Morphological and Morphometric Study of the Mental Foramen on the M-CP-18 Jiachenjiang Point

Estudio Morfológico y Morfométrico del Foramen Mental en el Punto M-CP-18 Jiachenjiang


**SUMMARY:** The purpose of this work was to study the morphology and morphometry of the mental foramen (MF), as well as to evaluate its morphological configuration; in addition to taking measures of its localization using as a parameter the distances of the foramen to the inferior border of the mandible and at the alveolar ridge. 80 dry mandibles were analyzed using the test of Qui-square and T test, with 5% of significance. Its average distance, on the right side, at the inferior edge of the mandible (IEM) was of 12.96(±1.57) mm and of the alveolar ridge (AR) was of 12.82(±3.4) mm. On the left side it was found distant of IEM 12.96(±1.32) mm and of the AR 12.82(±3.22) mm. The largest horizontal diameter found was of 3.32 (±0.91) mm to the right and 3.25 (±0.86) mm to the left side while the largest vertical diameter was of 2.38 (±0.63) mm on the right and of 2.39 (±0.58) mm on the left side. It was predominantly found in the oval form, on the right side, of which 98.3% presented as a larger diameter the horizontal (type I). On the left side, all the oval foramens were classified as of type I. 76 (95%) appeared single on both sides. As to the localization related to the mandibular dentition, it was localized in similar statistic proportions between the 1st and 2nd premolars and above the 2nd premolar, in 45.17% of the mandibles, on the right side. On the left side it was predominantly found between the 1st and 2nd premolars 48.48% of the mandibles. The study of the MF is of vital importance to the acupuncture practice, as well as to modern surgical procedures, like anesthesia, requiring a detailed and precise study of the morphology and morphometry of the area.

**KEY WORDS:** Mentonian foramen; M-CP-18 Jianchejiang point; Acupuncture; Morphology; Morphometry.

**INTRODUCTION**

The mental foramen is located in the body of the mandible, at an iqual distance from its superior and inferior edge, near the top of the premolars, below and behind this zone (Picosse, 1982; Marzola, 1989), and between the 1st and 2nd premolars, more frequently at the top level of the 2nd premolar, or discreetly more to the front (McMinn et al., 1995), by which the mental vessels and nerves emerge (Dangelo & Fattini, 2000). There is in its opening an oblique angle backward and upward, still presenting the foramen in a raised crest at the inferior-internal part of its shape (Marzola).

The technical use most often utilized in dentistry is in anesthesia, being the most common method used in dental offices to control pain.

The mentonian nerve is a terminal branch of the inferior alveolar nerve coming out of the mentonian foramen on the top of mandibular premolars or near them. The nerve blockage is basically used for procedures in the soft tissues of the mouth, like sutures of lacerations or biopsy (Malamed, 2001). It is responsible for the sensitive innervation of the soft tissues of the vestibular area, inferior lip and chin up to the mandible medial line (Prado & Salim, 2004).

The Jianchejiang point (Jian: lateral; lateral to the Chengjiang) is localized in the 1 cun (inch) lateral to the VC – 24 approximately in the mental foramen of the mandible (Ding, 1996); this is of vital importance to the practice of acupuncture, and in modern surgical procedures,
like anesthesia, requiring a detailed and precise study of topographical and morphometrical anatomy of the area, that contributes also to risk reduction and complications that may occur due to these procedures.

The knowledge of the distances of the foramen, in surgical proceedings, in relation to anatomic marks can be of assistance in the localization of important maxillo-facial neurological structures in many interventions. This information should be used as the most important rule in the development of a new surgical technique that is minimally invasive. The comprehension of the localization of this foramen will be of important clinical assistance in the performance of local anesthetic blockage (Cutright et al., 2003).

MATERIAL AND METHOD

The measurements were obtained directly from a total of 80 mandibles proceeding from colleges in the State of Alagoas, with the aid of a manual pachymeter with graduation in millimeters (MYTUTOYO®, Japan). In the measured mandibles, the presence of teeth or at least that of the intact alveolar ridge of the premolar area of both sides, was indispensable to obtaining measurement. A criteria of exclusion all the mandibles with damage or reabsorption of the alveolar ridge, of the premolar areas counter-laterally was adopted. Dry mandibles of children were not analyzed.

Variations of situation, localization in relation to the center of the foramen and its medial, lateral, superior and inferior margins, size (area), form, disposition and quantity of opening of the mentonian foramen were observed.

As to the form, the mentonian foramen was classified into three types:
Type I: oval horizontal form
Type II: oval vertical form
Type III: round form

Sagittal measure. A sagittal plane passed by the center of the mental foramen, parallel to the median sagittal plane. With the aid of a manual pachymeter the values of the distances were obtained between the alveolar ridge and superior margin of the mental foramen and of the inferior margin of the mandible and inferior margin of the mental foramen.

Transversal measure. The localization and relationships of the mental foramen were observed in relation to the top of the premolar mandibular teeth, determinating the frequency of emergency of the above-mentioned foramen (Fig. 1).

The obtained measurements were analyzed using the analytical methods of variance, in order to obtain the average and standard deviation, Test T for analysis of significance of the variance to parametric data, and the Qui-square, to non parametric data, all of them with 5% of significance, using the software SPSS 10.0 for Windows®. All the data were based on documents in a protocol of fact-gathering and photographs were realized to later analysis of results.

RESULTS

The mentonian foramen (MF) was present in all of the 80 analyzed mandibles. Its medium distance, on the right side, at the inferior margin (IMM) of the mandible was of 12.95 (±1.57) mm and at the alveolar ridge (AR) was of 13.84 (±3.4) mm. On the left side, it was found distant from the inferior margin of the mandible (IMM) 12.96 (±1.32) mm and of the alveolar ridge (AR) 12.82 (±3.22) mm. The greatest horizontal diameter of the (FIO) found was of 3.32 (±0.91) mm to the right side, and of 3.25 (±0.86) mm to the left side, while the greatest vertical diameter found was of 2.38 (±0.63) mm on the right side and of 2.39 (±0.58) mm on the left side.

The morphometric data analyzed and correlated above were significant (p< 0.05) and did not differ statistically in relation to its counterlateral (Figs. 2 and 3).

Table I. Morfologic analysis – form of mental foramen.

<table>
<thead>
<tr>
<th>Form</th>
<th>Right Side</th>
<th>Left Side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oval (Type I and II)</td>
<td>59 (73.8%)</td>
<td>57 (71.3%)</td>
</tr>
<tr>
<td>Round (Type III)</td>
<td>21 (26.2%)</td>
<td>23 (28.7%)</td>
</tr>
</tbody>
</table>
It was predominantly found in the oval form on the right side, in 59 (73.8%) skulls and on the left, in 57 (71.3%) skulls (Table I), of which 58 (98.3%), on the right side, presented a greater diameter in the horizontal (Type I) and only 1 (1.7%) in the vertical (Type II). On the left side, all the oval foramens were classified as of the type I.

In 48 (84.2%), skulls the FIO presented itself oval in both sides. The round form was found in 21 (26.2 %) skulls on the right side and in 23 (28.7%) skulls on the left side, being found bilaterally in 12 (52.2%) skulls.

Of the 80 right foramens analyzed, 76 (95%), presented themselves as unique, with this relation maintained in the 80 analyzed foramens on the right side (Table II).

In 74 skulls (92.5%), a unique foramen in both sides was found. In 2 (50%) skulls, a double foramen was found bilaterally. The qui-square test demonstrated statistic significance between the above analyzed data p<0.05.

The MF was found in similar statistic proportions between the 1st and 2nd premolars and above the 2 premolar, in 28 (45.17%) mandibles, for each, on the right side. As to the left side, it was predominantly found between the 1st and 2nd premolars, in 32 (48.48%) mandibles (Table III).

In 24 skulls (30%), the foramen was bilaterally localized between the 1st and 2nd premolars. But in 22 skulls (27.5%), it was localized below the 2nd premolar in both sides.

Table II. Disposition of the mental foramen.

<table>
<thead>
<tr>
<th>Disposition</th>
<th>Right Side</th>
<th>Left Side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unique</td>
<td>76 (95%)</td>
<td>76 (95%)</td>
</tr>
<tr>
<td>Double</td>
<td>4 (5%)</td>
<td>4 (5%)</td>
</tr>
</tbody>
</table>

Table III. Dental relationship of the mental foramen

<table>
<thead>
<tr>
<th>Dental Relationship</th>
<th>Right Side</th>
<th>Left Side</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st premolar</td>
<td>2 (3.22%)</td>
<td>2 (3.03%)</td>
</tr>
<tr>
<td>Between the 1st and 2nd premolars</td>
<td>28 (45.17%)</td>
<td>32 (48.48%)</td>
</tr>
<tr>
<td>2nd premolar</td>
<td>28 (45.17%)</td>
<td>29 (43.64%)</td>
</tr>
<tr>
<td>Between the 2nd premolar and 1st molar</td>
<td>2 (3.22%)</td>
<td>2 (3.03%)</td>
</tr>
<tr>
<td>1st molar</td>
<td>2 (3.22%)</td>
<td>1 (1.52%)</td>
</tr>
</tbody>
</table>

DISCUSSION

For Ding, and Xinnong (1999) this point is located at 1 cun (inch) to the side of Chengjiang (VC-24), close to the mental foramen of the mandible, the reason that it has the name Jianchenjiang (Lateral Chengjiang).

In 1930, Sicher & Tandler reported that at the crack between the first and the second premolars, many times also in the second plane (Sicher & Tandler, 1930). The mentonian foramen, the bone opening of the lower dental nerve ending, the mentonian nerve, leaves the lower dental conduct.
Sicher & Tandler, Shapiro (1943), Hollinshead (1996), Spaltenholz (1967), Neder & Arruda (1977), Woodburne (1984) and Marzola, all confirmed that this opening normally occupied the middle point between the lower border of the lower maxilla and the upper border of the elongation of the alveolar ridge.

Nevin & Puterbaugh (1942), Lockhart et al. (1983) and Aktekin et al. (2003) mentioned that the mentonian foramen normally is located under and between the apexes of the two premolars, at a little angle towards the back. This is not the case as is affirmed by Monheim (1961), Schram (1964), Spaltenholtz, Castro (1974), Goss (1977), Snell (1984), Woodburne (1984), Gardner et al. (1988), Bennet (1989), Marzola, Dangelo & Fattini (1991, 2000), Latarjet & Ruiz Liard (1993), Moore (1994), McMin et al. and Malamed. They believe that the usual position of the foramen is located below the crown of the second lower premolar.

Based on the findings of de Freitas et al. (1976), it is advisable to turn the needle at the moment of the penetration of the mental canal: 55 degrees posterior-anterior in relation to the horizontal plane and 40 degrees lateral-medial in relation to the horizontal tangent of the body of the mandible at the level of the mental foramen. Also, Fishel et al. (1976) did a radiological study of the mentonian foramen, where they examined one thousand full mouth inter-oral x-rays and after the analysis, on the horizontal plane, in around 70% of the cases, the mental foramen was located between the two premolars and in 22% of the cases the foramen was located in the apical area of the premolars. In the vertical plane the larger percentage of the foramens was found to be located in the apexes of the premolars being statistically similar to our findings, with the FM being located in similar statistical proportions between the first and second premolars and above the second premolar in 28 (45.17%) of the mandibles, on the right side of each.

On the left side the FM was generally found between the first and second premolars, in 32 (48.48%) of the mandibles.

For Neder & Arruda and Sicher & Tandler the mentonian foramen, in 90% of the cases, was found at the lower apex of the lower second premolar, the same as was found by Green (1987), Phillips et al. (1990, 1992), Mwaniki & Hassanali (1992), Sun et al. (1993), al-Khateeb et al. (1994), Shankland (1994), Ngeow & Yuzawati (2003), Smajilagic & Diberovic (2004) and Apinhosmit et al. (2006) being that in a few cases it was found under the apex of the first premolar and also could be found at times under and between the apexes of these teeth, this not differing from our findings, of which were found varied locations.

Wang et al. (1986) showed that the location of the mentonian foramen under the apex of the lower first premolar was the most common location (58.98%); on the average, the distance of the most anterior portion of the anterior border of the foramen to the mandibular symphysis was 28.06 mm; between the most anterior portion of the anterior border of the foramen to the posterior border of the mandibular branch was 74.14 mm; between the inferior portion of the foramen to the inferior border of the mandible was 14.70 mm and between the superior portion of the foramen to the crown of the second lower premolar was 2.50 mm. The distance of the mental foramen between the alveolar crest to the inferior margin of the body of the mandible was 30.29 mm, not differing from the findings of this study, however these showed that the medial distance of the FM, on the right side to the inferior margin (MIM) of the mandible was of 12.95 (± 1.57) mm and of the alveolar border (RA) was 13.84 (± 3.4) mm. On the left side, the distance was found to 12.96 (±1.32) mm from the inferior margin of the mandible and from the RA 12.82 (±3.22) mm. The largest horizontal diameter of the FIO found was 3.32 (±0.91) mm for the right side and of 3.25 (±0.86) mm for the left side, while the largest vertical distance found was 2.38 (± 0.63) mm on the right side and 2.39 (±0.58) mm on the left side.

In accordance with Marzola& Freitas (2006), in many cases the foramen was found between 13 and 15 mm from the base of the mandible, showing the variability in the distance between this and the alveolar arch, being found near to or in the arch, according to our analysis.

In 1990, Phillips et al. all examined 75 human adult mandibles to determine the size, the orientation, and the position of the mentonian foramen (Phillips et al., 1990). In accordance with their findings, the foramen, in general, was larger on the left side of the mandible and generally the angle as it left was in the posterior-superior sense. The most common position of the foramen was inferior to the crown of the second premolar and of approximately 60% of the distance from the point of the vestibular cuspid of this tooth to the inferior border of the mandible, confirming also some of our findings. Also Santini & Land (1990) studied the anterior-posterior portion of the mentonian foramen in 68 Chinese craniums and in 44 British craniums. The position of the Chinese samples was the longest on the longitudinal axel of the second pre molar while in the British samples it was located between the apexes of the first and the second premolars, not differing statistically in our analyses and of the findings of Cutright et al. where the medial position of
the foramen, in relation to the adjacent teeth was between the first and the second premolars in whites and only posterior to the second premolar in blacks and of Olasoji et al. (2004) where the same was seen most frequently most frequently located between the first and the second premolars, followed by the apical position of the second premolar.

According to Chung et al. (1995), by the comparative morphologic method of analysis starting with photographs of 124 Korean craniums (35 male, 28 female and 71 of unknown sex) the horizontal opening of the mentonian foramen was 2.4 mm. With Apinhasmit et al. the average horizontal opening of the mental foramen was 2.80 ± 0.7 mm, with no statistical differences seen from our analyses.

Esper et al. (1997), used a practical method of the insertion of Chinese needles in 100 people of both the male and female sex between the ages of 18 and 60, showing the clinical differentiation between the perpendicular and the oblique or angled insertion at the M-CP 18 (Jiachenjiang) in relation to the type of sensation, radiation and intensity, deepness and local symptoms, including what was the major clinical effect with the insertion of the M-CP 18 (Jiachenjiang) at an angle of 49 degrees with the anterior medial line and of 33 degrees with the external surface of the mandible in comparing with the perpendicular.

Moiseiwitsch (1998) identified the extension and the normal position of the mentonian foramen in 105 human cadavers, for regional dissection, with the foramen located predominantly between the premolars, however not statistically different from previous studies and of this present study.

According to Mbajiorgu et al. (1998) by the anatomical transverse sectional study in 32 mandibles of black adults from Zimbabwe the mentonian foramen was found to be a round shape in 14 of the 32 mandibles (43.8%) and of an oval shape in 18 (56.3%). The largest percentage of foramens was found under the second premolar tooth on the right side and in back of it on the left side. In the vertical plane, the mental foramen was found located exactly under the medial point between the lower border of the mandible and alveolar ridge (44.1% and 45.5% for the left and the right sides respectively.). On the horizontal plane it was located approximately one fourth (27.3% for the right side and 27.4% for the left side) of the distance from the mandibular symphysis to the posterior border of the mandibular branch, being in partial agreement with our findings.

Oguz & Bozkir (2002), did measurements, on the left side as well as on the right side in 34 dry adult mandibles of people from the country of Turkey (ages between 30–40 years of age). The distance if the mental foramen to the lower border of the mandible was 14.61 mm and 14.29 mm on the right and the left sides, respectively. The distance to the upper border was 13.6 mm on the right side and 14.62 mm on the left side. The horizontal dimension of the mental foramen was 2.93 mm on the right side and 3.14 mm on the left side. The vertical dimension was 2.38 mm and 2.64 mm on the right and left sides respectively. The mental foramen was found under the root of the second premolar in 21 mandibles (61.76%), on the right side and in 17 mandibles (50%) on the left side. In the remaining mandibles the foramen was located between the roots of the first and second premolars, in 13 mandibles (38.2%) on the right side and in 17 (50%) of the mandibles on the left side. The average inclination of the mental foramen was 96.82 degrees, not showing a statistical difference between their findings and those of this study.

Souaga et al. (2004), studied 61 dry mandibles in which, for the male sex, the mentonian foramen was found 14.89 mm above the lower border of the mandible and 16.16 mm below the alveolar ridge. In the feminine mandibles the foramen was located 14.21 mm above the lower mandible border and 15.66 mm below the alveolar ridge. The average size of the long and the short axels of the foramen were 5.66mm and 3.97mm in the male mandibles.

This dimension was 4.99 mm and 3.87 mm in the female mandibles, not differing from our findings in relation to the statistic values.

Our analysis showed also that in the 80 right foramens analyzed, 76 (95%) were found to be a singular foramen, with this relation maintained in the 80 left side foramens analyzed. The oval shape was found predominantly on the right side in 59 craniums (73.8%) as well as on the left side. In 57 (71.3%) of the craniums, of which 59 (98.3%) on the right side presented the larger diameter being horizontal (Type I) and only one (1.7%) being the larger diameter the vertical position (Type II). On the left side all of the oval foramens were classified as Type I.

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RESUMEN: El objetivo de este trabajo fue estudiar la morfología y morfometría del foramen mentoniano (FM), así como evaluar su configuración morfológica; tomar las medidas de su localización usando como parámetro la distancia del foramen hacia el borde inferior de la mandíbula y el rebordo alveolar. 80 mandíbulas secas se analizaron mediante la prueba de Chi-cuadrado y prueba t, con un 5% de significancia. Su distancia media, en el lado derecho, hasta el borde inferior de la mandíbula (BIM) fue de 12,96 (± 1,57) mm y del reborde alveolar (RA) fue de 12,82 (± 3,4) mm. En el lado izquierdo se encontró una distancia del BIM de 12,96 (± 1,32) mm y del RA de 12,82 (± 3,22) mm. El mayor diámetro horizontal encontrado fue de 3,32 (± 0,91) mm a la derecha y 3,25 (± 0,86) mm a la izquierda, mientras que el mayor diámetro vertical fue de 2,38 (± 0,63) mm a la derecha y de 2,39 (± 0,58) mm en el lado izquierdo. Se encuentra principalmente en forma oval en el lado derecho, de los cuales 98,3% presenta un diámetro mayor horizontal (tipo I). En el lado izquierdo, todos los forames ovales fueron clasificados como de tipo I. 76 (95%) aparecieron solamente en ambos lados. En cuanto a la localización en relación con la dentición mandibular, fue localizado en la misma proporción estadística entre el 1º y 2º premolar y por encima del 2º premolar en el 48,48% de las mandíbulas. El estudio del FM, es de vital importancia para la práctica de la acupuntura, así como para los modernos procedimientos quirúrgicos, como la anestesia, que requieren un estudio detallado y preciso de la morfología y morfometría de la zona.

PALABRAS CLAVE: Foramen mental; Punto M-CP-18 jiachenjiang; Acupuntura; Morfología; Morfometría.

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