

RESEARCH ARTICLE

## The relationship between bizygomatic width and mesiodistal width of six maxillary anterior teeth in a Javanese population

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### ABSTRACT

The selection of the mesiodistal width of maxillary anterior teeth is the key to success in prosthodontic treatment. Determining anterior teeth width when there is no existing pre-extraction record can be done through bizygomatic width measurement. The purpose of this study was to look at the relationship between bizygomatic width and mesiodistal width of six maxillary anterior teeth in the Javanese population. This study used a cross-sectional design and was conducted on 32 Javanese subjects who met the following criteria: being 18-25 years of age, having Angle class 1 malocclusion, having complete maxillary anterior permanent teeth, not using dentures, currently not undergoing any orthodontic treatment, and having no abnormalities found in the facial area. The bizygomatic width was measured with a digital caliper with an accuracy of 0.01 mm from the marked right and left bizygomatic points. The mesiodistal width of the six maxillary anterior teeth was measured using dental floss looped from the distal left canine to the right canine. Dental floss marked with a pen was stretched horizontally on paper and then measured with a digital caliper with an accuracy of 0.01 mm. The measurement was done in triplicate. Data were analyzed using Pearson's correlation and the simple linear regression test. This study's analysis revealed a strong and positive correlation ( $r = 0.538$  and  $p < 0.05$ ) between the bizygomatic width and mesiodistal width of the maxillary anterior teeth. The result of the simple linear regression test showed a significant result ( $p < 0.05$ ). It can be concluded that there was a relationship between the bizygomatic width and the mesiodistal width of the six maxillary anterior teeth in the Javanese population. The mesiodistal width of the six maxillary anterior teeth in the Javanese population can be measured by multiplying the bizygomatic width by the multiplier factor, i.e., 0.427.

**Keywords:** anterior teeth; bizygomatic width; Javanese; mesiodistal

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### INTRODUCTION

Tooth loss is a process where one or more teeth are loose in their sockets, causing the teeth of the opposing dental arches to lose contact. This will result in tooth movement into edentulous areas, mastication problems, and alveolar bone resorption.<sup>1,2</sup> Making dentures to replace missing teeth is one way to mitigate the effects of tooth loss.<sup>3</sup> In denture fabrication, the aesthetic factor is very important, because everyone has different tooth sizes, measuring tooth size during the preparation of artificial teeth has a significant effect on the resulting dentures. Age, gender, ethnicity, and area of residence are all factors that influence such differences.<sup>4</sup>

A dentist should have expertise and knowledge in the selection of artificial teeth for maxillary anterior teeth. This is important, particularly when there are no pre-extraction records. Pre-extraction records include study models, facial photos, extracted teeth, previous dentures, radiograph images, facial shape, maxillary arch shape, gender, age, race, and ethnicity.<sup>5,6</sup> In such cases, anatomical landmarks can be used to determine the size of maxillary anterior teeth. The anatomical landmarks that are frequently compared with the mesiodistal width of the six anterior teeth are the interpupillary distance, intercommissural width, intercanthal width, head circumference, and bizygomatic width. Bizygomatic width is the widest

facial width that can be used to determine the size of the maxillary anterior teeth.<sup>7</sup> The bizygomatic width is commonly located 1 to 1.5 inches behind the lateral corner of the eye.

Javanese people are the largest ethnic group in Indonesia, with a population reaching 90 million people.<sup>8,9</sup> The physical characteristics of the Javanese population include a narrow face, a medium nose, and a wide forehead.<sup>10</sup> The purpose of this study is to look at the relationship between bizygomatic width and mesiodistal width of six maxillary anterior teeth in the Javanese population.

## MATERIALS AND METHODS

This research has received an ethical clearance from the research ethics committee Faculty of Dentistry, Universitas Gadjah Mada number 00723/KKEP/FKG-UGM/EC/2021. Selecting research subjects based on the predetermined inclusion criteria: being 18-25 years old; being the member of Javanese ethnic group from 2 previous generations from Central Java, Yogyakarta and East Java; having normal occlusion (Angle class I malocclusion); having complete maxillary anterior teeth; having no restorations in maxillary anterior teeth; having no cleft or crowded maxillary anterior teeth; currently undergoing no orthodontic treatment; using no dentures, veneers, or crowns on maxillary anterior teeth; having no fractures on the maxillary anterior teeth; having no congenital abnormalities; having no growth abnormalities, trauma, facial asymmetry, or facial surgery. Signing informed consent as proof of the subjects' voluntary participation in the research.



Figure 1. Bizygomatic width<sup>11</sup>

The subjects were asked to sit in a dental chair and open their mouths according to what was instructed by the operator during the impression making, using a spoon that matched the size of the subjects' jaws. The material was alginate, while the negative impression was filled with dental stone to be used as a study model.

The width of the six anterior teeth in the study model was measured using dental floss which was looped from the distal surface of the left canine to the distal surface of the right canine. The dental floss, which was marked with a pen, was stretched horizontally on a paper and measured using a digital caliper with an accuracy of 0.01 mm. The measurements were performed by the same operator in triplicate, followed by calculating the mean width in millimeter (mm).



Figure 2. Measurement of six maxillary anterior teeth in the study model using dental floss and digital caliper<sup>12</sup>

**Table 1.** Mean and standard deviation (SD) of bizygomatic and mesiodistal width of six maxillary anterior teeth in millimeter

Measurement	n	Mean ± SD
Bizygomatic width	32	120.72 ± 5.98
Mesiodistal width of six maxillary anterior teeth	32	51.59 ± 2.45

n : number of samples

**Table 2.** Results of Pearson's correlation test of bizygomatic width and mesiodistal width of six maxillary anterior teeth

Measurement	r	Sig.
Bizygomatic width and mesiodistal width of six maxillary anterior teeth	0.538	0.002

r : Pearson's correlation coefficient  
 Sig. : significance (p < 0.05)

The bizygomatic width was measured by measuring the distance between the right and left bizygomatic points, which were already marked with a pen, using a digital caliper with an accuracy of 0.01 mm. During the measurement, the subjects were asked to face forward and sit in an upright position. The measurements were performed by the same operator in triplicate, followed by calculating the mean width in millimeter (mm).

The data obtained were quantitative data with a ratio scale. The data normality was tested using the Shapiro-Wilk method, followed by the Pearson's correlation. After that, a simple linear regression analysis was performed to determine the relationship between the dependent and independent variables.

## RESULTS

The mean and standard deviation of the bizygomatic width and the mesiodistal width of the six maxillary anterior teeth are presented in Table 1.

Prior to analyzing the data using the Pearson's correlation test, the data normality was first tested using the Shapiro-Wilk test. According to the Shapiro-Wilk test result, the significance of the bizygomatic width was 0.406 (p > 0.05) and that of the mesiodistal width of the six maxillary anterior teeth was 0.698 (p > 0.05). Based on

**Table 3.** Results of simple linear regression analysis of bizygomatic width and mesiodistal width of six maxillary anterior teeth

Measurement	B	Sig.
mesiodistal width of six maxillary anterior teeth	25.029	0.002
Bizygomatic width	0.220	0.002

B : unstandardized coefficient  
 Sig. : significance (p < 0.05)

The simple linear regression analysis resulted in the following equation:<sup>13</sup>

$$Y=a+bX$$

$$Y=25.209 + 0.220X$$

Where:

Y = dependent variables

a = constant (dependent variables)

b = regression coefficient (independent variables)

X = independent variables

these results, the data had normal distribution because the significance was greater than 0.05. The results of the Pearson's correlation test can be seen in Table 2.

Based on the Pearson's correlation test, the significance of the bizygomatic width and the mesiodistal width of the six maxillary anterior teeth was 0.002 (p < 0.05), indicating that there was a significant relationship between the bizygomatic width as measured from the malar prominence on both sides and the mesiodistal width of the six maxillary anterior teeth in the Javanese population. The correlation coefficient (r) of the relationship between the bizygomatic width and the mesiodistal width of the six maxillary anterior teeth was 0.538. The data were then analyzed using a simple linear regression analysis (Table 3).

## DISCUSSION

The mean bizygomatic width in the Javanese population as shown in Table 1 was 120.72 mm. This is different from a study conducted by Jain et al.<sup>11</sup> which showed that the mean bizygomatic width in the Indian population in Tamil Nadu was 141.85 mm and a study by Rajanikanth et al.<sup>14</sup> which showed that the mean bizygomatic width in the Indian population in Kanpur was 130.84 mm in males and 124.14 mm in females. This

difference is likely because of differences in race and areas of residence. The Indian population is categorized as the Caucasoid race, while the Javanese population is included in the Mongoloid race, especially the Deutromalayan sub-race.<sup>9,15</sup> The malar or zygomatic bone of the skull of the Caucasian race is not prominent, so the skull looks "pointed", while that of the Mongoloid race is extremely prominent and projected lower than the inferior border of the maxilla.<sup>16</sup>

The results of the study showed that the mean mesiodistal width of the six maxillary anterior teeth was 51.59 mm. The results are different from the results of a study by Rajanikanth et al,<sup>10</sup> showing that the mesiodistal width of the six maxillary anterior teeth was 48.30 mm in males and 46.49 in females. The different mean mesiodistal widths of the six maxillary anterior teeth are likely because of race and sex.<sup>17</sup>

The mean bizygomatic width and mesiodistal width of the six maxillary anterior teeth in the Javanese population were 120.72 mm and 51.59 mm, respectively. The ratio of the mesiodistal width of the six maxillary anterior teeth to the bizygomatic width in the Javanese population was 2.34:1. A study by Rajanikanth et al.<sup>14</sup> showed that the ratio of the bizygomatic width to the mesiodistal width of the six maxillary anterior teeth in the Indian population was 2.72:1 in males and 2.67:1 in females. This difference might be due to different races, causing the bizygomatic width and ratio to be different. The mesiodistal width of the six maxillary anterior teeth in this study was obtained by multiplying the bizygomatic width by the multiplier factor, i.e., 0.427. The multiplier was obtained from the mean mesiodistal width of the six maxillary anterior teeth divided by the mean bizygomatic width.

The results of the Pearson's correlation test showed that there was a significant relationship between the bizygomatic width and the mesiodistal width of the six maxillary anterior teeth in the Javanese population ( $p < 0.05$ ). This is in line with a study by Jain et al.<sup>11</sup> in the Indian population, showing that there was a significant relationship

between the bizygomatic width and the mesiodistal width of the six maxillary anterior teeth. This indicates that the bizygomatic width determines the mesiodistal width of the six maxillary anterior teeth, so it can be used as a technique in measuring the size of the maxillary impression when there are no pre-extraction records.

According to Susanti et al,<sup>18</sup> there are several interpretations of the significance of the relationship, i.e., coefficient interval of 0-0.249 (very weak); 0.25-0.499 (weak); 0.5-0.749 (significant); and 0.75-0.999 (very significant). Santoso<sup>19</sup> mentioned that a negative sign (-) in correlation coefficient indicates an inversely proportional relationship while a positive sign (+) indicates a directly proportional relationship.

The correlation coefficient of the relationship between the two variables in this study was  $r = 0.538$ , indicating that the bizygomatic width had a significant and positive (directly proportional) relationship with the mesiodistal width of the six maxillary anterior teeth. The significant relationship between the bizygomatic width and the mesiodistal width of the six maxillary anterior teeth is because facial growth is complete at the age of 18-25 years, as characterized by the complete growth and development of masticatory function, i.e., the eruption of the third molars and cessation of maxillary growth.<sup>20</sup>

The study also resulted in a regression equation of the relationship between the two variables, i.e., the mesiodistal width of the six maxillary anterior teeth =  $25.029 + 0.220$  bizygomatic width. This equation can help determine the mesiodistal width of the six maxillary anterior teeth using the bizygomatic width.

## CONCLUSION

There was a relationship between the bizygomatic width and the mesiodistal width of the six maxillary anterior teeth in the Javanese population. The mesiodistal width of the six maxillary anterior teeth in the Javanese population can be measured by multiplying the bizygomatic width by the multiplier factor, i.e., 0.427.

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