Effect of Ageing Towards Location and Visibility of Mental Foramen on Panoramic Radiographs

Wei Cheong Ngeow, Dionetta Delitta Dionysius, Hayati Ishak and Phrabhakaran Nambiar
Faculty of Dentistry, University of Malaya, Kuala Lumpur, Malaysia.

Abstract
Mental foramen is an opening of the mental canal onto the lateral surface of the mandible. In this pilot radiographical study, in Malay population the effects of ageing towards the location and visibility of the mental foramen were determined. Most of the mental foramina were found to be located inferior to the apex of the second premolar. Non-visibility of the foramen was greatly increased in patients aged 50 years and above (Pearson Chi-square; \( p = 0.00 \)). This finding may provide a guide to dental surgeries in Malay patients of different age groups. [Singapore Dent J 2010;31(1):15–19]

Key Words: mental foramen, radiograph, ageing

Introduction
Mental foramen is a funnel-shaped opening of the mental canal onto the lateral surface of the mandible.\(^1\) The mental nerve that exits this foramen provides sensation to the ipsilateral mucosa around the premolar regions as well as the mandibular lip and chin. Any injury to this nerve may result in various degrees of paraesthesia to the mandibular lip of the same side. Proper knowledge of the accurate location of the mental foramen is of great clinical significance, especially when performing dentoalveolar surgery in this anatomical region.

Many anatomical and radiographical studies have been conducted for determining the position of the mental foramen. However, these studies have focused mainly on Caucasian populations,\(^1–5\) and their findings may not be applicable to the Asian populations. The few studies undertaken on Asian populations reported that the most common location for the mental foramen is in the line of the second premolar.\(^6–12\) This is in contrast with the reports of mental foramen being located in between the first and the second premolars of the Caucasian populations. Therefore, these race-based studies are important, as they provide a guide on the possible location of mental foramen while treating patients of different races.

Fishel et al\(^5\) studied the vertical position of the mental foramen in relation to the apex of the second premolar. They found that about 60% were located superior to the level of the apex of the second premolar. Their result was in contrast with that reported by Phillips et al\(^3\) who found that the most common position was below the apex of the second premolar.

The location of the mental foramen has been reported to move upwards closer to the alveolar crest in elder edentulous patients due to bone resorption.\(^13\) However, no studies have looked into the effects of ageing towards its location and visibility on panoramic radiographs of fully dentate patients.

The purpose of this study was to determine the radiographical location of the mental foramen in a group of Malay subjects. The effect of ageing on the location and visibility of the mental foramen on dental panoramic radiographs was also studied. The null hypothesis is that age does not affect the...
location and visibility of the mental foramen on panoramic radiographs of fully dentate patients.

**Materials and Methods**

**Materials**

One hundred and twenty panoramic radiographs of Malay patients of four different age groups of each gender, taken between 2003 and 2005, were obtained from the Dental Faculty, University of Malaya. The age groups were categorized as 20–29, 30–39, 40–49 and 50 years and above.

All panoramic radiographs were taken using Planmeca® (Planmeca, Helsinki, Finland) and Siemen Orthophos® (Sirona, Bensheim, Germany). The magnification factors reported by the manufacturers were 1.2 and 1.25, respectively.14,15

The radiographs were chosen by two investigators according to the following criteria:

1. High quality with respect to geometric accuracy and contrast of the image.
2. Radiographs in which the mandibular teeth (between 36 and 46) were missing, had deep caries, endodontic treatment or multiple restorations were excluded because of possible associated periapical pathology.
3. Radiographs must be free from any radiolucent or radio-opaque lesion in the mandible. There should be no evidence of jaw fracture around the mental foramen region.
4. Radiographs with supernumeraries and unerupted teeth were excluded because the impacted/unerupted teeth might obscure the appearance of mental foramen.
5. Radiographs should be devoid of any radiographical exposure or processing artefacts.
6. Radiographs were excluded if the mandibular canines were missing, because of the possibility of mesial premolar drift.
7. Radiographs were excluded in which the maxillary premolars were missing, because of the possibility of over-eruption of the mandibular premolars.

**Methods**

**Locating mental foramen**

The radiographs were placed on a well-illuminated radiographical view box (0400 Series Countertop/ Wall-Mount Universal Viewers #67-0442, Dentsply, USA). A line following the inferior contour of the mandible and a second line passing through the apices of the premolars and the first molar were drawn on a tracing paper. Observations were then made for determining the presence (or the absence) of the mental foramen on the radiographs. If present, the relationship of the mental foramen to the second premolar was recorded. The vertical position of the mental foramen is categorized as inferior, superior or at the level of the apex of the second premolar, according the protocol used by Fishel et al5 (Figure 1).

**Results**

A total of 97 radiographs that fulfilled the selection criteria were examined. The breakdown of the number of subjects according to different age groups is shown in Table 1. Fewer radiographs

![Figure 1. Schematic illustration showing the method employed to determine the location of mental foramen (I = superior to the level of apex; II = apical level; III = inferior to the level of apex).](image-url)

<table>
<thead>
<tr>
<th>Age group (in years)</th>
<th>Number of subjects/radiographs [sites]</th>
</tr>
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<tbody>
<tr>
<td>20–29</td>
<td>31 [62 sites]</td>
</tr>
<tr>
<td>30–39</td>
<td>24 [48 sites]</td>
</tr>
<tr>
<td>40–49</td>
<td>22 [44 sites]</td>
</tr>
<tr>
<td>≥ 50</td>
<td>20 [40 sites]</td>
</tr>
<tr>
<td>Total</td>
<td>97 [194 sites]</td>
</tr>
</tbody>
</table>
fulfilled the selection criteria as the age of subjects increased as a result of increasing incidence of edentulism.

Figure 2 shows the overall distribution of the mental foramen. The mental foramen was more pronounced on the left (80.4%; 78 sites) than the right side (75.3%; 73 sites) of the mandible. The mental foramina were mainly located inferior to the apical level of the second premolar on both sides of the mandible (left = 52.6% and right = 45.4%) (see Figure 2). No mental foramen was found to be superior to the level of the apex. It was noted that the distribution of location and visibility of the mental foramen were not symmetrical between the left and right side of the mandible.

Figures 3–6 show the distribution of the location and visibility of the mental foramen according to different age groups. It is noted that the most common location was inferior to the apical level of the second premolar, regardless of the age of the subjects.

On the left mandible, the pattern of distribution and non-visibility of mental foramen was as follows: 52.6% inferior to the second premolar, 27.8% at the apex of the second premolar and 19.6% not visible (Figure 3). The non-visibility of the mental foramen varied between 9.7% (in the age group of 20–29 years) to 55% (in those aged 50 years and above) (Figure 4). The general pattern was an increase in the percentage of non-visibility
of the mental foramen when age increased, apart from the 3.40% drop seen between the age group of 30–39 and 40–49 years.

The distribution of the location of the mental foramen on the right mandible did not differ from that of the left mandible (Figure 5), with most (45.4%) mental foramina located inferior to the apical level of the second premolar. This was followed by 29.9% at the apex of the second premolar and 24.7% not visible.

The right mandible, however, did not register the pattern of increased non-visibility of the mental foramen with an increase in age as seen on the left side of the jaw (Figure 6). Instead, the right mandible registered a higher percentage of non-visible mental foramen for the age group of 20–29 (25.8%) and 40–49 (22.7%) years, as opposed to the left side (9.7% and 9.1%, respectively) for the respective age group.

The non-visibility of the mental foramen on panoramic radiograph was 19.6% on the left mandible and 24.7% on the right side. One obvious finding was that the visibility of the mental foramen was reduced to at least half (left = 55% and right = 50%), when the patients became 50 years and above. This difference was statistically significant (Pearson Chi-square; \( p = 0.00 \)).

**Discussion**

Accurate presurgical localization of the mental foramen is one of the critical factors that ensures successful dentoalveolar surgeries and prevents neurosensory disturbances from happening. Panoramic radiography is widely used by many clinicians for this purpose, as it provides a reasonably good image of the mental foramina. Its disadvantages included: image distortion, variable magnification of images ranging between 20% and 30%, and invisibility in the facio-lingual dimension. The location of the mental foramen also varies due to certain factors such as the presence of pathologies in the jaw, the technique of radiograph taking, age and the integrity of the dental arch.

The current study shows that the most common position of the mental foramen was below the apex of the second premolar. This is similar to that reported by Phillips et al., but is in contrast with that reported by Fishel et al. The difference found between this study and that reported by Fishel et al. may be related to the differences in positioning of the jaw when taking radiographs.

Depending on the sites, a non-visibility of the mental foramen that involved 19.6% panoramic radiographs on the left mandible and 24.7% on the right side was observed. This is higher than the 14% of severe limitation; i.e. to non-visualization in the region of clinical interests based on a grading of visibility, reported. It has been reported that the lack of identification of the mental foramen was attributed to the inability to distinguish it from the trabeculae pattern and poor radiograph quality.

Bone undergoes various quantitative and qualitative changes with age. Bone remodelling appears to be slower with ageing, and there is a marked increase in cortical porosity and the percentage of Haversian canals showing resorption after 50 years of age. As a result, the marrow space enlarges and disordered trabeculae are often seen, hence affecting the identification of the mental foramen. This may explain why the percentage of non-visibility of the mental foramen was more prominent and statistically significant in subjects aged 50 years and above.

Due to the high number of subjects (radiographs) excluded, the authors were unable to perform more statistical analysis, apart from a Chi-square test between the visibility of the mental foramen and age 50 and above.

It is important to note that although only a limited number of radiographs were examined...
in this study, the implication of this finding must not be ignored. The findings of this pilot study suggest that the location of the mental foramen remains constant with changes in age. However, the mental foramen becomes more difficult to locate with the increase in age, especially in patients above 50 years of age. As a result, panoramic radiographs may not be sufficient for presurgical assessment in older patients and may need to be supplemented with a CT scan.

Conclusion

In conclusion, most of the mental foramina were found to be located inferior to the apical level of the second premolar. However, non-visibility of the foramen is greatly increased in patients aged 50 years and above.

References