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Correlation of The Curved Distance Between the Distal Surfaces of Maxillary Canines and The Combined Width of the Six Maxillary Anterior Teeth When Selecting Artificial Teeth for Malay, Chinese and Indian Community in Malaysia.

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ABSTRACT

Selection of anterior teeth is crucial in denture fabrication. Manufacturers provide measurements of artificial maxillary anterior teeth in a straight line. These generate error during teeth selection. Cross-sectional descriptive study was done to correlate curved distance to combined width of maxillary anterior teeth. Width of each maxillary anterior tooth was measured with Vernier callipers to obtain Combined Width. Curved Distance was obtained by measuring the combined width from distal surfaces of maxillary canines. Average of three readings was used. For all races, there are no significant variations in mean Curved Distance and Combined Width values. Chinese showed the highest mean for Curved Distance, followed by Malays and Indians. Combined Width, Indians show the highest mean followed by Chinese and Malays For both genders, there are significant variations in mean Curved Distance and Combined Width values. Males show a higher mean Curved Distance than females. For Combined Width, malesare higher than females. A positive correlation between Curved Distance and Combine Width was seen irrespective of race or gender Females show a higher correlation between Curved Distance and Combined Width compared to males. Indians show the highest correlation, followed by Malays and Chinese for Curved Distance and Combined Width.

Keywords: Anterior Teeth selection, Combined Width, Curved Distance, Denture teeth.

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INTRODUCTION

One of the most important considerations in complete denture prosthodontics is the fabrication of esthetically acceptable dentures [1]. Selection of the maxillary anterior teeth, hence, plays an important role in complete denture fabrication. However, this may prove challenging in the absence of pre-extraction records [2].

Several theories have been proposed for the selection of maxillary anterior teeth. The first theory introduced was the temperamental theory[3]. Later, Frush and Fisher introduced dentogenic theory based on the Sex, Personality and Age (SPA) of each individual[4-6]. Lowery and Nelson proposed that a close relationship existed between face, tooth and tooth arch form[7, 8].

Conventionally, while fabricating a complete denture, the width of the six maxillary anterior teeth is determined by the marking of the location of canines on the maxillary occlusal rims from the corner of the mouth. The distance between the two marks is then measured around the curvature of the rim. However, most manufacturers of artificial teeth provide mold charts with measurement of the six maxillary anteriorsin a linear measurement and only a few provides the width of the six anteriors on a curve. These discrepancies generate errors and confusion during the selection of appropriate teeth size for the six maxillary anterior teeth. [2]

Currently, there is no universally accepted single esthetic factor that can be used reliably to aid artificial teeth selection[9]. Therefore, further studies seem to be necessary either to confirm or disprove some contradictory results from others studies[10].

The aim of our study is to correlate thecurved distance (CD) between the distal surfaces of the maxillary canines to the combined width (CW) of the six maxillary anterior teeth when selectingartificial teeth for patients in three races, namely Malay, Chinese and Indian communityin Malaysia.

OBJECTIVE

General Objective

- To correlate the curved distance (CD) between the distal surfaces of maxillary canines and the combined width (CW) of the six maxillary anterior teeth when selecting artificial teeth based onraces in Malaysia and gender.

Specific Objectives

- To identify the Ethnic variation in CD and CW when selecting artificial teeth for Malay, Chinese and Indian ethnics in Malaysia
- Gender variation in CD and CW when selecting artificial teeth for Malay, Chinese and Indian ethnics in Malaysia
- Correlation between CD and CW when selecting artificial teeth for Malay, Chinese and Indian ethnics in Malaysia
- Correlation between CD and CW with ethnics when selecting artificial teeth for Malay, Chinese and Indian ethnics in Malaysia
- Correlation between CD and CW with gender when selecting artificial teeth for Malay, Chinese and Indian ethnics in Malaysia

Operational Definitions

- Curved distance (CD): The length from the distal surface of left maxillary canine to the distal surface of right maxillary canine, measured in a curved plane in the arch.
- Combined width (CW): The sum of the mesiodistal dimensions of individual anterior teeth.

- Malay: Someone born to a Malaysian citizen who professes to be a Muslim, habitually speaks the Malay language, adheres to Malay customs and is domiciled in Malaysia or Singapore according to Article 160 of the Constitution of Malaysia.
- Chinese: Malaysians of Han Chinese descent.
- Indian: Malaysians of Indian origin.

METHODOLOGY

Study Design

A descriptive correlational study was done in which consenting adults were selected. Quota sampling was used whereby patients were selected based on a list of specific criteria.

Population and Samples

- Reference population: All Malay, Chinese and Indian community in Malaysia
- Source population: All Malay, Chinese and Indian students and patients in Melaka
  With reference to the sample size determination table [13]and variance value [2]of 0.881, α = 0.05, Power (1-β) = 12 (90%), hence, a sample size of 12 for each ethnic group and each gender was employed for our study. Therefore the total sample size for our study was determined as 72 subjects.

Sampling Frame

Inclusion Criteria

- All consenting Malay, Chinese and Indian adult male and female students and patients in Melaka
- All maxillary anterior teeth present and morphologically normal
- Anterior teeth with good alignment

Exclusion Criteria

- Congenital dental or developmental defects
- Anterior teeth with dental restorations, incisal wear and gingival hyperplasia
- Crowding, spacing, rotation, supra eruption of teeth
- Abnormal facial or lingual inclination of teeth
- History of orthodontic treatment with arch expansion

Data Collection

Ethical approval was obtained from Ethical Committee of FOD, MMMC. Consent forms were prepared and distributed to the subjects before the study. All patients attending KlinikPergigian, Faculty of Dentistry, Melaka-Manipal Medical College, Melaka were included in the study. Patients were selected by based on inclusion and exclusion criteria. Quota sampling was used. Impression of the maxillary arch were made using alginate impression material following the manufactures instructions. Cast were poured using Type III gypsum product. To measure curved distance (CD), Dental tape was adapted on the buccal surfaces from the distal of one canine to the distal of other canine. CD was marked with a permanent marker on the tape and measured using a vernier caliper. To measure combined width (CW), crest of curvature for mesial and distal surfaces of anterior six was marked. CW of each tooth from canine to canine was measured using digital vernier calipers. The total of the individual width of each teeth represented the CW. Three examiners measured each cast independently. The average of three measurements was used. To reduce inter-observer variability all the examiners were calibrated prior to the study. Data entry and statistical analysis were done using Epi-info software for Mean, Unpaired T- test, ANOVA and Pearson's correlation coefficient.

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RESULTS

Socio-demographic feature

In total, 72 participants were involved in our study. Demographic characteristics which included age, gender and race were the variables of our study. Equal number of Malay, Chinese and Indian participants were selected for our study, which was 24 participants (33.33%) from each race. Among the 24 participants from each race, 12 (50%) were females and 12 (50%) were males. These participants were selected based on the inclusion and exclusion criteria of our study.

Racial variations in Curved Distance (CD) between distal surfaces of maxillary canines (Table 1)

Mean values for Curved Distance (CD) are 53.64 ± 2.30 (P=0.7541) for Malays, 54.19 ± 2.77 (P=0.7541) for Chinese, 53.78 ± 2.78 (P=0.7541) for Indians. Chinese show the highest mean values for CD, while Indians show the lowest mean values for CD. However, there are no significant variations in mean CD values for all the three races.

Table 1: Ethnic variations in CD and CW (n=72)

ETHNIC	CURVED DISTANCE (CD) Mean±SD	COMBINED WIDTH (CW) Mean±SD
Malay	53.64 ± 2.30	46.91 ± 2.28
Chinese	54.19 ± 2.77	47.05 ± 2.59
Indian	53.78 ± 2.78	47.34 ± 2.47
P-value	0.7541	0.8244

Racial variations in Combined Width (CW) of six maxillary anterior teeth (Table 1)

Mean values for Combined Width (CW) are 46.91 ± 2.28 (P=0.8244) for Malays, 47.05 ± 2.59 (P=0.8244) for Chinese, 47.34 ± 2.47 (P=0.8244) for Indians. Indians show the highest mean values for CW, while Malays show the lowest mean values for CW. However, there are no significant variations in mean CW values for all the three races.

Gender variations in Curved Distance (CD) between distal surfaces of maxillary canines (Table 2)

Mean values for Curved Distance (CD) are 54.78 ± 2.30 (P=0.0024) for males and 52.96 ± 2.59 (P=0.0024) for females. Between the two genders, males show a higher mean CD values as compared to females. There are significant variations in mean CD values for the two genders.

Table 2: Gender variations in CD and CW (n=72)

GENDER	CURVED DISTANCE (CD) Mean ± SD	COMBINED WIDTH (CW) Mean ± SD
Male	54.78 ± 2.30	47.70 ± 2.37
Female	52.96 ± 2.59	46.90 ± 2.34
P-value	0.0024	0.0024

Gender variations in Combined Width (CW) of six maxillary anterior teeth (Table 2)

Mean values for Combined Width (CW) are 47.70 ± 2.37 (P=0.0024) for males and 46.90 ± 2.34 (P=0.0024) for females. Between the two genders, males show a higher mean CW values as compared to females. There are significant variations in mean CW values for the two genders.

Overall Correlation between Curved distance (CD) and Combined Width (CW) (Table 3)

Based on the descriptive statistics for Pearson's Correlation Coefficient test, overall r value is 0.8981(P<0.001) which indicates a positive correlation between CD and CW irrespective of race or gender. Within gender, r values for males are 0.8816 (P<0.001) and for females are 0.908 (P<0.001). This shows that

females show a higher correlation between CD and CW than males. In contrast, within race, r values are 0.8815 (P<0.001) for Malays, 0.8759(P<0.001) for Chinese, 0.9257(P<0.001) for Indians. Among these three races, Indians show the highest correlation between CD and CW.

Table 3: Correlation between CD and CW among gender and ethnic (n=72)

	r	P-value
OVERALL	0.8981	<0.001
GENDER		
Male	0.8816	<0.001
Female	0.908	<0.001
ETHNIC		
Malay	0.8815	<0.001
Chinese	0.8759	<0.001
Indian	0.9257	<0.001

DISCUSSION

Selection of appropriate maxillary anterior teeth is one of the challenging steps while fabricating a complete denture. The aim of restoring edentulous patients is to ensure that the dentolabial relations of maxillary anterior teeth is in harmony in relation with the overall facial appearance.In the absence of pre extraction records, selecting the correct size of the denture teeth will be difficult[2].

According to Varjao et al, the Pearson correlation analysis showed a strong correlation between CD and CW in all ethnic groups studied. The following coefficients (r) were obtained: Whites = 0.957, Blacks = 0.803,Multiracial = 0.917 and Asians = 0.881. All coefficients were statistically significant (P<0.001). With reference to Varjao's[2] study, our overall r value is 0.8981 (P<0.001), which is almost similar to the Asian population in his study.

Specifically, Indians show the highest correlation between CD and CW (r=0.9257) as most of the Malaysian Indians originate from same region, whereas Chinese show the lowest correlation (r=0.8759) as they originate from different provinces of China.

All CD and CW values for the three races, i.e. the Malays, Chinese and Indians are higher than Varjao's study. This is probably because our study did not include a thorough investigation of the ancestry of the subjects of our study. Besides, Varjao's[2] study failed to mention specifically the types and number of races that constitute the Asian population in his study. For example, Asians may comprise of the Chinese, Japanese, Koreans, Vietnamese, Indonesians and many more.

As for gender, since there are no previous studies for CD and CW, the mean values obtained could not be justified. However, based on Kurt et.al [14] and Isik-Ozkoi et.al [15]literature review, Frush and Fisher's "Dentogenic theory" claimed that there is a relationship between the gender of a person and his or her tooth shape. Roundness, smoothness and softness are feminine characteristics while vigour and boldness are masculine characteristics. Hence, this justify a difference in values of CD and CW between males and females. Since squares-shaped teeth are definitely larger than oval-shaped ones, this justify a larger mean CD and CW values for males as compared to females.

In accordance with our study, Srivastava R et al[1] and La Vere et al[16]showed that the total mesiodistal width of anteriors in artificial teeth was smaller than the total mesiodistal width in the natural dentition of the study population. Incidentally, Keng indicated anterior arch width represented by the inter-canine cusp tip distance was 35.74 +/ - 2.17mm.

On the other hand, Kumar MV[11] et al reviewed the multiple concepts of anterior teeth selection, which included White's Concept, H. Pound's Concept, Dentogenic Concept, Winkler's Concept and Leon William's Concept. EllakwaA[18] et al concluded that the average length and width of the maxillary arch and interalar width were the anatomical landmarks that provided the strongest predictive relationship with anterior maxillary teeth. MitchnerRW[19] et al made measurements from the crest of one pterygomaxillary

notch to another on the maxillary cast to aid in the selection of six maxillary anteriors. However, this method is not satisfactory in all situations and are more time consuming. Lastly, Scandrett et al[20] showed that it was evident that more than one variable was needed to predict the width of the maxillary anterior teeth and central incisors, since there are no accurate enough best single predictors available.

Varjao et al and Keng SB, Foong KW conducted studies which involved different groups of ethnicity, while Ellakwa A et al, Srivastava R did studies involving genders.

Grave and Johnson reported various mistakes clinicians make when treating patients with removable prostheses because they lacked knowledge of racial differences. Understanding these differences suggest that some esthetic and functional alterations should be made in treatment plans to accommodate different ethnic groups.

CONCLUSION

In conclusion, there is a positive strong correlation of the curved distance (CD) between the distal surfaces of maxillary canines and the combined width (CW) of the six maxillary anterior teeth when selecting artificial teeth for Malay, Chinese and Indian community in Malaysia. However, there are no significant racial variations in the curved distance (CD) and combined width (CW) values. On contrary, there is a significant variation in the curved distance (CD) and combined width (CW) between males and females.

Clinical Implications

Clinically, during the selection of the width of the six anterior denture teeth for patients of Malay, Chinese and Indian racial groups in Malaysia, the results obtained in this study can be applied to the information provided by most manufacturers for an accurate relationship between the curve and straight measurements.

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