

## Vertical Height and Horizontal Width Assessment of Mental Foramen for Sex Determination from Panoramic Radiograph

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### Abstract

**Introduction and Objectives:** In dentistry, a panoramic radiograph is not only used as an additional diagnostic tool, but also can be used as a sex determination tool by using the vertical and horizontal dimension of mental foramen as an indicator. The purpose of this study was to determine the differences vertical height of the mental foramen to the inferior border of the mandible between men and women, and the differences horizontal width between the mental foramen in both men and women.

**Materials and Methods:** The material of this research is 80 panoramic radiographs of data consisting 40 males and 40 females from Dento and Maxillofacial Radiology Installation, Faculty of Dentistry, Trisakti University. The method used in this study is comparative analysis.

**Results and Discussion:** The results show that mean of the vertical height of the mental foramen to the inferior border of the mandible in men (14.9333 mm) is significantly greater than in women (13.3185 mm). However, the mean of horizontal width between the mental foramen in men (57.7395 mm) and women (56.7775 mm) are shown to be similar.

**Conclusion:** As a conclusion, vertical height of the mental foramen to the inferior border of the mandible evaluated from panoramic radiograph is can be used as an indicator for sex determination.

**Keywords:** Panoramic Radiograph; Sex Determination; Mental Foramen; Vertical Height' Horizontal Width

### Introduction

Panoramic radiography is one of the most popular radiograph technique in the last three decades, used by dentists as an additional diagnostic tool, to determine treatment plans, and to evaluate treatment outcome [1]. In addition, panoramic radiograph can be used as a tool to determine sex, age, and race of an individual. Which is an advantage to identify victims with incomplete body parts caused by mass accidents, bomb explosions, and natural disasters [2-5].

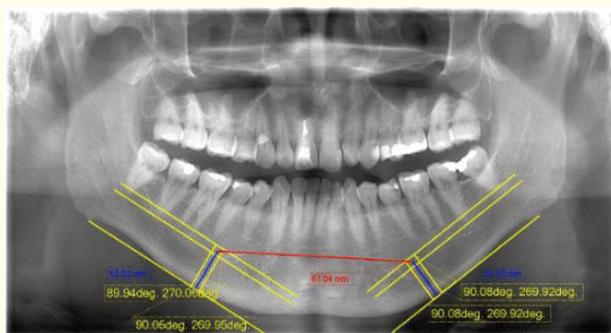
Many studies show the anatomy of mandible are useful as an indicator for sex determination, one of the anatomical structure is mental foramen which has high degree of validity and accuracy because of its stable position throughout life, in accordance to the research done in 1974 by Wical and Swoope [6]. Vertical measurement of mental foramen carried out in North and South India shows in 95% of cases are significantly greater in males than females [7]. The results are consistent with the previous study done by Thomas, *et al.* in 2004, Mahima, *et al.* in 2009, and Catovie, *et al.* in 2012 [3]. While, horizontal measurement of mental foramen performed by Guler, *et al.* in 2005 on 173 radiographs, by evaluating the distance of mental foramen to the midline shows there are no significant difference in horizontal distance between males and females [8].

However, in Indonesia the understanding about mental foramen as a sex determination tool is very little, so the aim of this study is to examine the difference in vertical height of the mental foramen to the inferior border of the mandible and the horizontal width between the mental foramen in males and females using the panoramic radiograph.

**Materials and Methods**

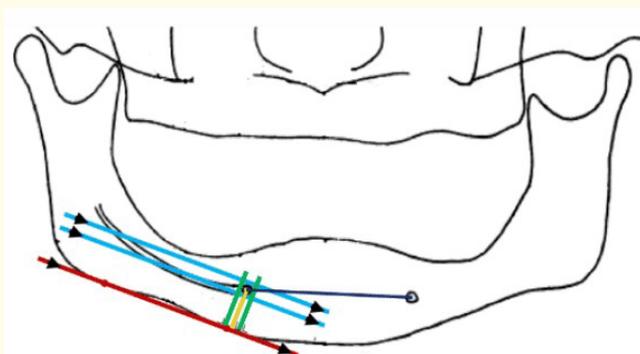
This research is a comparative analysis study that aim to examine the difference in vertical height of mental foramen to the inferior border of the mandible and the horizontal width between the mental foramen in males and females using the panoramic radiograph. A total of 80 digital panoramic radiographs consisting 40 males and 40 females obtained from Veraviewpocs 2D (Morita, Japan) at Dento and Maxillofacial Radiology Installation, Faculty of Dentistry, Trisakti University during June to October 2016. The digital panoramic radiograph that were used in this study must be in good quality with the visualization of mental foramen bilaterally, and the radiographs must be belongs to subject aged 18 - 60 years. For samples that have a tooth with pathological conditions in the periapical region, post orthognatic surgery, facial asymmetry, jaw fracture, maxillary and mandibular abnormalities, and premolars impaction should be excluded from this study.

Measurement of the vertical height of mental foramen to the inferior border of the mandible and the horizontal width between the mental foramen is done by using a modified Guler and Taguchi technique with i-Dixel software version 2.2.0.3 (Morita, Japan) (Figure 1).



**Figure 1:** Measurement with modified Guler and Taguchi technique on i-Dixel software version 2.2.0.3 (Morita, Japan).

Measurement steps using modified Guler and Taguchi technique (Figure 2):



**Figure 2:** Modified Guler and Taguchi technique illustration.

1. Determine two reference points, the most inferior part of the mandibular angle and mandibular corpus. Then a straight line was drawn to connect those two points, and this line called as the reference line.
2. On the most superior and inferior border of the mental foramen, two line are drawn parallel to the reference line, and to divide the distance between them into two equal parts, a horizontal diameter line is drawn parallel to the line in the superior and inferior border of the mental foramen.
3. Two lines are drawn perpendicular to the reference line on the left and right border of the mental foramen, and then draw a vertical diameter line parallel to both lines on the left and right border of mental foramen to divide the distance into two equal parts.
4. The results of the intersection of the two diameter lines is the midpoint of the mental foramen, and if a perpendicular line is drawn from the midpoint of the mental foramen to the reference line, the measured length is the vertical height of the mental foramen to the inferior border of the mandible.
5. Perform these steps in sequence on the other side of the mandible
6. And last, by connecting the two midpoints of the left and right mental foramen, the horizontal width of mental foramen can be determined.

In this study, the data obtained was tabulated and were analyzed using SPSS software. If the data was normal ( $p \geq 0.05$ ), the data was tested with parametric test (independent sample T-test), whereas if the data was not normal ( $p < 0.05$ ), the data was tested with non-parametric test (Mann-Whitney). As a result, there is a statistically significant difference if the p value  $< 0.05$ , and if the p value  $\geq 0.05$  the result show there is no statistically significant difference.

### Results and Discussion

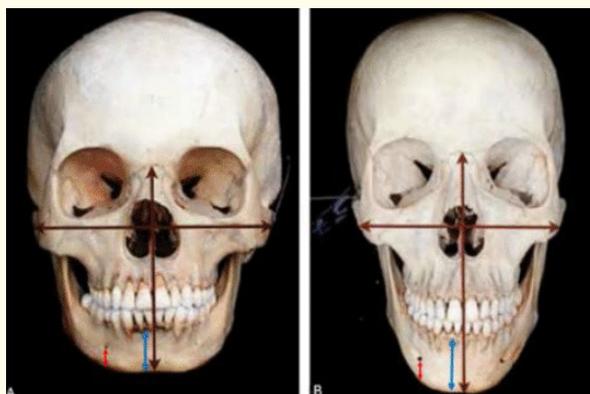
The measurement of the vertical height of the mental foramen to the inferior border of mandible in both males and females were performed on the left and right sides of the mandible. According to the measurement, the results shows there is no significant difference in the vertical height of the mental foramen on the left and right sides in both males and females. In order to compare the vertical height of mental foramen in males and females, the average of vertical height in each sample can be used.

The comparison of the vertical height of mental foramen to the inferior border of mandible in males and females shows that the average of vertical height in males is 14.9333 mm, while females with an average of 13.3185 mm. The analysis show the p value is 0.001 which indicate the average of vertical height of mental foramen are significantly greater in males when compared to females (Table 1).

Vertical Height		
	Males	Females
Number of radiograph	40	40
Vertical height means	14,9333	13,3185
Normality test value	0.084	0.723
Means $\pm$ SD	1.6146 $\pm$ 0.3980	
t-value	4.056	
P-value	0.001	

**Table 1:** Vertical Height Measurement.

This condition allegedly caused by the tendency of the male skulls to be dolichocephalic, while the female skulls tend to be brachycephalic [9]. The dolichocephalic skull shows an oval shape that extends downwards, while the brachycephalic skull is more rounded, broad, and short [10]. There is a possibility, because the vertical height of men skull is higher, so the vertical height of mandibular symphysis and mandibular corpus are also higher, so the vertical distance of the mental foramen to the inferior border of the mandible is greater in males than in females (Figure 3).



**Figure 3:** a: Brachycephalic (Female) and b: Dolichocephalic (Male).

Sika., *et al.* through their research in 2016 using 126 mandibular bones, proved that the height of mandibular symphysis and the height of mandibular corpus were significantly greater in males when compared with females. In males, the average height of the mandibular symphysis was 25.4 mm and the average in females was 23.2 mm. While the average of males’ mandibular corpus height was 24.9 mm and 22.8 mm in females [11]. This results amplify the presumption linkage between the vertical height of mental foramen to the mandibular symphysis and the mandibular corpus, the vertical height of the mental foramen to the inferior border is greater. Thus, the results of this research have conformity with other previous studies.

A comparison of the horizontal width between the mental foramen in males and females shows that the average of horizontal width in males is 57.7395 mm and in females with an average of 56.7775 mm (Table 2).

Horizontal Width		
	Males	Females
Number of radiograph	40	40
Horizontal width means	57.739	56.777
Normality test value	0.624	0.473
Means ± SD	0.9620 ± 0.9855	
t-value	0.976	
P-value	0.332	

**Table 2:** Horizontal Width Measurement.

### Conclusion

In dentistry, radiograph especially panoramic is proved not only can be used as an additional diagnostic tool, but can also be used as a sex determination tool. The result of vertical height measurement of the mental foramen to the inferior border of the mandible shows significantly greater in males when compared to females. While the results of horizontal width measurements between the mental foramen shows no significant difference. So, the vertical height of the mental foramen to the inferior border of mandible evaluated from panoramic radiograph can be used as an indicator for sex determination.

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