Original Article

Correlation between Interalar Distance and Mesiodistal Width of Maxillary Anterior Teeth in Thrissur, Kerala, Indian Population

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ABSTRACT

Aims and Objectives: The aim of this study was to assess the validity of interalar distance as an aid in maxillary anterior teeth selection in Thrissur, Kerala, Indian population. The study also evaluated whether interalar distance and maxillary anterior teeth undergo any changes as age increases in this population and whether there is a gender difference in these parameters in this population. **Materials and Methods:** A study was planned on 1200 participants in Thrissur Municipal Corporation area, Kerala, India, with the aim of checking the validity of interalar distance as a successful aid in maxillary anterior teeth selection. The collected data were analyzed using SPSS version 21.0. Mean standard deviation and 95% confidence intervals were estimated. Student's *t*-test was used for comparison between gender and two age groups such as 18–25 and 40–50 years. One-way ANOVA analysis was done for combined effects. **Results:** The study showed that there is a high statistical significance between the interalar distance and the mesiodistal width of six maxillary anterior teeth in females ($P < 0.01$) and no significance in males. **Conclusion:** The study concluded that, within the population evaluated, there was a high significant correlation between interalar distance and the mesiodistal width of six maxillary anterior teeth in both males and females. Both interalar distance and mesiodistal width of maxillary anterior teeth showed a significant increase in size as age increases. There was a significant increase in size difference for males compared to females in relation to interalar distance and not for mesiodistal width of maxillary anterior teeth.

KEYWORDS: *Facial and dental proportion, interalar distance, maxillary anterior teeth, mesiodistal width*

INTRODUCTION

For a successful rehabilitation of missing teeth, selection of teeth is of paramount importance. In today's world, even the most callous will not be willing to compromise on the esthetics of maxillary anterior teeth. A patient who comes for replacement of missing maxillary anterior teeth will want it be as natural as possible. For a successful anterior teeth replacement, its ability to defy detection is of paramount importance. For this, the step of artificial teeth selection is very critical.[1] Failure in this step will lead to a prosthesis which will not be accepted by the patient, however, comfortable it may be.

Pre-extraction records are valuable guides for teeth selection, and the clues gained from the patient's own natural dentition are reliable aids in achieving a successful, attractive restoration for a patient. The absence of pre-extraction records of natural teeth such as casts, photographs, and radiographs makes correct the selection of anterior teeth difficult. To assist the teeth selection procedure, various artificial teeth manufacturing companies have supplied dentists with many molds,

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Access this article online

Quick Response Code:

Website: www.jispcd.org

DOI: 10.4103/jispcd.JISPCD_47_18

guides, shade guides, folders, and pamphlets. Most of these teeth selection aids supplied by these companies are derived from various studies based on Caucasian populations. It has been proven beyond doubt that there is a significant difference between the various facial parameters in different races and ethnic groups. Therefore, the norms and features of one population cannot be used for another.

Review of literature shows that various anatomical measurements have been proposed to aid in the successful selection of maxillary anterior teeth such as bizygomatic width,[2] interpupillary distances,[3] intercommissural width,[1] head diameter,[4] innercanthal distance,[5] and interalar distance.[1]

Advancements in the field of medical science and health care in our country have contributed significantly to the increase in life span in India. The number of patients coming for prosthodontic rehabilitation of missing teeth has increased considerably in dental practices. Increased lifespan and dental awareness coupled with overall economic improvement are going to increase the need for prosthodontic rehabilitation in our country.

The information regarding the various anatomical factors that can be used to select maxillary anterior teeth for a Thrissur population is very scanty. Only one study has been reported in the literature regarding this population, based on innercanthal distance.[6] Therefore, to provide more clarity, a study was planned to study the role of interalar distance as an aid in maxillary anterior teeth selection in Thrissur, Kerala, Malayali population.

A study was conducted on 1200 participants in Thrissur municipal corporation area, Kerala, India, whose aim was to check the validity of interalar distance as a successful aid in maxillary anterior teeth selection. The objectives of the study were (i) to evaluate whether there is a correlation between interalar distance and maxillary anterior teeth in this population; (ii) to check whether interalar distance and maxillary anterior teeth undergo any changes as age increases in this population; and (iii) to determine whether there is a difference in these parameters between the males and females in this population. The null hypothesis is that the interalar distance has no correlation with the maxillary anterior teeth.

MATERIALS AND METHODS

Thrissur municipal corporation with an area of 101.42 km^2 and 317,526 population is situated in the central part of Kerala state.[7] Five wards of Thrissur municipal corporation area were selected at random from total fifty wards with 95% confidence interval (CI) and 85% power and a sample size of 1200 was selected. Two hundred and forty participants were selected from each ward, of which 120 participants were from the 18–25-year age group and 120 from the 40–50-year age group. Sixty males and females were selected from each age group.

A house-to-house survey was conducted in the selected five wards and the selected participants were invited to visit a nearby dental clinic in their ward for data collection. A request letter for participation for the study and informed consent were made in both Malayalam and English, and the consent form was to be signed by the participants. The study proposal was presented before the Ethics Committee of PSM Dental College, Thrissur, and approval was obtained (PSM/IES/12).

During data collection, each of the five wards was denoted as I, II, III, IV, and V, respectively. Males and females were denoted as M and F, respectively.

SUBJECT SELECTION CRITERIA
Inclusion criteria
- Participants with no proximal restorations on the mesial and distal surfaces of six maxillary anterior teeth, which affects its mesiodistal dimension
- Intact contact points between six maxillary anterior teeth which are fully erupted
- Absence of crowding of maxillary anterior teeth
- Participants who are free from any congenital or acquired facial abnormality
- Participants with Thrissur ancestors from both father and mother side from at least two previous generations.

Exclusion criteria
- Participants who have undergone restorations or size alterations of maxillary anterior teeth
- Participants with spacing of maxillary anterior teeth
- Participants with gingival hyperplasia or gingival recession of maxillary anterior teeth
- Participants who have undergone orthodontic treatment
- Participants who have undergone prosthodontic treatment such as crowns or fixed partial dentures
- Participants who have undergone plastic facial surgery.

DETERMINATION OF INTERALAR DISTANCE
Participant is seated in upright position, with head firmly positioned. Two points are marked on either side of the nose with fine tip marking pen indicating the widest point in the outer surface of the alae of the nose. The distance is measured using a digital Vernier caliper (Digimatic caliper, Mitutoyo Corporation, Japan). Each measurement is a mean of three readings, and all readings were carried out by the same examiner to avoid interexaminer variability.

IMPRESSION MAKING

Maxillary alginate (Tropicalgin Zhermack, Italy) dentulous impressions of the participants were made using the correct water powder ratio. The resultant casts were poured immediately (Type III dental stone Kalabhai, India). The mesiodistal width of six maxillary anterior teeth as in a dental arch was measured on the cast using a flexible millimeter scale. The distance between the distal surfaces of maxillary canines from the region of proximal contacts was measured. To rule out interexaminer variability, the same examiner made all the impressions and measurements. The measurements were made three times, and the mean was calculated.

SPSS (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp) was used to analyze the collected data. Mean standard deviation (SD) and 95% CIs were estimated. Comparison between the gender and the two different age groups was estimated using the Student's t-test. One-way ANOVA analysis was done for combined effects. $P < 0.05$ was considered statistically significant.

RESULTS

From five wards of Thrissur Municipal Corporation, 1200 participants were selected and 240 participants were selected from each ward. Out of this, 120 participants were from 18 to 25 years' age group and 120 from 40 to 50 years' age group. In both the age groups, 120 participants were equally selected as sixty males and females.

Table 1 shows the mean values and SD of interalar distance and mesiodistal width of six maxillary anterior teeth for both males and females in the age groups such as 18–25 and 40–50 for all the five wards.

Mean interalar distance was 37.32 ± 3.54 mm and the mean mesiodistal width of six maxillary anterior teeth was 54.69 ± 2.34 mm for 1200 participants [Table 2]. This was found to be highly statistically significant ($P < 0.001$).

In the age-wise correlation in the 18–25 years' age group, out of 600 participants, the mean interalar distance was 36.57 ± 3.31 mm and the mean mesiodistal width of six maxillary anterior teeth was 54.25 ± 2.13 mm. This was found to be highly significant $P < 0.001$. In the 40–50 years' age group, out of 600 participants, the mean interalar distance and the mean mesiodistal width of six maxillary anterior teeth was 38.07 ± 3.61 mm and 55.12 ± 2.47 mm, respectively. This was also found to be highly significant ($P < 0.001$) [Table 3]. The difference in the mean of both interalar distance and the mesiodistal width of six maxillary anterior teeth is seen to be extremely statistically significant, suggesting that there is a significant change in both these parameters as age increases.

In gender-wise correlation, in males (600 participants), the mean interalar distance and the mean mesiodistal width of six maxillary anterior teeth were 40.07 ± 2.45 mm and 55.91 ± 2.23 mm, respectively. In females (600 participants), the mean interalar distance and the mean mesiodistal width of six maxillary anterior teeth were 34.56 ± 1.97 mm and 53.46 ± 1.74 mm, respectively [Table 4]. In the gender-wise correlation, the parameter of interalar distance was found to be extremely statistically significant and there was a significant difference between the males and females in this population. However, the mesiodistal width of six maxillary anterior teeth was not found to be significantly different between the males and females.

DISCUSSION

Ideal teeth selection which is pleasing both esthetically and functionally is a critical step in the fabrication of prosthesis.[8] Even though different anthropometric landmarks have been suggested for aiding teeth selection in the absence of any preextraction records, it has been proven beyond doubt that these landmarks vary from different race and ethnic origin.[9]

This study evaluated whether interalar distance can be used as a guide to determine the mesiodistal width of six maxillary anterior teeth in Thrissur, Kerala population. The study also evaluated whether these two parameters undergo any changes as age increases and whether there is a gender difference between these two parameters in this population.

In this study population, a very high significant correlation was found between interalar distance and mesiodistal width of six maxillary anterior teeth. The mean interalar distance in this study was found to be 40.07 ± 2.45 mm in males ($n = 600$) and 34.56 ± 1.97 mm in females, and the mean mesiodistal width of six maxillary anterior teeth was found to be 55.91 ± 2.23 mm and 53.46 ± 1.74 mm for males and females, respectively. In this study, difference in the mean of the interalar distance was statistically significantly high in this population, for males compared to females, but the mean mesiodistal width of six maxillary anterior teeth was not found to be statistically significant for males and females.

Gomes *et al.*[10] on 81 Brazilian participants also concluded that the interalar distance can be used as a successful aid in selecting six maxillary anterior teeth. In their study, the mean interalar distance was 38.75 ± 3.11 mm and 43.19 ± 2.64 mm for females and males and mean mesiodistal width of six maxillary teeth was 53.50 ± 3.28 mm and 54.0 ± 3.25 mm for females

Table 1: Mean values with standard deviation of interalar distance and mesiodistal width of six maxillary anterior teeth for both males and females in the age groups 18-25 and 40-50 for all the five wards

Age category (*n*=600 each)	Ward (*n*=120 each)	Sex (*n*=60 each)	Mean±SD	
			Inter alar distance	Mesiodistal width of 6 maxillary anterior teeth
18-25 years	Ward I	Male	38.71±3.21	55.00±1.88
		Female	34.28±1.19	53.38±1.85
	Ward II	Male	39.28±1.34	55.30±1.95
		Female	33.96±1.88	52.55±1.47
	Ward III	Male	38.06±1.60	55.40±1.51
		Female	33.99±1.82	54.18±1.11
	Ward IV	Male	38.25±0.49	54.68±1.65
		Female	34.97±0.65	52.52±0.91
	Ward V	Male	41.89±0.60	56.78±2.21
		Female	32.30±0.94	52.72±1.46
40-50 years	Ward I	Male	39.72±1.77	55.82±2.78
		Female	34.88±1.50	53.98±1.38
	Ward II	Male	43.84±1.16	55.67±2.29
		Female	34.65±1.72	52.63±1.65
	Ward III	Male	39.35±1.13	56.67±1.81
		Female	36.66±1.41	55.97±1.39
	Ward IV	Male	39.31±2.27	56.05±1.52
		Female	36.94±1.59	53.90±1.12
	Ward V	Male	42.32±0.61	57.73±2.65
		Female	32.99±0.98	52.77±1.45

SD=Standard deviation

Table 2: Correlation of interalar distance and mesiodistal width of six maxillary anterior teeth (*n*=1200)

Parameters	Mean±SD	R	P
Inter alar distance	37.32±3.54	0.529	<0.001**
Mesiodistal width of 6 maxillary anterior teeth	54.69±2.34		

**There is a highly significant correlation between the interalar distance and the mesiodistal width of six maxillary anterior teeth in the study population (*P*<0.001). SD=Standard deviation

Table 3: Comparison of the mean of interalar distance and mesiodistal width of six maxillary anterior teeth between the two age groups studied

	Age category (years)	Mean±SD	*t*-test	P
Inter alar distance	18-25	36.57±3.31	−7.491	<0.001**
	40-50	38.07±3.61		
Mesiodistal width of 6 maxillary anterior teeth	18-25	54.25±2.13	−6.511	<0.001**
	40-50	55.12±2.47		

**The difference in the mean of both interalar distance and mesiodistal width of six maxillary anterior teeth is seen to be extremely statistically significant (p<0.001), suggesting. SD=Standard deviation

and males, respectively [Figure 1]. They also found statistically significant difference between females and males for interalar distance but not for mean mesiodistal width of maxillary anterior teeth.

Kurien *et al.*[11] on a study on 300 participants in Mangalore, India, also reported an average interalar width of 29.72 and 31.52 mm and 47.35 and 49.91 mm in females and males, respectively. The study concluded that the interalar distance showed significant relation to the width of six maxillary anterior teeth in the studied population. Mishra *et al.*,[12] Dwivedi *et al.*,[13] Nazir *et al.*,[14] and Strajnić *et al.*[15] are all in agreement with the use of interalar distance as a predictor for selecting maxillary anterior teeth.

AL-Kaisy and Garib[16] in a study on 65 Kurdish participants found that females had significantly smaller interalar distance compared to males as 34.63 ± 2.01 and 37.17 ± 2.28 mm, respectively, and mesiodistal width of six maxillary anterior teeth as 43.87 ± 2.47 mm and 45.18 ± 2.41 mm, respectively. However, their study found no significant correlation between interalar distance and mesiodistal width of six maxillary anterior teeth in this population. Deogade *et al.* also found no correlation between interalar distance and width of maxillary anterior teeth.[17] Gupta *et al.*,[18] Reddy *et al.*,[19] and Dharap *et al.*[20] also found that females have smaller interalar distance compared to males in their study.

In this study, age-wise evaluation of the two parameters (interalar distance and the mesiodistal width of six maxillary anterior teeth) showed that in the
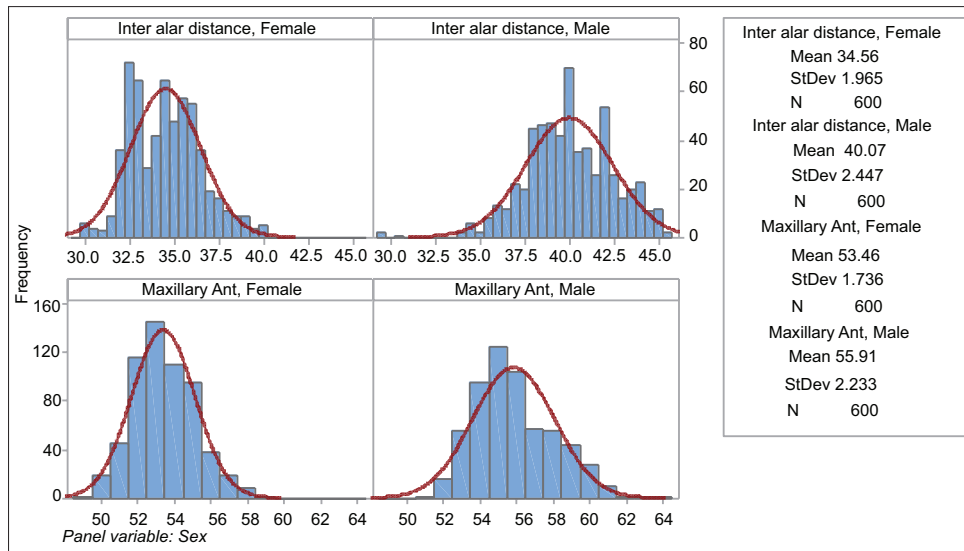
Figure 1: Sex wise distribution of Interalar distance and mesiodistal width of six maxillary anterior teeth
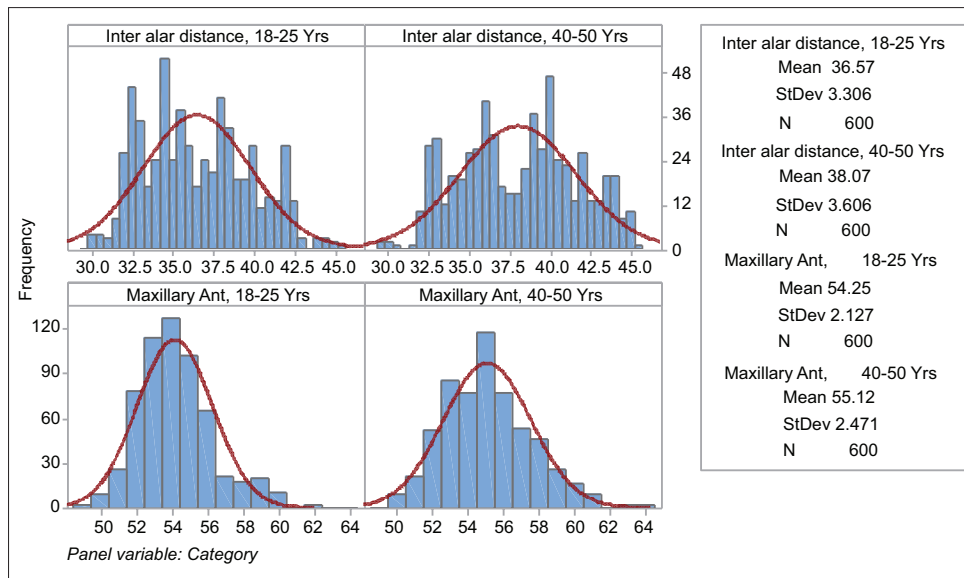

Figure 2: Age wise distribution: Inter alar distance and mesiodistal width of six maxillary anterior teeth in the 18–25 and 40–50 years' age group

40–50 years' age group (n = 600) was 38.07 ± 3.61 mm and 55.12 ± 2.47 mm and in the 18–25 years' age group (n = 600) was 36.57 ± 3.31 mm and 54.25 ± 2.13 mm, respectively [Figure 2]. There was a significant increase in both these parameters as age increases in this population. Abdullah et al.[21] on a study on 310 participants in Saudi Arabia found an increase in the mesiodistal width of maxillary anterior teeth as age increases.

Only one study has been published, regarding the selection of maxillary anterior teeth of Thrissur, Kerala population in relation to innercanthal distance. Latta, Weaver, and Conkin have concluded that at least more than one variable is needed to predict the width of maxillary anterior teeth.[22] Therefore, the information regarding the factors which will help in selection of teeth for this population is scanty. Such an information will be beneficial to the dental professionals who are treating this segment of the population.

However, this study should be seen only as an initial step, as the sample size is only 1200 participants and this study covers only the Thrissur Municipal Corporation area and has evaluated only the interalar distance as a parameter for teeth selection. Therefore, interalar distance must not be used as a sole aid in selecting maxillary anterior teeth. A larger sample size covering the full Thrissur district and involving more facial parameters

Table 4: Comparison of the mean of interalar distance and mesiodistal width of six maxillary anterior teeth between the male and female population studied

	Sex	Mean±SD	t-test	P
Inter alar distance	Male	40.07±2.45	43.004	<0.001**
	Female	34.56±1.97		
Mesiodistal width of 6 maxillary anterior teeth	Male	55.91±2.23	21.217	<0.001**
	Female	53.46±1.74		

**The difference in the mean of both interalar distance and mesiodistal width of six maxillary anterior teeth is seen to be extremely statistically significant (p<0.001), suggesting. SD=Standard deviation

must be planned to formulate more definite guidelines for dental rehabilitation of this population. Therefore, the interalar distance should be used only as a preliminary aid for maxillary anterior teeth selection and must be used in conjunction with other teeth selection methods.

This study recommends the use of interalar distance as a preliminary aid in the selection of maxillary anterior teeth in Thrissur, Kerala population in the absence of preextraction guides. However, further research with greater sample size covering a larger area and with different parameter combinations is needed.

Conclusion

Within the limitations of this study in 1200 participants of Thrissur, Kerala population, the following conclusions were drawn

1. There was a highly significant correlation between interalar distance and the mesiodistal width of six maxillary anterior teeth
2. Both the two parameters, interalar distance and mesiodistal width of six maxillary anterior teeth showed significant increase in size as age increases
3. Interalar distance was more in males than females in this population
4. There was no significant difference in the mesiodistal width of maxillary anterior teeth between males and females in the studied Thrissur population.

Financial support and sponsorship

Conflicts of interest

There are no conflicts of interest.

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