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## RESEARCH ARTICLE

# RELATION BETWEEN COMBINED WIDTH OF MAXILLARY ANTERIOR TEETH AND INTERPUPILLARY WIDTH, INTERCOMMISSURAL WIDTH AMONG DENTATE DAKSHINA KANNADA POPULATION

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### ABSTRACT

**Background & Objectives:** The maxillary anterior teeth are the key elements contributing to the esthetic importance of dentofacial beauty. Over the years, guidelines for teeth selection and arrangement have been suggested. However, no universally accepted single parameter currently exists. **Methodology:** Interpupillary width and intercommissural width of 400 subjects of age ranging from 21-30 years were obtained. Interpupillary width, intercommissural width and combined width of maxillary anterior teeth were measured using digital vernier caliper (Mitutoyo Ltd 505-633-50). The results were statistically analyzed using Pearson correlation test and student t test. **Results:** A positive correlation was found between intercommissural width and combined width of maxillary anterior teeth and a non-significant correlation was found between interpupillary width and combined width of maxillary anterior teeth. **Interpretation & Conclusion:** It can be concluded that,

- There is correlation between Intercommissural width and combined width of maxillary anterior teeth which can be used as a guide for selection of combined width of maxillary anterior teeth among Dakshina Kannada population.
- There is no correlation between Interpupillary width and combined width of maxillary anterior teeth which cannot be used as a guide for selection of combined width of maxillary anterior teeth among Dakshina Kannada population.

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### INTRODUCTION

Face is the most expressive part of the human body which decides an individual's social acknowledgment. Loss of teeth influences facial appearance as well as makes psychological trauma to the individual; subsequently it is crucial that an esthetically satisfying and practically agreeable substitution of the missing teeth ought to be provided. Selection of ideal anterior teeth for edentulous patient becomes a difficult task in the absence of pre-extraction records. *The size, form and color of teeth should be in harmony with surrounding oral and facial structures.* One of the important landmarks every dental professional strive to achieve after delivering treatment is "improvement in patient esthetic value". Very often, while constructing denture prosthesis in absence of pre-extraction records dentist face great difficulty in choosing the ideal analog of missing teeth.

Several anatomic measurements, including bizygomatic width (BZW), inter-pupillary distance (IPD), interalar width (IAW), innercanthal distance (ICD), and inter-commissural width have been suggested to aid in the estimation of a combined width of the maxillary anterior teeth. Moreover most of the standard guideline present in literature uses soft tissue landmarks, which may be misleading due to soft tissue changes with ageing; weight & build of person. The maxillary anterior teeth are the key elements contributing to the esthetic importance of what we call dento- facial beauty. However the selection and arrangement of maxillary anterior teeth for edentulous patients in a natural and esthetically pleasing form has remained an elusive and challenging endeavor. Over the years, norms, criteria and guidelines for esthetic tooth selection and arrangement have been suggested by the artisans of the dental profession. However, no universally accepted parameter currently exists for selection of anterior teeth in local population, and no such studies have been carried out previously. The maxillary anterior teeth are considered the most important in denture esthetics. The most influential factors contributing to a harmonious anterior dentition are the size, shape, and arrangement of the maxillary anterior teeth. By using anatomic references, it is possible to place artificial teeth

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within the bounds, or “average of nature,” permitting individual esthetics and physiologic variations.

### Objectives of the study

- To study the relation between combined width of maxillary anterior teeth and inter-pupillary width.
- To study the relation between combined width of maxillary anterior teeth and inter-commissural width.

## MATERIALS AND METHODS

The study was carried out in the Department of Prosthodontics, K.V.G. Dental College and Hospital, Sullia. A total of 400 subjects with age ranging between 21-30 years were selected among the population belonging to Dakshina population on the basis of defined inclusion and exclusion criteria.

### Inclusion criteria

- Angle Class I molar relationship, pleasing profile, and sound morphologically normal permanent dentition up to the second molar.
- Subject's age ranging between 21-30 years.
- Should be a native of Dakshina Kannada
- No evidence of apparent loss of tooth structure due to attrition, erosion, abrasion or trauma

### Exclusion criteria for the subject in this study:

- Subjects with history of orthodontic treatment
- Gingival inflammation and hypertrophy in the upper anterior region
- Severe attrition; crowns or proximal restorations placed in the anterior teeth
- History of congenital anomaly, orbital disease, trauma, or facial surgery

### Methods of Collecting Data

#### Instruments and materials that were used during course of study

- Irreversible hydrocolloid impression material (Tropicalgin ISO 1563:1990/ADA18/BS )
- ADA type III dental stone
- Wooden tongue spatula
- Dentulous rim lock perforated stock tray (SS WHITE)
- Digital vernier caliper (MITUTOYO Ltd 505-633-50)
- Curved and straight stainless steel spatula
- Flexible Rubber bowl
- Base former
- Water & Powder measuring device (supplied by manufacturer)
- Dental floss (Colgate-waxed dental floss)

## METHODOLOGY

Following the written approval of the ethical committee, K.V.G.

Dental College and Hospital, Sullia, the subjects were screened according to the defined inclusion and exclusion criteria. The subjects qualifying for the study were selected.

**Impression & cast making procedures:** After doing a brief oral examination, proper size perforated rim lock stock tray (S S WHITE) was selected, utility/beading wax was used for customization of tray if required in any specific area. Alginate impression powder (Tropicalgin ISO 1563:1990/ADA 18/BS 4269) was mixed with water according to manufacturer instructions with 1:2.6 (proportion by weight) water / powder ratio in flexible rubber bowl with curved stainless steel spatula by spatulating it in figure of eight motion then swiping and stropping it against the rubber bowl walls. Impression tray was loaded and maxillary impression was made. The cast was poured immediately with hard setting dental stone (TYPE III). Dental stone was taken in proper powder liquid ratio (according to manufacturer) and spatulated in rubber bowl with wide blade straight stainless steel spatula. After one hour, casts were recovered & damaged casts were discarded & impression was remade. Base was made for the casts.

**To measure the combined width of the maxillary anterior:** Mesiodistal dimension of maxillary six anterior teeth was measured with the help of dental floss passing through distal surface of the canine in the maxillary cast. Dental floss was placed at the greatest curvature of the maxillary teeth, and a mark on each side was placed at the distal surface of the canines. Dental floss was made straight, and the distance was measured between the marks using digital vernier calliper (Fig.1).

**To measure the Inter-pupillary distance:** After seating the subject comfortably on the dental chair, subject was asked to look straight, then the midpoint of the pupils was marked on a wooden tongue spatula held horizontally at the forehead. The distance between the markings were measured using digital vernier caliper to get the inter-pupillary distance. (Fig.2)

**To measure the Inter-commissural width:** The inter-commissural width was determined by measuring the maxillary lip vermilion from commissure to commissure. Distances were measured using a digital vernier caliper without the application of pressure. Subjects were asked to widely open and close their mouth several times and to move their lips to allow fatigue of the surrounding muscles to relax during the measurement. (Fig.3). The measurements were obtained from the patient by two independent observers and average value was tabulated and analyzed statistically. All measurements were obtained in millimeters. The study results were analyzed using Pearson's correlation coefficient and Student 't'-test

## RESULTS

Table 1 shows the Measurement of interpupillary width, intercommissural width and combined width of maxillary anterior teeth of study participants. (n= 400). Minimum value recorded for the interpupillary width was 50mm and the maximum value recorded for the interpupillary width was 69mm. The mean of the interpupillary width as recorded by the observer is  $61.70 \pm 3.352$ mm. Minimum value recorded for the intercommissural width was 42.5mm and the maximum value recorded for the intercommissural width was 69.5mm.

**Table 1. Measurement of interpupillary distance, intercommissural distance and combined width of maxillary anterior teeth of study participants**

	IPD	ICM	COMWIDTH
N	400	400	400
Mean	61.70	50.123	52.27
Std. Deviation	3.352	3.4989	2.154
Minimum	50	42.5	47
Maximum	69	69.5	63

**Table 2. Mean ratio of relative interpupillary distance, intercommissural distance and combined width of maxillary anterior teeth among males**

	IPD	ICM	COMWIDTH
N	200	200	200
Mean	62.07	49.886	52.25
Std. Deviation	3.336	3.1333	2.158
Minimum	54	42.6	47
Maximum	69	60.1	63

**Table 3. Mean ratio of relative interpupillary distance, intercommissural distance and combined width of maxillary anterior teeth among females**

	IPD	ICM	COMWIDTH
N	200	200	200
Mean	61.33	50.360	52.29
Std. Deviation	3.335	3.8230	2.156
Minimum	50	42.5	49
Maximum	69	69.5	63

**Table 4- Correlation between combined width of maxillary anterior teeth and interpupillary distance**

	Mean	Std. Deviation
IPD	61.70	3.352
COMWIDTH	52.27	2.154

	IPD	COMWIDTH
Pearson Correlation( r )	1	.067
Sig. (2-tailed)	.	.180

**Table 5- Correlation between combined width of maxillary anterior teeth and intercommissural distance**

	Mean	Std. Deviation
COMWIDTH	52.27	2.154
ICM	50.123	3.4989

	ICM	COMWIDTH
Pearson Correlation( r )	1	.454
Sig. (2-tailed)	.	.000

**Table 6- Mean values of interpupillary width intercommissural width and combined width of maxillary anterior teeth among males and females**

	GENDER	Mean	Std. Deviation	Std. Error Mean
IPD	Male	62.07	3.336	.236
	Female	61.33	3.335	.236
ICM	Male	49.886	3.1333	.2216
	Female	50.360	3.8230	.2703
COMWIDTH	Male	52.25	2.158	.153
	Female	52.29	2.156	.152



**Figure 1- Measurement Of Combined width of Maxillary Anterior Teeth Using Dental Floss**



**Figure 2- Measurement of Interpupillary Width**



**Figure 3. Measurement Of Intercommissural Width Using Digital Vernier Caliper**

**Table 7- Mean difference between interpupillary distance ,intercommissural distance and combined width of maxillary anterior teeth among Males and Females using independent sample t- test.**

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
IPD	Equal variances assumed	.040	.842	2.223	398	.027 (<0.05)	.74	.334	.086	1.397
	Equal variances not assumed			2.223	398.000	.027	.74	.334	.086	1.397
ICM	Equal variances assumed	4.432	.036	-1.356	398	.176 (>0.05)	-.474	.3495	-1.1611	.2131
	Equal variances not assumed			-1.356	383.224	.176	-.474	.3495	-1.1612	.2132
COMWIDTH	Equal variances assumed	.019	.890	-.188	398	.851 (>0.05)	-.04	.216	-.465	.384
	Equal variances not assumed			-.188	397.999	.851	-.04	.216	-.465	.384

The mean intercommissural width as recorded by the observer is 50.123 ±3.4989mm. Minimum value recorded for combined width of maxillary anteriors was 47mm and maximum record value of 63mm. The mean value for the combined width of maxillary anteriors was 52.27±2.154mm. Table 2 shows Mean ratio of relative interpupillary width, intercommissural width and combined width of maxillary anterior teeth among males (n = 200). The minimum values obtained for the interpupillary width, intercommissural width and combined width of maxillary anteriors are 54mm, 42.6mm and 47mm respectively. The maximum value obtained for the interpupillary width, intercommissural width and combined width of maxillary anteriors are 69mm, 60.1mm and 63mm respectively. The mean ratio obtained for the interpupillary width, intercommissural width and combined width of maxillary anteriors are 62.07mm, 49.886mm and 52.25mm respectively.

Table 3 shows the mean ratio of relative interpupillary width , intercommissural width and combined width of maxillary anterior teeth among females (n = 200). The minimum values obtained for the interpupillary width, intercommissural width and combined width of maxillary anteriors are 50mm, 42.5mm and 49mm respectively. The maximum values obtained for the interpupillary width, intercommissural width and combined width of maxillary anteriors are 69mm, 69.5mm and 63mm respectively. The mean ratio obtained for the interpupillary width, intercommissural width and combined width of maxillary anteriors are 61.33mm, 50.360mm and 52.29mm respectively. Table 4 shows the correlation between combined width of maxillary anterior teeth and interpupillary width. Pearson correlation indicates that there is no positive correlation between interpupillary width and combined width of maxillary anterior teeth since the value of significance is greater than 0.05 ( p > 0.05 ). Table 5 shows the correlation between combined width of maxillary anterior teeth and intercommissural width . Pearson's correlation indicates that there is a high correlation between combined width of maxillary anterior teeth and intercommissural width ( p < 0.001 ; R = 0.454 ; R<sup>2</sup> = 0.206 ) and R<sup>2</sup> = 0.206 , this means 20.6 % of ones intercommissural width is directly accounted for ones combined width of maxillary anterior teeth. Table 6 shows the mean values of interpupillary width, intercommissural width and combined width of maxillary anterior teeth among males and females. The mean values for interpupillary width (IPD) among males and females are 62.07±3.336mm and 61.33±3.335mm.

The mean values for intercommissural width (ICM ) among males and females are 49.88 ±3.122mm and 50.30 ±3.823mm .The mean values for combined width of maxillary anterior teeth among males and females are 52.25±2.158mm and 52.29±2mm. Table 7 shows the mean difference between interpupillary width, intercommissural width and combined width of maxillary anterior teeth among Males and Females using independent sample t- test. Levene's tests of equality of variance in different samples were used to determine the assumption of equal variances or not. From the test it can be concluded that there is a significant difference in interpupillary width among males and females and there is no significant difference in intercommissural width and combined width of maxillary anterior teeth among males and females.

## DISCUSSION

The artificial teeth selection and arrangement is always a challenge to dentist. It becomes more difficult in the resorbed residual ridges. Boucher has stated, "The only correct position of a tooth is the one in which it was placed by nature. Pre extraction records serves as an aid in arranging teeth in nature's position .Various intra oral landmarks like Incisive papilla, Inter-canine distance has also been taken into consideration for selection and arrangement of teeth. Many of the soft tissue landmarks are subjective to change as age progress .The interpupillary distance of human remains fairly static throughout the life. Mishra MK et al conducted a study to find out the relationship between the inner inter-canthal distance, inter-pupillary distance, inter-commissural width, inter-alar width, and the width of maxillary anterior teeth in Aryans and Mongoloids. The inter-alar width was measured as the distance between the widest points on the outer surface of the alae of the nose on either side . For the measurement of inter-pupillary distance, the midpoint of the pupils was marked on a wooden tongue spatula. The inter-commissural width was determined by measuring the maxillary lip vermilion from commissure to commissure. The inter-canthal distance was measured as a distance between the medial angle of the palpebral fissure of the eyes. Distances were measured using a Boley's gauge without the application of pressure. . A highly significant correlation was found between inter-pupillary distance and combined width of maxillary anterior in the total population, Aryans, and Mongoloids. For Aryans, inter-alar width, inter-pupillary distance, and inter-commissural width can be used to determine anterior teeth widths.

For Mongoloids, inter-pupillary can be used to determine anterior teeth widths. A study was performed by Kini AY., Angadi GS in 2013 to correlate dental measurements i.e. combined mesio-distal width of six maxillary anterior teeth with facial measurements i.e. inner canthal distance, interpupillary distance and intercommissural width. Two standardized digital photographs of the face were generated; one, when the facial muscles were relaxed and the other, when the subject was smiling; thereby, revealing the maxillary anterior teeth up to the canine tip. Inner canthal distance, interpupillary distance, intercommissural distance, distance between the tips of the maxillary canines and distance between the distal surfaces of the canines were measured. On the cast, the distance between tips of maxillary canines and distance between distal surfaces of maxillary canines were noted. Extra oral anthropometric measurements of the interpupillary distances and the intercommissural distances with the help of standardized photographs can help us determine the combined widths of the anterior teeth accurately, thus aiding their selection in the absence of pre-extraction records. A study was conducted by Glynis Anita Miranda, Mariette D'Souza in 2016 to evaluate the reliability of interalar width and intercommissural width as guide in selection of artificial maxillary anterior teeth. Total of 200 samples were selected. The four parameters such as interalar width, intercanine distance, intercommissural width, and distance between distal aspects of canines were measured. The data obtained were statistically analyzed. A correlation was observed between the interalar distance and the intercanine distance and also between the intercommissural distance and the distance between the distal aspects of canines. With the review of literature it is clear that, in the absence of pre-extraction records, there is however, no accurate objective method in order to select the width of maxillary anterior teeth for edentulous patients. Although many methods have been utilized, none of these methods are absolutely reliable for teeth selection. The anatomical landmark as a guide for selecting maxillary anterior teeth will vary from population to population. Development of a more scientific or objective method of teeth selection would greatly assist dentist in delivering their service for patient care and satisfaction confidently and will also enable lab technician to accurately pick the teeth without seeing the patient on dental chair, computer would also be used to scan and measure cast to give image of patient teeth in the proper size relationship.

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