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Research Report

A gender-based comparison of intermolar width conducted at Padjajaran University Dental Hospital, Bandung, Indonesia

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ABSTRACT

Background: *Evaluation of dental arches is important for both diagnosis and treatment in the fields of orthodontics, prosthodontics, and forensics. The perimeter or circumference affects the gender-specific dimensions of the dental arch.* ***Purpose:*** *To identify the inter-gender difference between maxillary and mandibular intermolar width of the first molars in Indonesia.* ***Methods:*** *This retrospective and comparative analytical study involved a gender-based comparison of maxillary and mandibular intermolar width in the first molars. A purposive sampling technique was employed for data selection. Ninety dental cast models were selected according to the inclusion criteria of non-growing patients and perfect dental conditions, with any damaged dental models being rejected. After selection, the dental cast was marked at the maxillary and mandibular first molar central fossae before being measured three times with a digital vernier caliper. The data obtained was subsequently analyzed by means of a Kolmogorov-Smirnov test, an F-test-Snedecor (with p>0.05) and Independent Sample t-test (with p<0.05).* ***Results:*** *The average maxilla intermolar widths for males and females were 49.36mm and 46.75mm respectively, while the average mandibular intermolar widths for males and females were 43.17mm and 40.5mm. An independent sample t-test showed that the maxilla and mandibular intermolar widths were significantly different for males and females (p=0.000, p<0.05), with male subjects possessing a higher value than female subjects.* ***Conclusion:*** *A significant gender-based difference existed between the maxillary and mandibular intermolar width of patients attending Padjadjaran University Dental Hospital, Bandung, Indonesia.*

Keywords: *malocclusion; orthodontic; sex*

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INTRODUCTION

Information regarding the arch dimension in human populations can be used for a variety of purposes. The width, length, and depth of dental arches have significant implications for orthodontic diagnosis and treatment planning which affect the available space, dental aesthetics, and dentition stability.[1] The arch dimension may be also useful in the field of forensic dentistry since gender determination of skeletal remains constitutes a key element within forensic science.[2,3] In prosthodontics, a significant aspect of denture manufacture is closely related to differences in the dimensions of dental arches.[4]

Various landmarks employed in measuring the dental arch have previously been described and discussed by several researchers. For example, the various dental arch widths of contralateral teeth have been measured in numerous ways, such as the arch across the permanent canines, premolars and first molars, or at the cusp tips, central fossae, contact points and the largest distance between buccal surfaces.[5] Certain research has posited that the arch dimension is affected by gender, while other studies have identified no significant gender-based differences in arch dimensions.[6] The contrasting results of these studies could be due to different landmarks, sample sizes, age groups, subject ethnicity, or investigative procedures. Moreover, the fact that members of the various ethnic groups present different morphological conditions should induce clinicians to anticipate contrasts in size and form, rather than treating all cases in an identical manner.[2,7]

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There are numerous studies comparing intermolar width in the maxillary and mandibular teeth. However, to date, no study has been carried out to compare the difference in intermolar width of the maxillary and mandibular in Indonesians, specifically among non-growing young adults. This knowledge can be used to develop a more comprehensive understanding of this period and enhanced diagnosis and treatment planning in the future. A greater comprehension of these aspects could also influence patient expectations regarding the formulation of treatment and subsequent retention plans by orthodontists. Therefore, a comparison of intermolar width in the maxillary and mandibular of male and female students at Padjadjaran University Dental Hospital, Bandung, Indonesia has been the focus of interest in further research. The objective of the present study is to investigate the difference between maxillary and mandibular intermolar width in the first molars of male and female students at Padjadjaran University Dental Hospital, Bandung, Indonesia.

MATERIALS AND METHODS

This study constitutes retrospective comparative analytical research where two distinct samples, in this case male and female students at Padjadjaran University Dental Hospital, constituted the subjects of the investigation. The research samples were supplied by the Orthodontic Laboratory of Padjadjaran University between January and March 2017. Sample selection employed a purposive sampling technique.[8] According to the central limit theorem (CLT), a minimum of 30 samples is required in comparison studies. Between 2013 and 2015, three batches of dental models were made available by the Orthodontic Laboratory of Padjadjaran University. Thus, a total of 90 samples was obtained in the three batches each containing 30 samples equally divided between 15 male and 15 female.

In the preparation phase, an ethical letter (registration number 0217030350) was issued by Hasan Sadikin Hospital, Bandung and submitted together with a permission letter to the Dental Hospital Administration Department and the Orthodontics Department Laboratory of Padjadjaran University since this research utilized secondary data in collections. 94 dental models were obtained from the Orthodontics Department Laboratory Padjadjaran University and divided into male and female groups equal in size. All dental models selected were required to satisfy the inclusion criteria of dental models of non-growing patients aged between 18 and 24 years old. Dental models should also be free of molar rotation, mesial dentition drifting, crowding at the molar region, edentulous regions, or sagittal and transversal discrepancies of molar tooth position. Dental models were required to be symmetrical and possess a complete set of teeth. Certain exclusion criteria were applied to dental models including; attrited, broken, or extracted teeth; agenesis; malocclusion; a history of orthodontic treatment; and adolescent individuals who were not Universitas Padjadjaran students.

According to the previous study, several materials including pencils, erasers and digital vernier calipers were employed. The dental models were marked with a pencil at the maxillary and mandibular central fossae which acted as an intermolar width distance indicator.[7,9,10] A digital vernier caliper (Mitutoyo, Japan) was used to measure the intermolar width distance according to the stated indicator (Figure 1). An internal calibration technique was used during intermolar width measurement, whereby three measurements were taken on different days, to increase accuracy. The experiment was conducted three times on different days by undergraduate students (AA) during internal calibration and supervised by postgraduate teachers (EM and IA). After the data had been collected and recorded, its analysis was initiated. The data obtained was analyzed using Statistical Package for Social Science (SPSS) version 20.0 software (Student Edition, IBM America), while the Kolmogorov-Smirnov test ($p>0.05$) was employed as a normality test, a F test–snedecor test ($p>0.05$) was used to assess homogeneity and an Independent Sample t-test ($p<0.05$) was used to quantify the differences in intermolar arch width between the genders.

RESULTS

The research sample was divided into three age groups. Group one: patients aged 18-20 years old; Group two:

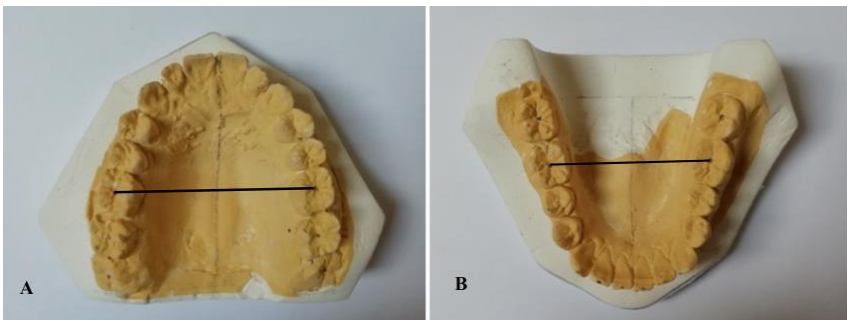

Figure 1. A) Upper intermolar width measured from the central fossa left M1 to the right M1; B) Lower intermolar width measured from the central fossa left M1 to the right M1.

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patients aged 20-22 years old; and Group three: patients aged 22-24 years old. Each group consisted of 30 patients; 15 males and 15 females.

Table 1 contains the results of a normality test for maxillary and mandibular intermolar width of the first molars of males and females. The results of a Kolmogorov-Smirnov test ($p>0.05$) indicated normal distribution across all groups. Meanwhile, a homogeneity test using F test–Snedecor ($p>0.05$) revealed that the homogeneity value of the maxillary intermolar width in males and females was 1.1, while the homogeneity value of mandibular intermolar width in both genders was 1.28. These results indicated that there was no significant difference between the samples. In other words, homogeneity prevailed.

According to Figure 2, the average maxilla intermolar widths for male and female were 49.36 ± 2.75 mm and 46.75 ± 2.62 mm respectively. The average of mandibular intermolar widths of males and females were 43.17 ± 2.92 mm and 40.5 ± 2.58 mm. An independent sample t-test showed that maxilla and mandibular intermolar width between male and female was significantly different ($p = 0.000$, $p<0.05$), with male subjects possessing larger values than their female counterparts.

According to the contents of Table 2, the average maxilla intermolar widths of males and females were 49.36 ± 2.75 mm and 46.75 ± 2.62 mm respectively. The average mandibular intermolar widths of males and females were 43.17 ± 2.92 mm and 40.5 ± 2.58 mm. Independent sample t-test showed that the maxilla and mandibular intermolar widths of males and females were significantly different ($p=0.000$, $p<0.05$), while male subjects possessed a larger value than female subjects.

DISCUSSION

The study reported here found significant inter-gender differences in maxillary and mandibular intermolar width in Indonesia, whereby that of males was greater than that of females. In this discussion, intermolar width in Indonesian adults with normal occlusion had been compared with values from previous studies featuring various populations of both males and females from the same group.

Previous studies have demonstrated the intermolar width of Taiwanese people to be wider than that of Southern Chinese people of both genders by approximately 1.3 mm. Although both populations are of the same racial group, different locations and lifestyles produce contrasting results.[5] Ethnic diversity creates varied results of intermolar width values. Environmental factors are equally important, whereas culture and human behavior enhance dental arch dimensions. For example, Middle Eastern, Caucasian and Asian people have a different range of intermolar width values. The maxilla intermolar width of Iraqi males and

Table 1. Result of normality test for maxillary and mandibular intermolar width in first molars among males and females

	Gender	Result of normality test	
		p-value	Distribution
Maxilla	Female	1,000	Normal
	Male	0,817	Normal
Mandible	Female	0.826	Normal
	Male	0.763	Normal

Table 2. Result of independent sample t-test for maxillary and mandibular first intermolar width among male and female students at Padjadjaran University Dental Hospital, Bandung

Gender	Maxillary intermolar width		Mandibular intermolar width		p-value
	Mean	SD	Mean	SD	
Female	46.74	2.62	40.50	2.58	0.000*
Male	49.36	2.75	43.17	2.92	0.000*

Note: *significance

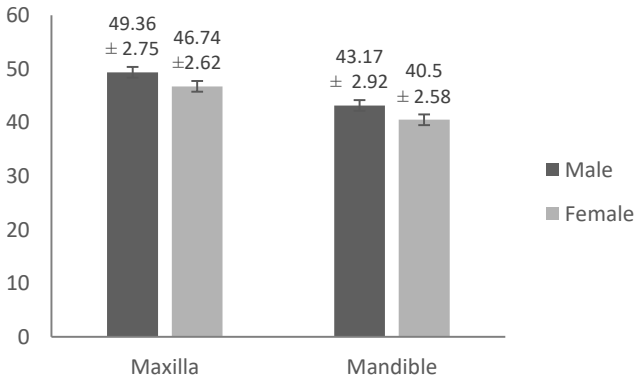

Figure 2. Gender-based comparison of intermolar width in maxilla and mandible.

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females are 45.14 mm and 43.46 mm respectively, while the average mandibular intermolar width is 40.76 mm for males and 39.55 mm for females.[1] The respective maxilla intermolar width of Spanish males and females are 56.99 mm and 55.19 mm, while the mandibular intermolar width of males and females are 53.74 mm and 52.41 mm.[11]

A previous study conducted by Pondicherry (2014) cited the respective maxilla intermolar width of males and females to be 48.74 mm and 45.44 mm. In contrast, the mandible intermolar width of males and females were 42.45 mm and 39.53 mm respectively.[3] The study from Peshawar measured the maxilla intermolar width at the midpoint of the cervical region of the first molar and reported that the maxilla and mandible intermolar widths were 34.67 mm and 32.82 mm.[12] Another Indian researcher reported the maxilla intermolar width of males and females being 53.36 mm and 49.5 mm, whereas the mandible intermolar width for males and females were 46.66 mm and 42.88 mm.[13]

Similarly, another study reported that the maxilla intermolar width of males and females were 49.24 mm and 46.31 mm respectively.[9] A study from another state of India, Peshawar stated the maxilla intermolar width of males and females to be 47.37 mm and 44.29 mm, whereas the mandible intermolar width for males and females were 41.67mm and 38.06 mm respectively.[10] The maxilla intermolar width of Saudi Arabian males and females were 45.38 mm and 43.42 mm respectively.[14] The value of intermolar width in several earlier studies could not be compared with the present research because of the differences in sample selection, difference reference points, and measuring techniques.

The results the authors of this article are similar to those of other previous studies which have also observed males to have wider intermolars than females. These findings might be because dental arch width lies on the basal bone which, in general, is larger in males than females, the same might apply to the dental arches. The above differences in results may be explained by several factors such as type of measurement and sample size used. Given the variation of results across studies, the environmental and genetic factors may also appear to play an essential role in determining intermolar width, variety of sample size, mastication function and environmental factors such as nutrition.[1,2]

This study yielded a database about arch dimensions, especially intermolar width, in Indonesians. Gender considerations relating to space management of intermolar arch width can be considered as underpinning aesthetic considerations and stability in orthodontic treatment. Another implication of gender-based intermolar differences can be applied to the manufacture of dentures. Moreover, in the forensic field, intermolar arch width may be useful in determining gender from dental remains.

The limitations of this study lie in the fact that the ethnicity of the patients included in the sample was restricted to Javanese and Sundanese and, as such, was not representative of the entire population of Indonesia. A comprehensive study of Indonesians from all regions across the country is necessary to yield more complete data. Nevertheless, in conclusion, it is evident that a significant gender-based difference existed between maxillary and mandibular intermolar width among patients at Padjadjaran University Dental Hospital, Bandung, Indonesia.

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