# The Relationship of Facial Soft Tissue Parameters with Inter-Premolar Width

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# ABSTRACT

**Introduction:** The purpose of this study was to determine the co-relation between inter-pupillary width, inter-canthal width and inter-tragus width to the inter-premolar width.

**Material and Method:** Sample size consisted of 100 adults (aged 18-25yrs) equally distributed into two groups of 50 males and 50 females exhibiting Angle's class I molar relation and class I canine relation with normal overjet and overbite. Inter-premolar width measured on study models of the individuals. Inter-pupillary and outer inter-canthal widths were measured with the help of a digital vernier caliper and by marking reference points on protective eye wear glasses. Inter-tragus width was measured with the help of a standard cephalostat.

**Results:** descriptive statics was used to calculate mean and standard deviation. Comparison between genders were done by using unpaired t test. Pearson's coefficient test was used to find co-relation between facial parameters and inter-premolar width. All facial parameters were higher in males than in females. In females the outer inter-canthal width shows significant positive co-relation.

**Conclusion:** Outer inter-canthal width in females shows positive co-relation, while other facial parameters show weak co-relation with inter-premolar width indicating further extensive research required to confirm the results.

**Keywords:** Inter-premolar width, inter-pupillary width, Inter-tragus width, outer inter-canthal width.

## INTRODUCTION

The facial aesthetics play an important role in determining an individual's social appearance.<sup>1</sup> For centuries artists and physicians across the globe have tried to quantify the ideal proportions of the face. Orthodontists have developed a keen interest as it provides guidelines for facial aesthetics and harmony which has lead to a gradual shift from Angles hard tissue paradigm to soft tissue paradigm.<sup>2</sup> The study of facial aesthetics and the harmonious relation with each other has taken the centre stage in orthodontic practice.<sup>3</sup>

A well balanced facial aesthetics involves a harmonious relation between the soft tissue, skeletal tissue and dental tissue. The width of dental arches also play a vital role in the orthodontic diagnosis to achieve post-treatment stability and improved aesthetics.<sup>4</sup>

The variations seen in the width of the dental arches and soft tissue dimensions of the different populations is usually influenced by genetic inheritance. These inherited differences are very useful for the implementation of effective orthodontic treatment. Hence, a thorough knowledge and understanding of the association between the soft tissue and their dental parameters for a given population becomes an obligation. In this present study, the ratio of different facial parameters to its arch width is calculated in individuals with acceptable facial aesthetics, along with Angle's class I molar and class I canine relation (evaluated by orthodontist). This ratio can be helpful for formulating the treatment plans in the patient requiring arch width modifications.

Aim and Objectives of the research were to determine the ratio between-

- 1. Inter-pupillary width (IP) to inter-premolar width (IPRE)
- 2. Outer-inter-canthal width (OIC) to inter-premolar width(IPRE)
- 3. Inter-tragus width (IT) to the inter-premolar width (IPRE)
- To determine whether a relationship exists between inter-pupillary width (IP), outer inter-canthal width (OIC), inter-tragus width (IT) and their co-relation to the inter-premolar width (IPRE) taking gender into consideration.

## MATERIAL AND METHODS

This present study was conducted in the department of Orthodontics and Dentofacial Orthopaedics of of our institute. The subjects included in the study were students, residents, and the patients who visited the institute and fulfilled the inclusion criteria.

In this descriptive type of observational study, the subjects were selected by the panel of three judges including the researcher. A total of 100 subjects were selected with age ranging from 18 to 25 years. An informed consent was taken from each subject for the same. As it is an observational study, no harm was caused to the individuals; hence approval from the ethical committee was not required.

The subjects were separately placed into two groups

Group A = Male (50 subjects)

Group B = Female (50 subjects)

The inclusion criteria for the study considered was;

1. The individuals with full complement of natural teeth

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- Individuals having Angle's class I molar and class I canine relation with normal overjet and overbite with absence of crowding and spacing.
- 3. Normal morphological shaped teeth.
- 4. No history of orthodontic, orthopaedic and facial surgical treatment.
- 5. No history of any adverse oral habits.
- 6. Well-aligned dental arches.
- 7. Acceptable facial aesthetics with no gross facial asymmetry.

The maxillary inter-premolar width (IPRE) was recorded by making alginate impressions and study models were prepared. The deepest point of the transverse fissure of the maxillary first premolar tooth was considered as the reference point for inter-premolar width.<sup>5,6</sup> A digital vernier caliper was used to measure the distance between these two reference points (Figure no 1).

To record the inter-pupillary width (IP) the individuals were instructed to sit in an upright position wearing a protective eye wear. A 0.5 mm permanent marker was used to mark two points on transparent adhesive tape place on the eye wear. These points were used as a guidance of the midpoint of the pupils. The distance between these two points was measured using a digital vernier caliper and at the same time the outer inter-canthus width (OIC) was also recorded. (Figure no 2)

To measure the inter-tragus width, the subjects were made to stand upright in between the ear rods of the cephalostat of digital lateral cephalometric machine. The outermost prominent part of the tragus was considered as the reference point. The ear rods were adjusted so that the ear rod touches to the reference point without any pressure on the soft tissue. The distance between two ear rods was measured using the same digital vernier caliper (Figure no 3).

To eliminate the observer bias and also to get consistent readings, the same examiner performed all the measurements thrice on different days and at different time. A mean value was then calculated from these readings to establish the consistency of the measurements.

#### RESULTS

Descriptive statistics such as mean and standard deviation (SD) were used. The ratio of IP, OIC, IT to IPRE was calculated. Comparison between the ratios of gender was done by unpaired 't' test. A p-value less than 0.05 were considered as statistically significant. Pearson correlation coefficients were used to determine whether any correlation exists between the facial measurements (IP, O-IC, IT, IPRE) and inter-premolar width. Data analysis was done by using software SPSS v16.0.

The mean value of 50 male subjects were 63.86mm, 103.42mm, 149.32mm, 37.68mm for inter-pupillary width (IP), outer inter-canthal width (OIC), inter-tragus width (IT), inter-premolar width (IPRE) respectively (table no -1). The mean of 50 female subjects were 60.77mm, 99.44mm, 135.74mm, 35.94mm for inter-pupillary width (IP), outer inter-canthal width (OIC), inter-tragus width (IT), inter-premolar width (IPRE) respectively (Table no -1).

The unpaired 't' test showed inter-pupillary width (IP), out-



Figure-1: Measurement of inter-premolar width



Figure-2: Measurement of inter-pupillary width and outer inter-canthal width





Figure-3: Measurement of inter-tragus width

er inter-canthal width (OIC), Inter-tragus width (IT) and the Inter-premolar width in the male group were significantly larger than in female group (Table no -1).

The ratio of inter-pupillary width (IP), outer inter-canthal width (OIC), inter-tragus width (IT), to the inter-premolar width (IPRE) were calculated. These were 1.7018, 2.7548,

Sex	Inter-pupillary width (IP)		outer inter-canthal width (OIC)		Inter-tragus width (IT)		Inter-premolar width(IPRE)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Male	63.86	3.36	103.42	5.27	149.32	5.19	37.68	2.37
Female	60.77	2.28	99.44	3.68	135.74	5.99	35.94	1.96
t-value	5.38		4.378		12.116		4.001	
p-value	P<0.0001		P<0.0001		P<0.0001		P=0.0001	
Table-1: Comparison of different parameters between genders.								

Sex		IP/IPRE	OIC/IPRE	IT/IPRE	
Male	Mean	1.7018	2.7548	3.979	
	SD	0.018	0.030	0.0426	
Female	Mean	1.6975	2.7732	3.787	
	SD	0.0145	0.0225	0.0360	
Table-2: Ratio between means of different parameters					

Male	Pearson's correlation coef- ficient 'r' value	p-value			
Inter-pupillary width (IP)	0.174	0.228			
outer inter-canthal width (OIC)	0.190	0.187			
Inter-tragus width (IT)	-0.071	0.623			
Table-3: Pearson's correlation coefficient between different					
parameters with inter-premolar width (IPRE) in male group.					

Female	Pearson's correlation coefficient 'r' value	p-value		
Inter-pupillary width (IP)	0.203	0.158		
Outer inter-canthal width (OIC)	0.334	0.018 *		
Inter-tragus width (IT)	0.113	0.435		
*- significant				
<b>Table-4:</b> Pearson's correlation coefficient between different parameters with inter-premolar width (IPRE) in female group.				

3.979 respectively for male and 1.6975, 2.7732 and 3.787 for female respectively (Table no 2).

The Pearson's correlation coefficient test showed positive correlation for only one parameter i.e. in female group. In the female group outer inter-canthal width showed positive correlation to the inter-premolar width i.e. r value of 0.334. Other facial parameters in both male and female showed weak correlation to the inter-premolar width (Table no-3, 4 and Graph 1,2).

# DISCUSSION

Facial parameters like Inter-pupillary width and outer-intercanthal width plays a crucial role in determination of combined width of maxillary incisors.<sup>7,8</sup> In previous studies, bizygomatic width was considered to evaluate the co-relation between width of maxillary incisors, but due to variations in facial soft tissue thickness and also considering the possible practical errors to accurately locate bizygomatic prominence, hence in the current study we have considered the outer-tragus distance to avoid bias.<sup>9</sup>

Inter-premolar width is one of the most important parameter to be taken into consideration while modifying the arch width.<sup>10</sup> In this study for first time, we have made an attempt



Pearson's correlation coefficient between OIC with IPRE in male group





**Graph-1:** Pearson's correlation coefficient between different parameters with inter-premolar width (IPRE) in male group.

to find co-relation between soft tissue parameters with interpremolar arch width depending upon the positive co-relation of these facial soft tissue parameters with selection of maxillary anterior teeth.<sup>7,8</sup>

In the present study, inter-premolar width was found to be significantly larger in males. The findings are found to be in



Pearson's correlation coefficient between IP with IPRE in female group





Pearson's correlation coefficient between OIC with IPRE in female group



Graph-2: Pearson's correlation coefficient between different parameters with inter-premolar width (IPRE) in female group.

co-relation with the studies conducted by Mandava Prasad et al 1<sup>st</sup> premolar arch width (male 39.05 and female 38.02) and Nitin Dungarwal etal (male 37.59 female 35.61).<sup>11,12</sup> According to R. Haranadh Babu premolar width for male and female was 36.83 and 36.47 respectively which were statistically not significant.13

Inter-pupillary distance (IPD) is the distance measured between the centres of the pupils. In this study, inter-pupillary width (IPRE) was measured by same examiner with the help of digital vernier caliper. Therefore inter-examiner error was removed.<sup>14</sup> Though this parameter showed positive co relation with selection of maxillary central incisors here, it shows that there is a weak co-relation between inter-premolar width (PIRE) and interpupillary width (IP).<sup>7</sup>

According to H.M. AL-EL-Sheikh, M.S. AL-Athel, the in-

ter-pupillary width (IP) is larger in males (male 64.14 and for female 60.97) which coincides with the readings in this study (for male 63.86 and for female 60.77).<sup>15</sup> According to Zakiah Mohd Isa et al, the mean inter-pupillary width (IP) was 62.28.16 According to Shuchita Sharma etal, in the present study, the mean of inter-pupillary width (IP) was found to be 59.77 mm in males and 57.56 mm in females, males having greater measurements than females.<sup>7</sup>

Outer inter-canthal distance and combined maxillary anterior width showed a positive co-relation.<sup>17</sup> Therefore, in the present study the same parameters were used and we found that in females it has a significant co-relation. According to H.M.AL-EL-Shaikh et al there was significant co-relation between facial and dental measurements in female group while no co-relation was found in males.<sup>15</sup> According to Gupta VP et al the range for male was 76-105 mm and for females it was 71-105mm, which is within the range of our present study.<sup>17</sup> Meltem Acar Gudek et al and reported that outer inter-canthal distance ( for male  $96.43 \pm 11.90$  and for female 95.08  $\pm$  9.85) was higher in male than that of female.<sup>18</sup> According to Agrawal J et al the outer inter-canthal distance ranges from  $95.69 \pm 1.62$  and  $94.16 \pm 1.17$  for males and females respectively in 14 to 25 yrs age group.<sup>19</sup>

In this study we have considered the inter-tragus width (IT) because it is made up of cartilage and lesser soft tissue thickness over the tragus, which enables us to record the inter-tragtus distance accurately.

In present study, the co-relation between premolar arch width and facial parameters are highly significant. The Pearson correlation test of outer inter-canthal (OIC) to inter-premolar width (IPRE) shows significant correlation in female subjects. Other parameters i.e. inter-pupillary (IP) shows weak positive correlation to the inter-premolar width (IPRE) while inter-tragus width shows a weaker negative co-relation.

According to Benjamin and Burris arch width varies with gender, ethnicity and facial morphology.20 According to Nitin Dungarwal there is no single unique arch form related to a particular ethnic group. Arch width also gets affected by facial growth pattern.<sup>11</sup> According to Methew Forster there is trend to decrease arch width as SN-MP plane increases.<sup>21</sup> Therefore in present study facial parameters shows weak co-relation to inter-premolar width.

## Limitations of study

The present study is based on only clinical examination of individuals, the cephalometric variations was not taken into consideration. The present study was conducted in subjects having Angle's class I molar relation with good occlusion. Individuals with Class II and class III molar relation were not considered. Further extensive study is required to formulate its co-relation and to confirm the results.

## **CONCLUSION**

The Pearson correlation test of outer inter-canthal width (O-ICD) to inter-premolar width (IPRE) shows significant correlation in female subjects. All other facial parameters show weak co-relaration to inter-premolar (IPRE) width. All the facial and dental parameters recorded (IP, O-IC, IT, IPRE) were significantly higher in male than that of female subjects. The ratio of inter-pupillary width (IP), outer inter-canthal width (O-IC), inter tragus width (IT), to the inter-premolar width (IPRE) were 1.7018, 2.7548, 3.979 for male and 1.6975, 2.7732, 3.787 for female respectively, which are highly significant.

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