The Mental Foramen Position in Dentate and Edentulous Brazilian’s Mandible

Posición del Foramen Mental en Mandíbulas de Brasileños Dentados y Desdentados

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SUMMARY: The mental foramen has been reported to vary in position in different ethnic groups. Repeated failures during injections and operative procedures involving the mental foramen suggest the presence of local differences in a given population. The aim of the present study was to determine the position of mental foramen (MF) in a sample of one hundred seventy Brazilian adult dry mandible, being 79 edentulous and 91 dentate. The assessment was made, having as it referential, the base of the mandible (BM) and the mandibular symphysis (MS), whereby the comparisons were carried out considering genders, the mandible side (left or right), and dentition (dentate or edentulous). The statistical analysis was performed using multifatorial ANOVA (alpha=5%). It was found the male mandibles presented higher values of MF-MS than the female ones and the dentate presented higher values when compared to edentulous ones (p<0.0001). No difference was observed between left and right sides (p=0.2990), as well, as concerning to gender (p=0.152). The most frequent position of MF was in the long axes of the second premolar for male (p<0.0001) and female (p=0.0004). No statistical difference (p>0.05) was found between right and left sides comparing male to female. It was concluded the position of the mental foramen is mainly altered in edentulous subjects as it is consider a symmetric structure in Brazilian population and its most common position is in the long axes of the second premolar.

KEY WORDS: Mandibles; Mental Foramen.

INTRODUCTION

The orientation and position of the mental foramen is important to performing anesthetic block prior to clinical procedures in lower-anterior teeth and also to preserve the integrity of the mental nerve trunk in surgical interventions (Julian et al., 1998; Cutright et al., 2003; Mwaniki & Hassanali, 1992). The mental nerve injury can cause transitory or permanent sensitive, thermal and tactile changes (Phillips et al., 1990; Wismeijer et al., 1997).

The location of the mental foramen has been studied by means of direct measurement on dry mandibles or by using radiographs of dry mandibles or patients (Phillips et al., 1990; Phillips et al., 1992b; Aghthong et al., 2005; Apinhasmit et al., 2006; Captier et al., 2006).

A number of studies have shown difference in the position of the mental foramen in relation to the second premolar according to the ethnic group studied. The literature shows studies conducted on Asians (Chung et al., 1995; Igbigbi & Lebona, 2005), Africans (Mbajiorgu et al., 1998; Olasoji et al., 2004; Souaga et al., 2004) and Caucasians (Cutright et al., 2003).

The Brazilian population shows high degree of miscegenation (IBGE, Brazil, 2000) and the literature on the location of the mental foramen in this population is very scarce (de Freitas et al., 1975; de Freitas et al., 1976) hence does not present any statistical analysis.

The development of implant techniques increased the interest in the mandible anatomy, specially the MF localization. Despite this interest a small number of papers has been published on the position of mental foramen in edentulous subjects (Soikkonen et al., 1995; Güler et al., 2005; Captier et al.)
The aim of this paper was to evaluate the position of the mental foramen in dentate and edentulous Brazilian subjects attempting to spot a light to surgical interventions and anesthetic block procedures.

MATERIAL AND METHOD

One hundred and seventy human Brazilian dry mandibles (91 dentate and 79 edentulous) were obtained from the collection of Piracicaba Dental School and Institute of Biology, State University of Campinas – UNICAMP, Brazil. The dentate mandibles presented a mean of at least 14 erupted teeth whereas the edentulous present any. Hundred eighteen mandibles were from male gender and 52 from female. All of them have shown any osseous or dental abnormalities.

This study was performed of directly measures and observations, over dry mandibles as it is described:

Position of the mental foramen (MF) to the mandibular symphisis (MS) and the base of the mandible (BM) as shown in Fig. 1.

Mandibles were placed on a standard basal plane searching the maximous contact surface when a vertical pressure was applied to the region of the second molars. The distance between the center of mental foramen and the mandibular symphisis (midline of the mandible) was then measured. This measure was performed on a plane parallel to the standard basal plane.

The distance between the mental foramen center to the base of the mandible was measured on a vertical straight line perpendicular to the standard basal plane passing on the center of the mental foramen.

The measurements were performed with a digital pachymeter of 0.01 mm accuracy (Mitutoyo, Japan), by one investigator. Three measurements were conducted with one week interval and submitted to intraclass coefficient (ICC) analysis to assess the measurement replicability. Multifactorial ANOVA was performed to analyze the influence of the variables (gender, side and dental state) on the measurements. The significance level adopted was 5%.

The orientation and position of the mental foramen was visually inspected. According to its orientation it was classified as posterior-superior, superior and posterior. The results were submitted to Kruskal-Wallis test with 5% significance level.

RESULTS

The values obtained for the ICC were higher than 0.98; therefore the replicability was considered excellent.

Position of the mental foramen (MF) to the mandibular symphisis (MS) and base of the mandible (BM)

Table I shows the results of the measurements from mental foramen to the mandibular symphisis (MF-MS) and from the mental foramen to the base of the mandible (MF-BM), according to the side, gender and dental status.

Data analysis showed that gender (p<0.0001) and dental status (p<0.0001) significantly affected the measure MF-MS; the male mandibles presented higher values than the female ones and the dentate presented higher values when compared to the edentulous mandibles. No difference was...
Table I. Mean (±SD) of the measurements from mental foramen to the mandibular symphisis (MF-MS) and from mental foramen to the base of the mandible (MF-BM) (in mm), according to the side, gender and dental status.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Dental status</th>
<th>MF-MS</th>
<th>MF-BM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Right (mm)</td>
<td>Mean (±SD) [95% CI]</td>
<td>Left (mm) Mean (±SD) [95% CI]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Edentulous (n=28)</td>
<td>26.9 (±0.30) [26.3 - 27.5]</td>
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<tr>
<td></td>
<td></td>
<td>Male* Dentate (n=24)**</td>
<td>27.3 (±0.42) [26.5 - 28.2]</td>
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<tr>
<td></td>
<td></td>
<td>Edentulous (n=51)</td>
<td>27.7 (±0.33) [27.1 - 28.4]</td>
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<tr>
<td></td>
<td></td>
<td>Male* Dentate (n=67)**</td>
<td>28.9 (±0.23) [28.5 - 29.4]</td>
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<td>Female Dentate (n=24)**</td>
<td>13.5 (±0.31) [12.9 - 14.1]</td>
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<tr>
<td></td>
<td></td>
<td>Edentulous (n=51)</td>
<td>14.2 (±0.41) [13.4 - 15.0]</td>
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<tr>
<td></td>
<td></td>
<td>Male Dentate (n=67)**</td>
<td>13.3 (±0.23) [12.8 - 13.7]</td>
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<td></td>
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<td>Female Edentulous (n=28)</td>
<td>14.2 (±0.21) [13.8 - 14.6]</td>
</tr>
</tbody>
</table>

* Significantly differences (p<0.0001) between male and female. **Significantly differences (p<0.0001) between edentulous and dentate.

observed between left and right sides (p=0.2990).

Considering the FM-BM measurement, the dentate mandibles presented higher values (p<0.0001) than the edentulous ones. No differences were observed in relation to the gender (p=0.1520) and side (p=0.4420).

Fig. 2 shows the graphical representation of the variation of mental foramen according to the measures performed.

Orientation of the mental foramen (MF) and position in relation to the teeth.

Table II shows the results for orientation of the mental foramen. No differences (p=0.9682) were observed in relation to the gender, dental status, and side.

The position of the mental foramen in relation to the mandibular teeth is shown in Table III. The most frequent position of the mental foramen was in line with the long axes of the second premolar for male (p<0.0001) and female (p=0.0004). No difference (p>0.05) was found between sides for both, male and female.

Finally, no accessory or multiple foramens were observed in this study.

DISCUSSION

The location of the mental foramen is an important factor when considering the mental and incisive anesthetic block and surgeries in the outer premolar mandibular region. The present study shows, for the Brazilian population, the location in line with the long axes of the second premolar as the most common position of the mental foramen, followed by the position between the first premolars. These results, in consistence with others (Freitas et al., 1975; Phillips et al.; Apinhasmit et al.; Mwaniki & Hassanali 1992; Ari et al., 2005; Oguz & Bozkir, 2002 and Cutright et al., 2003) show this is
the most common finding in the majority of the ethnic groups. A few number of researches has shown these two locations in inverse order as the most common positions for the mental foramen (Olasoji et al.) or with similar percentages of frequency for Saudis, for white Americans and for Jordanians claimed by others.

As observed previously by Apinhasmit et al. and now in the present study this parameter is not influenced by gender.

Another parameter that seems to show little variance among races is the orientation of exit of the mental foramen. As shown by others, such as Apinhasmit in Thais, Mwaniki & Hassanali in Kenian Africans, Igbigbi & Lebona in Malawian, and Phillips in mandibles with unknown race, the postero-superior direction is the most common orientation of exit of the mental foramen.

Concerning the measurements, the FM-BI measures of the dentate mandibles studied are in the same range observed by other studies (Phillips et al.; Oguz et al.; Agthong et al.; Apinhasmit et al.). Contrary to the findings of Agthong et al., dentate mandible showed bigger FM-BI measure than edentulous mandibles. This difference can be related to the high variability of the results and small number of edentulous mandibles (2) evaluated by these authors. According to the findings of G"uler et al. no differences were found among genders in the FM-BI measure.

Considering the means and the respective standard deviations for MF-MS measures in dentate mandibles, the results of the present study were similar to that observed for black Africans, Chinese and Thai subjects (Souaga et al. and Apinhasmit et al.) and bigger than that related for white British, Korean, and black and white Americans (Chung et al. and Cutright et al.). In the present study, male mandibles presented bigger MF-MS measures than female ones, similar to the result observed previously by Apinhasmit et al., however, this outcome was not observed by Chung et al. and Cutright et al.

The difference between genders was also found in the edentulous mandibles for the MF-MS measure, which are in agreement with that of G"uler et al., but with less individual variability.
As observed for the FM-BI measures, the dentate mandibles showed bigger MF-MS measures, which can be related to the mechanic forces of mastication and the consequent osseous deposition response for consolidation of the mandibular symphysis region, as the factors associated to the alveolar osseous growth that follows the anterior teeth eruption (Hylander, 1984; Kaifu, 1997). Therefore, the atrophic processes that took part in the edentulous mandibles with alveolar bone resorption may be responsible for the lower measures observed in these specimens.

In addition, muscle forces, facial biotype, teeth size, shape and size of neurocranium, diet habits, the head position, environmental influences, and socioeconomic factors, along with ethnic characteristics and racial miscegenation could also change the mastication function and mandibular morphology (Bogin & Rios 2003; Prado & Caria 2007).

The differences observed among studies may be related to different methodology, such as measurements on skull photographs (Chung et al.) or different skull marks - center versus anterior or inferior border of the mental foramen or ascense of skull marks information (Cutright).

Another important factor is the great variability of the measures as shown by the standard deviation in some studies (Apinhasmit et al. and Chung et al.). This variability could be due to individual variability or to the instrument of measurement. Although Brazilian population presents a high degree of miscegenation (IBGE, 2000), little variability was found among measurement sample.

Concerning the ethnic factor, the Brazilian population sample studied presents results more similar to Africans and Chinese, with bigger measures than other ethnic groups.

Although the inferior third of face is related as the most asymmetric portion of the skull (Türp et al., 1998; Melnik, 1992), this statement was not observed in the parameters related to the mental foramen analyzed in the present study, which corroborate the findings of Captier et al. for dentate and edentulous subjects.

In conclusion the position of the mental foramen is altered in edentulous when compared with dentate subjects.

Mental foramen is a symmetric structure in Brazilian population being most commonly located in the long axes of the second premolar as it was previously described by others elsewhere. Thus, our findings are in consistence with previous studies described before showing little variations for Brasillian ethnology.

RESUMEN: El foramen mental ha sido reportado variablesmente en diferentes posiciones, según los grupos étnicos. Repetidos errores durante el procedimiento anestésico, que involucran al foramen mental, sugieren la presencia de diferencias locales en una determinada población. El objetivo del presente estudio fue determinar la posición del foramen mental (MF) en una muestra de 170 mandíbulas secas de la población brasileña, siendo 79 desdentadas y 91 dentadas. La evaluación fue hecha teniendo como referencia la base de la mandíbula (BM) y la sínfisis mandibular (MS). La comparación fue dada y llevada por géneros, según el lado de la mandíbula (izquierdo o derecho) y la dentición (dentada o desdentada). El análisis estadístico fue realizado usando el test multifactorial ANOVA (alpha 5%). Mandíbulas masculinas presentaron valores mayores que el grupo femenino y las mandíbulas dentadas presentaron valores superiores, cuando fueron comparadas con las mandíbulas desdentadas (p<0.0001). Ninguna diferencia fue observada entre los lados derecho e izquierdo (p=0.2990), como tampoco para los géneros masculino y femenino (p=0.152). La posición más frecuente de MF para las mandíbulas masculinas fue a lo largo del eje del segundo premolar (p<0.0001), así como para las mandíbulas femeninas (p=0.0004).

No fueron encontradas diferencias estadísticamente significativas (p>0.05) entre los lados derecho e izquierdo, comparando mandíbulas masculinas y femeninas. Se concluye que la posición del foramen mental es principalmente alterada en sujetos desdentados, es considerada una estructura simétrica en la población brasileña y más comúnmente localizado a lo largo del eje del segundo premolar.

PALABRAS CLAVE: Mandíbulas; Foramen Mental.

REFERENCES


