



*Full Length Research Paper*

## Location of mental foramen among Malaysia populations: Retrospective study by using orthopantomogram

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The aim of this study is to determine the location of mental foramen (MF) among Malaysia populations. Six hundred orthopantomogram (OPG) radiographs were observed. Inter-examiner calibration was estimated using Kappa-Cohen formula. Data were tabulated according to the following, position 1: MF in line with long axis of 1<sup>st</sup> premolar; position 2: MF between 1<sup>st</sup> and 2<sup>nd</sup> premolar; position 3: MF in line with long axis of 2<sup>nd</sup> premolar; position 4: MF between 2<sup>nd</sup> premolar and 1<sup>st</sup> molar. Chi-square test was used to analyze the data. Three hundred and seventy six OPGs were selected out of 600. In Malay population, the common location of MF on the right was position 2 (n=183, 51.91%) followed by position 3 (n=183, 31.15%). The common location of MF on the left was position 2 (n=184, 57.07%) followed by position 3 (n=184, 35.32%). In Chinese population, the common location of MF on the right was position 2 (n=122, 50.82%) followed by position 3 (n=122, 33.61%). The common location of MF on the left was position 2 (n=121, 56.20%) followed by position 3 (n=121, 30.58%). In Indian population, the common location of MF on the right was position 2 (n=71, 45.07%) followed by position 3 (n=71, 36.62%). The common location of MF on the left was position 2 (n=71, 62.0%) followed by position 3 (n=71, 22.53%). Malaysian populations were insignificantly associated with position of MF on left and right side (p>0.05). There was no significance difference between the locations of MF among Malaysia populations. The most common location among all population was position 3.

**Key words:** Mental foramen, races, dental implantation, oral surgical procedures.

### INTRODUCTION

The knowledge of anatomical landmark of mental foramen is essential in planning any surgical procedure involving the mental foramen area. For instances, delivery of local anesthesia, orthognathic surgery, periapical surgery, and mandibular fixation and reduction

in case of mandibular fractures. Mental foramen in early child life lies near the lower border (Chummy, 2006). After eruption of permanent dentition, the mental foramen lies higher, halfway between upper and lower border (Chummy, 2006). The location of the mental foramen may change with age, like in edentulous jaw, mental foramen is nearer to the upper border of the mandible due to bone resorption (Chummy, 2006). While Kjaer (1989) found that the mental foramen lies in between primary canine and 1<sup>st</sup> molar in early life.

Location of mental foramen varies among individuals

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(Shankland, 1994; Sawyer et al., 1998) and may be related to races (Fishel et al., 1976; Wang et al., 1986; Ngeow and Yuzawati, 2003). Some research showed that the location of mental foramen is not gender dependant (Al-Jasser and Nwoku, 1998; Rupesh et al., 2001).

Some studies used other anatomical landmarks to measure the location of the mental foramen. Agthong et al. (2005) reported that mental foramen is 28 mm from the midline of mandible and 14-15 mm from inferior border of mandible. Neiva et al. (2004) indicated 27.6 mm (range: 22-31 mm) from the midline and 12 mm (range: 9-15 mm) from the most apical portion of the lower cortex of the mandible. While Apinhasmit et al. (2006) found that the mental foramen has the mean of 28.52±2.15 mm lateral to midline of the mandible. The same study, Apinhasmit et al. (2006) reported that the average distance between the cusp tip and the superior border of mental foramen by direct measurement and panoramic assessment is 23.43 and 25.69 mm, respectively. And the mean distance between superior border of mental foramen and bottom of mandible by direct measurement and panoramic assessment is 14.33 and 16.52 mm, respectively (Apinhasmit et al., 2006). The aim of this study is to relate the location of the mental foramen in the Malaysian different ethnic group. To our knowledge, this study is the first of its kind conducted on Malaysia population.

## MATERIALS AND METHODS

600 panoramic radiographs were collected from the MAHSA Dental Clinic. All panoramic radiographs were taken using Siemen Orthophos (Sirona) with magnification of 1.2. The collected panoramic radiographs should fulfill the inclusion and exclusion criteria as stated below:

### Inclusion criteria

1. Age 25 and above
2. Malaysia ethnicity: Malay, Chinese and Indian
3. Film should show no radiographic exposure and processing artifacts.

### Exclusion criteria

1. Unreadable and poor quality of OPG
2. Missing teeth, especially missing lower canine must be excluded when mesial premolar drift occur.
3. Presence of supernumerary teeth in mandibular dentition.
4. Presence of periodontal lesion in mandibular dentition that may cause dental mesial drift
5. Patients with previous and current orthodontic treatment
6. Presence of deep caries or root canal treatment for the teeth located within mental foramen area.

7. Presence of crowding and spacing in the mandibular arch.

## Procedure

Panoramic radiographs (Figure 1) were observed using an x-ray viewer and the mental foramen was identified by a magnifying glass. A sheet of transparent paper was superimposed on panoramic film and the mental foramen was traced on the transparent paper by using a fine blue marker pen. A line was draw from the apex of 1<sup>st</sup> premolar to 2<sup>nd</sup> premolar and it formed the vertical plane by using a ruler. 2 horizontal planes were drawn on the longitudinal axis of 1<sup>st</sup> premolar and 2<sup>nd</sup> premolar respectively by using a ruler (Figure 2).

The horizontal position of the mental foramen was recorded as follows:

- position 1: in line with the 1<sup>st</sup> premolar
- position 2: between the 1<sup>st</sup> and 2<sup>nd</sup> premolar
- position 3: in line with 2<sup>nd</sup> premolar
- position 4: between 2<sup>nd</sup> and 1<sup>st</sup> molar

The vertical position of the mental foramen was recorded as follow:

1. Above to the vertical plane
2. At the vertical plane
3. Below the vertical plane

30 panoramic radiographs were studied by 2 observers to perform the inter-examiner calibration, and Cohen's Kappa formula was used.

$$\kappa = \frac{\text{Pr}(a) - \text{Pr}(e)}{1 - \text{Pr}(e)},$$

Pr(a) = relative observed agreement among raters

Pr(e) = hypothetical probability of chance agreement

The inter-examiner kappa statistic shows 0.899 (0.81–1 as almost perfect agreement). All the data collected were analyzed by using chi-square test. The confidence level of this study is L<0.05.

## RESULTS

376 OPGs were selected from 380 OPGs based on the exclusion criteria. In position 1, the location of mental foramen in Malay is (n=183, R=2.8%) (n=184, L=2.7%), Chinese (n=122, R=4.9%) (n=121, L=4.1%), Indian (n=71, R=4.3%) (n=71, L=7%). In position 2, the location of mental foramen in Malay is (n=183, R= 51.9%) (n=184, L=57.1%), Chinese (n=122, R=50.8%) (n=121, L=56.2%), Indian (n=71, R=45.1%) (n=71, L=62%). In position 3, the location of mental foramen in Malay is (n= 183, R=31.2%)

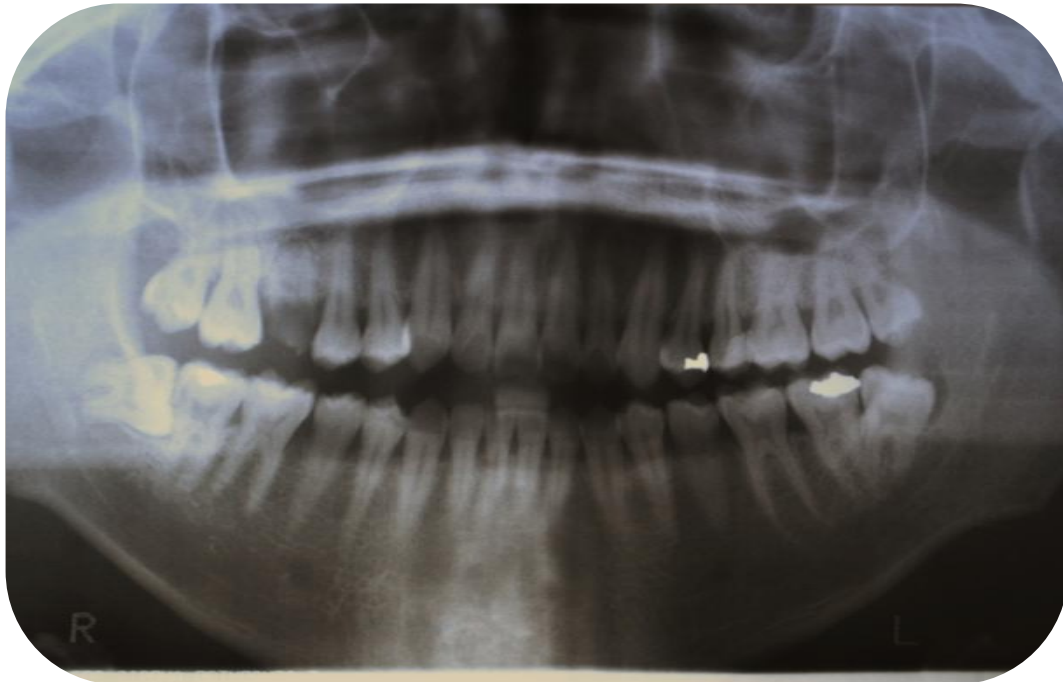


Figure 1. An overall view of panoramic radiograph.

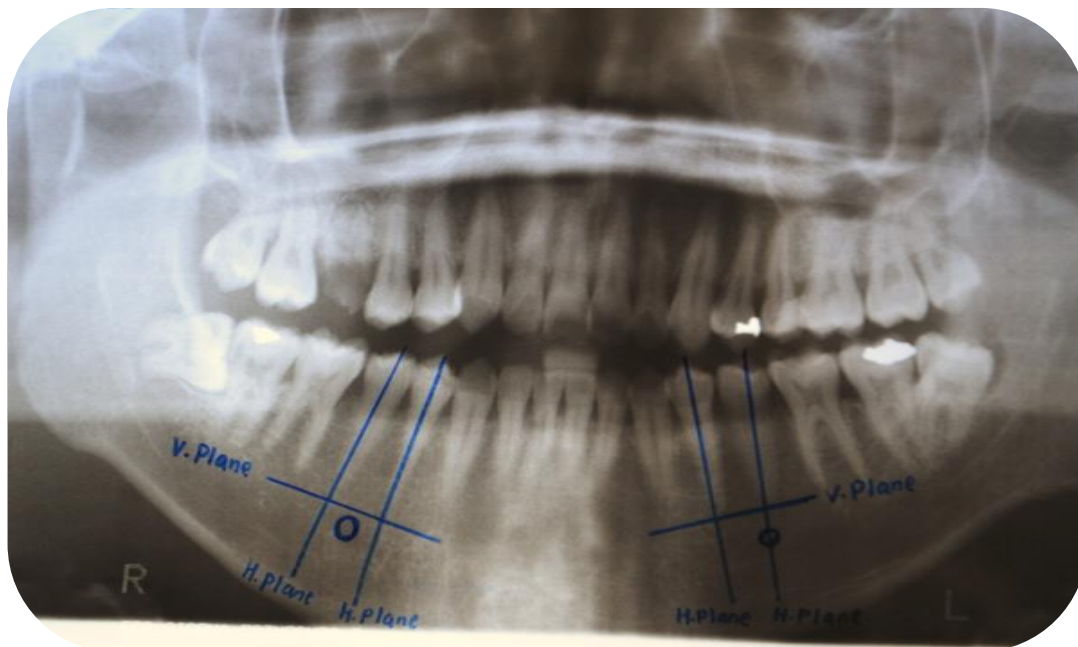


Figure 2. Position of the mental foramen based on the vertical and horizontal planes.

(n=183, L=35.3%), Chinese (n=122, R=33.6%) (n=121, L=30.6%), Indian (n=71, R=36.6%) (n=71, R=22.5%). In position 4, the location of mental foramen in Malay is (n=183, R=13.8%) (n=184, L=4.9%), Chinese (n=122,

R=10.7%) (n=121, R= 9%), Indian (n=71, R= 11.6%) (n=71, L=8.4%) as illustrated in Figures 3 and 4.

The position of mental foramen in the right and left side of mandible are illustrated in Tables 1 and 2).

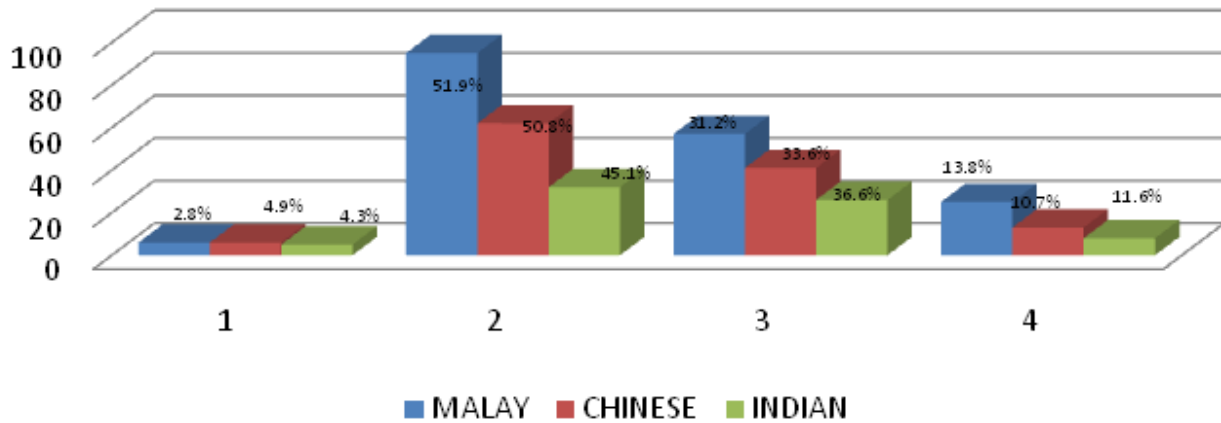


Figure 3. The location of MF in Malay, Chinese and Indian in right side of mandible.

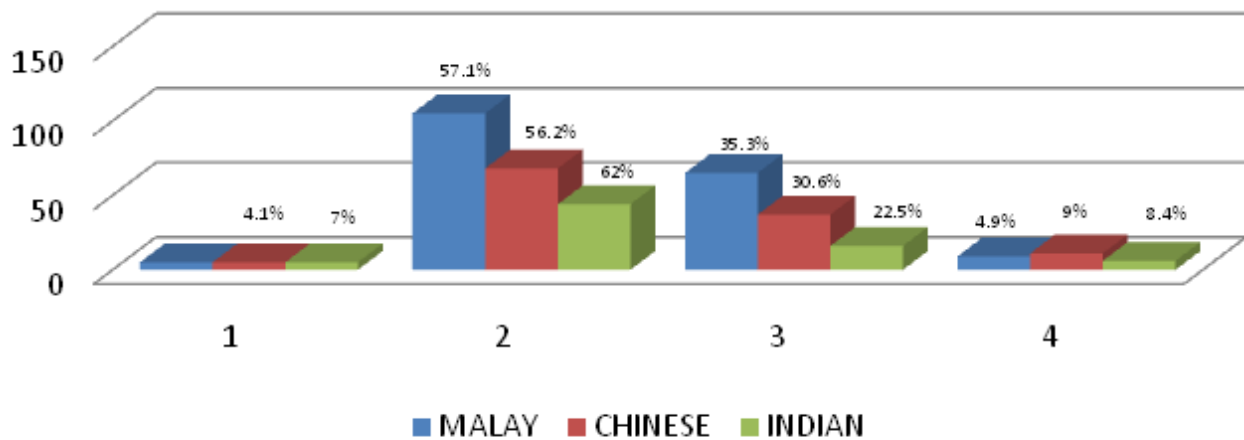


Figure 4. The location of Mf in Malay, Chinese and Indian in left side of mandible.

Table 1. Position of mental foramen in the right side of mandible.

	Position 1	Position 2	Position 3	Position 4	Total
<b>MALAY</b>	6	95	57	25	183
<b>CHINESE</b>	6	62	41	13	122
<b>INDIAN</b>	5	32	26	8	71
<b>TOTAL</b>	17	189	124	46	376

Table 2. Position of mental foramen in the left side of mandible.

	Position 1	Position 2	Position 3	Position 4	Total
<b>MALAY</b>	5	105	65	9	184
<b>CHINESE</b>	5	68	37	11	121
<b>INDIAN</b>	5	44	16	6	71
<b>TOTAL</b>	15	217	118	26	376

The chi-square value obtained for right and left was 2.378 and 7.585, respectively. The degree of freedom (df) is 6 for both right and left. The p-value (P) for right was 0.8851 ( $P > 0.05$ ) and the left was 0.2717 ( $P > 0.05$ ), which is not statistically significant. Thus, the null hypothesis was supported and the alternative hypothesis was rejected. Therefore, there is no relationship between Malaysia population and location of mental foramen.

## DISCUSSION

Normally, MF is located below the interval between the two premolars (Ngeow and Yuzawati, 2003; Singh and Srivastav, 2011), but many studies have shown that there are variations in the position of MF in different populations and especially between different races (Fishel et al., 1976; Wang et al., 1986; Ngeow and Yuzawati, 2003). It may lie between the apices of premolars, below the apex of second premolars (Singh and Srivastav, 2011).

According to Ngeow and Yuzawati (2003), the most common location of MF was apical to the 2<sup>nd</sup> premolar (69.2%) in Malay population. Our findings were not in line with the findings of previous study, when the location of MF in Malay population lies between 1<sup>st</sup> and 2<sup>nd</sup> premolar (R=51.9%) (L=57.1%).

Wang et al. (1986) reported that the most common location of MF among Chinese population was apical to the 2<sup>nd</sup> premolar (59%). Our findings were confounding with the findings of Wang et al. (1986) in which the mental foramen lies between 1<sup>st</sup> and 2<sup>nd</sup> premolar (R=50.8%) (L=56.2%) in Malaysian Chinese population.

However, Shankland (1994) on the study of Asian Indian population, reported that the most common location of MF was apical to the 2<sup>nd</sup> premolar (75.4%). Singh and Srivastav (2011) reported that among India population, the MF was commonly located apical to the 2<sup>nd</sup> premolar (68.8%). According to Rupesh and Jasmin (2001), the MF was commonly located between the apices of 1<sup>st</sup> and 2<sup>nd</sup> premolar (47.6%) in Asian Indian population. Sumit and Jagdish (2012) reported that the most common location of MF was apical to the 2<sup>nd</sup> premolar (75.8%) in Indian population. Our study supported the study by Rupesh and Jasmin (2001) in Indian population in which the mental foramen lies between 1<sup>st</sup> and 2<sup>nd</sup> premolar (R=45.1%) (L=62.0). The difference between our study and previous studies may be attributed to different factors, such as evaluating a region rather than a determined point, difference in the population ethnic origin, and angulations of the measurements (perpendicular vs. oblique). We consider the vertical line as the long axis of the tooth (premolars) which is easier to determine and evaluate. The usage of 2-D image of OPG and small sample size were the limitations in this study. Therefore, the authors recommend for future study to utilize 3-D Cone-beam computed tomography with bigger sample size.

## Conclusion

The prevalence of location of mental foramen among Malaysian population is in position 2. There is no relationship between Malaysian population and location of mental foramen. Clinician must always take into consideration the location of the mental foramen and should not be determined based on races. Therefore, precautions should be taken if there is need for any surgical procedure to be carried out on the mental foramen area.

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