % | N | % | N | % |
| Male | 212 | 50.5% | 4 | 1.0% | 216 | 51.4% |
| Female | 204 | 48.6% | 0 | 0% | 204 | 48.6% |
| ≤40 years | 98 | 23.3% | 0 | 0.0% | 98 | 23.3% |
| >40 years | 318 | 75.7% | 4 | 1.0% | 322 | 76.7% |
| Right | 209 | 49.8% | 1 | 0.25% | 210 | 50% |
| Left | 207 | 49.3% | 3 | 0.75% | 210 | 50% |
| Edentulous | 106 | 25.2% | 0 | 0% | 106 | 25.2% |
| Non-edentulous | 310 | 73.8% | 4 | 1.0% | 314 | 74.8% |
| Total | 416 | 99.0% | 4 | 1.0% | 420 | 100% |

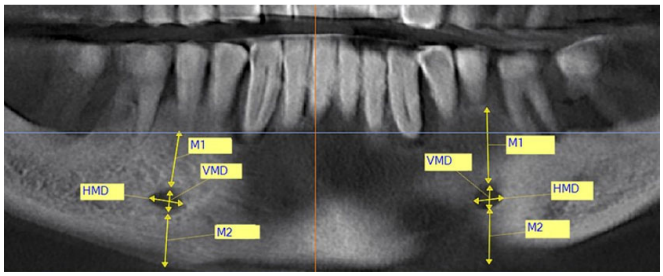


**Figure I:** Panoramic sectional image showing VMD and HMD of MF shapes in non-edentulous patients.

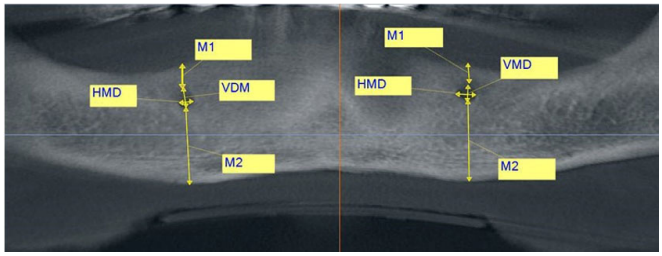


**Figure II:** Panoramic sectional image showing VMD and HMD of MF shapes in edentulous patients.

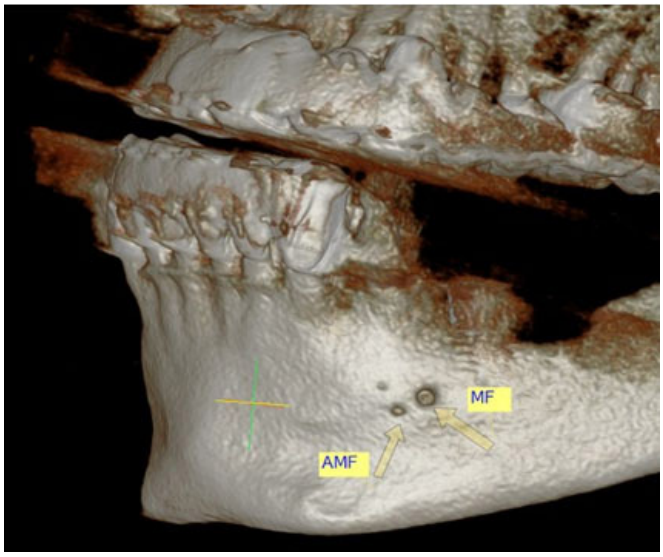


**Figure III**: 3D view showing MF and AMF on the left side.

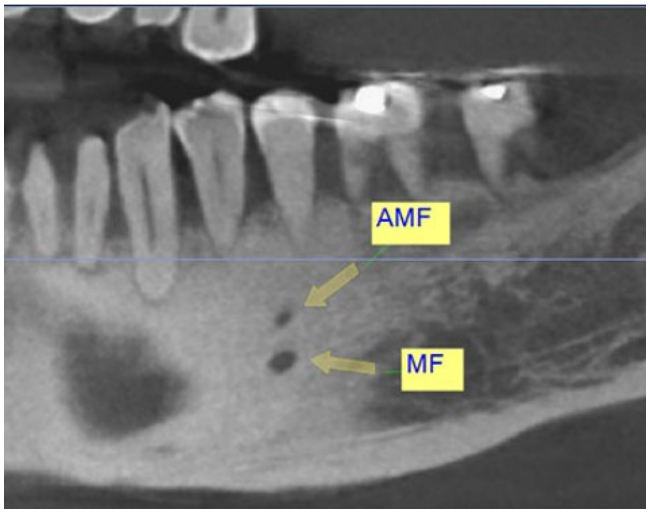


**Figure IV:** panoramic view showing MF and AMF on the left side.

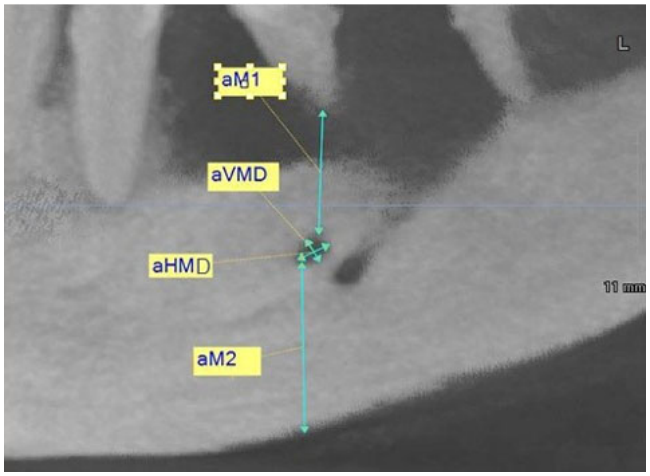


**Figure V:** Panoramic sectional image showing VMD and HMD of AMF shapes.