



Ratio of Inter Canthal Distance to Mesiodistal Width of Upper Anterior Teeth of the Upper Jaw Between Batak and Minangkabau Tribe

Dewi Indah Sari^{1*}, Sri Wahyuningsih Rais¹, Tri Suciati¹

¹Dentistry Program, Faculty of Medicine, Sriwijaya University, Palembang, Indonesia

*Correspondence author email: dewiindah@gmail.com

Abstract

Introduction. Indonesia is rich in diversity of ethnic groups, each of which has its own characteristics, including the Batak and Minangkabau tribes. One of these characteristics can be seen from the intercanthal distance and mesiodistal width of the six maxillary anterior teeth. This research was aimed to determine whether there is a difference in the ratio of the intercanthal distance to the mesiodistal width of the six maxillary anterior teeth between the Batak and Minangkabau tribes.

Methods. This research is analytic observational with nonexperimental correlation design. The research subjects were 60 people with the subject inclusion criteria were aged > 17 years. The intercanthal distance was measured from the median angle of the right eye to the left in the study subjects. Mesiodistal width measurements of six maxillary anterior teeth were performed in the study model, measured from the mesial to the widest distal margin of each tooth. Both measurements were carried out using a digital caliper with three repetitions. Data were analyzed using Pearson correlation test and independent t-test.

Results. The results showed a significant ($p > 0.05$) and strong relationship between the intercanthal distance and mesiodistal width of the maxillary anterior six teeth in both tribes. The results of the independent t-test showed that there was a significant difference between the two tribes ($p < 0.05$) with the mean value of comparison in the Batak tribe 1:1.42 and the Minangkabau tribe 1: 1.45.

Conclusion. There was a significant difference in the ratio of the intercanthal distance to the mesiodistal width of the six maxillary anterior teeth between the Batak and the Minangkabau.

Keywords: *Intercanthal, Mesiodistal width of six maxillary anterior teeth, Malay Proto sub-race, Malay deutro sub-race.*

Introduction

Tooth loss not only affect facial appearance but also psychological state, so patient satisfaction is important in denture treatment. When the patient talks or laughs, the anterior teeth will be visible, causing the anterior to withdraw more aesthetic attention.¹ According to White's theory, the aesthetic concept of dentures includes the relationship between age, gender, and appearance, the proportion of teeth to the correct face size, and the harmony of the color of the face and teeth. The important principle in the aesthetic factor of tooth proportion is the length and width of the teeth. However, tooth width determination is considered more important than length because tooth length can be adjusted directly to the patient's lip anatomy.²

Different anatomical landmarks of a person's face are influenced by age, gender, area of residence and ethnic origin. Ethnicity or race is a classification of nations based on physical



characteristics, such as face shape, hair, and skin color.³ These facial anatomical landmarks can be measured by the anthropometric measurement method.

There are several existing measurement methods, one of them is the anthropometric measurement of the face which is the distance between the inner corners of the eye (intercanthal distance). It reaches full maturation at the age of 11 years in men and 8 years in women and is relatively stable in adulthood. Therefore, the measurement of this intercanthal distance has been considered as an anatomical dimension that can be used for proper selection of anterior teeth.^{4,5}

Guidelines for tooth selection can be obtained from neighboring teeth that are still present, but for full dentures where most of the teeth have been lost there is no such guide. The availability of records before extraction including tooth models, facial photographs, and dental radiographs can be used as a guide in the process of selecting anterior teeth. Where no pre-extraction guidelines are available, other methods are used to aid dentists to determine the anterior sixth width of the maxilla. Most methods provide a value for the total width of the maxillary anterior six teeth, not the width of individual teeth.^{6,7}

There are differences in skull morphology including cranium, face, mandible, and teeth in each race. Most of the population in Indonesian belongs to the Malay race which is part of the Mongoloid race. It is divided into two groups, the Proto Melayu (old Malay) sub-race and the Deutro Melayu (young Malay) sub-race. Proto Melayu consists of the Batak, Gayo, Sasak, Nias, Kubu, and Toraja tribes, while Deutro Melayu consists of Minangkabau, Javanese, Aceh, Bali, Lampung, Coastal Sumatra, Bugis / Makassar, Coastal Manado, East Lesser Sundanese, and Malay.^{8,9} The Proto-Malay race has a longer head shape (dolichocephalic) while the Deutro-Malay race is shorter (brachycephalic). The distribution of the Batak and Minangkabau tribes is considered quite broad in Indonesia and these two tribes are among the ten largest populations in Indonesia.^{10,11,12} This allows for differences in the measurement of inter canthal distances for different races.

Indonesia still has many other tribes that have not been researched. So far, there has not been clear data regarding the average ratio of the inter canthal distance and mesiodistal width of the anterior teeth in the Batak ethnic group of the Proto Malay sub-race and the Minangkabau tribe from the Deutro Malay sub-race. Therefore this study aims to investigate whether these measurements can be used as a guideline for determining the width of the six anterior teeth in the Batak and Minangkabau tribes.



Methods

This is an analytic observational (cross sectional) research. The study was conducted on 25 October 2018 in the laboratory of the Dental Medicine Study Program, Faculty of Medicine, Sriwijaya University. The subjects in this study were the Undergraduate Medical and Dental Program Faculty of Medicine Universitas Sriwijaya Class of 2014, 2015, 2016 and 2017.

This study used non-random purposive sampling method by selecting subjects based on specific criteria set by the researcher.⁴⁷ Samples will be further selected using inclusion and exclusion criteria. The minimum number of samples in this study is 30.⁴⁸ Samples will be divided into two groups, 30 samples from the Batak tribe and 30 samples from the Minangkabau tribe. The total sample was 60.

Inclusion criteria were age > 17 years; Mongoloid race (Proto-Malay sub-race: Batak tribe and Deutro Malay sub-race: Minangkabau tribe) who were the third descendants; Angle class 1 malocclusion; no congenital abnormalities (example: cleft lip/palate, Down's syndrome); had six complete and fully erupted maxillary anterior teeth; no anterior crowding. Exclusion criteria were a history of using the orthodontic appliance, fractured maxillary anterior teeth, interproximal caries in the maxillary anterior teeth, had any restoration (crown, bridge denture, fillings, or removable prosthesis) on the maxillary anterior teeth, loss of anterior teeth, unwilling to participate in the study.

The independent variable in this study was the inter canthal distance. Dependent variables were age, race, sex, and congenital abnormalities. The intercanthal distance method is one of the methods used to determine the appropriate denture element based on the patient's facial anatomy if no pre-extraction records are available. It is the distance between the medial angles of the palpebral fissures bilaterally. Anatomically, the corner of the eye is divided into two, namely the medial (inner) angle and the lateral (outer) canthal angle. The intercanthal distance is considered normal when it is 28 to 35 mm. The advantage of this method is that it does not require radiographs or other special measuring devices. The distance between the eye's median angle and the palpebral fissure between the left-right eye is called the intercanthal distance (Figure 1). Al-Wazzan et al. reported that the intercanthal distance measurement was using the Boley gauge, while most other studies used a sliding caliper.



Figure 1. Measurement of the intercanthal distance in men and women.

The data obtained from the results of this study were analyzed using the independent T-test to see the comparison of the intercanthal to mesiodistal distance of six maxillary teeth in the Batak and Minangkabau tribes if the data distribution was normal. If it is not normal then the Mann-Whitney test is used.

Results

This research was conducted on 60 people, 30 Batak tribes and 30 Minangkabau people. The measurement of the intercanthal distance was carried out directly on the research subject, while the measurement of the mesiodistal width of the six maxillary anterior teeth was carried out on the study model with a digital calipers. The mean results of the intercanthal distance and mesiodistal width of the six maxillary anterior teeth in the Batak and Minangkabau tribes are presented in the Table 1.

Table 1. The mean values of the intercanthal distance and mesiodistal width of the six maxillary anterior teeth in the Batak and Minangkabau tribes

Tribe	N	Intercanthal distance			Mesiodistal width of the six maxillary anterior teeth		
		min	max	\bar{x}	min	Max	\bar{x}
Batak	30	26,25	35,01	29,72	38,38	46,68	43,43
Minangkabau	30	28,26	37,09	31,82	40,46	48,69	45,43

Table 1 shows that the intercanthal distance and mesiodistal width of the six maxillary anterior teeth in the Batak tribe are smaller than the Minangkabau tribe. Comparison of the intercanthal distance and mesiodistal width of the six maxillary anterior teeth in the Batak and Minangkabau tribes is presented in the table below.



Table 2. Comparison of the intercanthal distance and mesiodistal width of the six maxillary anterior teeth in the Batak and Minangkabau tribes

Tribe	N	Minimal	Maximal	Average
Batak	30	1:1,30	1:1,55	1:1,42
Minangkabau	30	1:1,32	1:1,59	1:1,45

The ratio of the intercanthal distance and mesiodistal width of the six maxillary anterior teeth in the Batak tribe is 1: 1.42 while in the Minangkabau tribe is 1: 1.45.

Kolmogorov-Smirnov normality test was performed on the data of the intercanthal distance and mesiodistal width of the maxillary anterior six teeth in each tribe. The test results show $p > 0.05$, which means that the data is normally distributed. So that the data analysis was continued using the Pearson correlation test. The results of the Pearson correlation test are presented in the following Table 3.

Table 3. Pearson correlation test results between intercanthal distance and mesiodistal width of six RA anterior teeth in the Batak and Minangkabau tribes

Tribe	Pearson's Correlation	P value
Batak	0,805**	0,000*
Minangkabau	0,819**	0,000*

Note: *: 95% significant on one test
**: 99% significant on 2 tests

Table 3 showed that the value (r) is 0.805 and 0.819 for the Batak and Minangkabau tribe, respectively. Based on the Pearson Correlation test, it is known that the significant value is 0.000. This significant value is below 0.050 ($p < 0.05$).

Discussions

The results showed that the mean size of the intercanthal distance and mesiodistal width of the six maxillary anterior teeth were different in the Batak and Minangkabau tribes. The difference of the mesiodistal width ratio of six maxillary anterior teeth in this study was in line with Bhusan Bangar et al.^{13,14} They reported that the mean mesiodistal width of the maxillary anterior six teeth in the Indian population in males was 50.22 mm and in females was 49.34 mm. El Sheikh et al.¹⁵ reported in their study the mean mesiodistal width of six maxillary anterior teeth in a Saudi population in male 54.87 mm and 50.28 mm in female. The Indian population and the Saudi population are sub-racial from the Caucasoid race, this research concluded that each race or tribe has a different tooth width.



Factors that can affect the intercanthal distance and width of the maxillary anterior teeth are genetics, race, and sex. There are differences in the morphology of the skull including the cranium, face, mandible, and teeth in each race.^{16,17} The Proto-Malay race has a longer (*dolichocephalic*) head shape, while the Deutro-Malay race has a shorter head shape (*brachycephali*). The Batak tribe is included in the Proto-Malay sub-race while the Minangkabau tribe is included in the Deutro-Malay sub-race.^{18,19}

In the craniofacial growth the tooth arch width and the intercanthal width are included in the middle third of the face with the same direction of growth, i.e in the horizontal direction. The size and shape of the dental arch is one of the supports in establishing the diagnosis. Dental arches are a major factor in achieving good occlusion in harmonious arches based on the increase in arch width associated with tooth development.^{20,21,22}

The rule of fifth theory dividing the five parts of the face vertically, consisting of the right postaurale to the right exocanthus, the right exocanthus to the right endocytus, the right endocytus to the left endocytus, and the left exocanthus to the left postaurale. The width of this section is equal to the eye width. This suggests that the intercanthal distance of the eye is an accurate anatomical dimension and provides a valid approach for the selection of maxillary anterior teeth.^{23,24,25}

The results of this study showed the ratio of the intercanthal distance and mesiodistal width of the maxillary anterior six teeth was 1: 1.42 1: 1.45 in the Batak and Minangkabau tribe, respectively. This is in accordance with the results of Tandale et al. and Al Wazzan et al.^{26,27}, 1: 1,428 in Indian population and 1: 1,426 in tribal Arab population. This difference is due to the fact that the intercanthal distance and mesiodistal width of the six maxillary anterior teeth differ in each race because each has specific physical characteristics that differ from one another.

The correlation value obtained in this study was +0.805 and +0.819 in the Batak and Minangkabau tribe, respectively. it can be concluded that there is a very strong and significant relationship between the intercanthal distance and the mesiodistal sixth width of the maxillary anterior teeth in each tribe. The positive sign indicates a proportional relationship between the intercanthal distance and the mesiodistal width of the six maxillary anterior teeth. The greater the intercanthal distance, the greater the mesiodistal width of the six maxillary anterior teeth. The value of the strength of this relationship means that the intercanthal distance affects the mesiodistal width of the six mandibular anterior teeth by 80% in the Batak tribe and 81% in the Minangkabau tribe, the rest is influenced by other factors. This is in line with Bhusan



Bangar et al.^{28,29,30} that reported there was a relationship between the intercanthal distance and the mesiodistal width of six anterior jaw teeth with a p value of 0.000. Arun Kumar et al. also explained that there is a positive correlation and a high significant value between the intercanthal distance and the mesiodistal width of the six maxillary anterior teeth.^{31,32}

Based on the results of the study, it can be concluded that there is a correlation between the intercanthal distance and the mesiodistal width of the six maxillary anterior teeth. Anthropometric measurements of the intercanthal distance can be used as a comparative method in prosthodontics in determining the mesiodistal width of six maxillary anterior teeth by multiplying the results of the intercanthal distance by 1.42 for the Batak and 1.45 for the Minangkabau tribe. In addition, research can be carried out on other ethnic groups in Indonesia, such as the Dayak or Toraja population, which are included in the Proto-Malay sub-race and the Malay, Balinese, or Sundanese tribes, which are included in the Deutro-Malay sub-race.

Conclusion

The average ratio between the intercanthal distance and the mesiodistal sixth width of the maxillary anterior teeth in the Batak tribe was 1:1.42. The mean ratio between the intercanthal distance and the mesiodistal width of the maxillary anterior six teeth in the Miangkabau tribe was 1:1.45. There is a positive correlation with a very strong correlation between the intercanthal distance and the mesiodistal width of the six maxillary anterior teeth in the Batak and Minangkabau tribes.

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