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Original Article

CORRELATION BETWEEN FACIAL REFERENCES AND MESIODISTAL WIDTH OF MAXILLARY ANTERIOR TEETH

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ABSTRACT

Objectives: *To find the relationship between facial measurements Inter Arch Width (IAW), Inter Canthal Distance (ICD), Inter Pupillary Distance (IPD) and the mesiodistal width of maxillary anterior teeth.*

Materials and Methods: *The study employed non-probability purposive sampling on 100 patients, including both genders Measurements for ICD, IAW, IPD were taken using a digital vernier caliper and a wooden spatula. Pearson correlation coefficients assessed correlations between maxillary anterior teeth width and the measured parameters.*

Results: *The study involved 100 participants with a mean age of 29.95 years (SD ± 6.83), comprising 40% females and 60% males. Key facial and dental measurements included a mean inter-canthal width of 35.62 mm (SD ± 2.22), inter-pupillary distance of 61.44 mm (SD ± 4.35), inter-alar width of 40.62 ± 5.35 mm, and combined maxillary teeth width of 47.02 mm (SD ± 3.30). Significant correlations were found between combined width of maxillary teeth (CWMT) and the facial measurements: ICD (r = 0.48), IPD (r = 0.42), and IAW (r = 0.61), all with p < 0.001. Strong correlations were found Between Combined Width Of Maxillary Teeth (CWMT) and ICD in females (r = 0.59) and moderate in males (r = 0.46), all statistically significant.*

Conclusion: *The findings showed significant correlations between CWMT and facial dimensions (ICD, IPD, IAW) across all genders with the strongest correlation between CWMT and IAW, indicating their potential as biometric landmarks for selecting upper anterior teeth .*

Key words: *Biometric Landmarks, Correlation, Facial Dimensions, Inter-Alar Width, Inter-Canthal Distance, Inter-Pupillary Distance*

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INTRODUCTION

After comfort second main factor for patients seeking treatment is aesthetics. Prosthodontics treatment for the missing teeth holds immense importance as the face is the most expressive part of a person's body. The aesthetic restoration of an edentulous patient greatly influences their psychological well-being. It boosts patient's self-esteem of the and therefore it is a crucial aspect of the oral rehabilitation. Failure to achieve the natural appearance often results in the disapproval of well-formed, comfortable and efficient denture by the patient[1].

The appearance of the anterior teeth is essential for an appealing face and good lookinglooks. The key factors that contribute to balanced anterior

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dentition are the size, shape, and positioning of the maxillary anterior teeth. smile. Choosing and positioning replacement teeth to the correct proportions helps achieve a natural look. Achievement of excellent aesthetics during replacing maxillary anterior teeth is a challenging job in dentistry. Attractive and good-looking smile needs proper alignment of front teeth. Size, shape and alignment of maxillary front teeth is key for creating harmonious smile and aesthetics[2].

According to most authors the tooth width is more critical than length. Shillinberg reported that total width of upper central incisors accounts for 37% of circumferential arch distance between distal surfaces of canines[3].

Many attempts have been made to device a scientific method for the determination of mesio-distal width of maxillary front teeth for complete denture patients[4]. Various anatomic guides have been proposed for determination of the size of the anterior teeth such as bizygomatic width, intercommissural width, interpupillary width etc[5].

The rationale of the current study is to figure out that the IAW, ICD and IPD Could could serve as a reference for selecting the width of maxillary anterior teeth in our populations and to find out which of these three facial measurement's is more reliable to Serve as a guide for choosing upper anterior teeth for edentate patients without pre-extraction records[6].

Given that facial aesthetics serve as a major determinant of patient satisfaction in complete denture therapy, establishing a reliable, population-specific method for selecting maxillary anterior teeth is essential. Although previous literature has proposed several anatomical guides including interpupillary distance, inter-alar width, and inter-canthal width-most of these measurements are based on Western populations and may not accurately represent craniofacial proportions in the Pakistani population. Since maxillary anterior tooth width plays a critical role in achieving natural-looking aesthetics, and failure to replicate appropriate proportions can result in patient dissatisfaction despite optimal function, this study hypothesizes that facial measurements such as IAW, IPD, and ICD can serve as practical reference standards for selecting anterior tooth width in edentulous patients. Furthermore, the study aims to determine which of these parameters demonstrates the strongest correlation and therefore provides the most reliable guide for tooth selection in Pakistani individuals.

MATERIALS AND METHODS

This cross sectional study was initiated after taking approval from the Ethical Committee of (an Ethical approval from Institutional Review Board (IRB) of Islamic International Dental College Islamabad vide Ref. No. IID/IRC/2024/07/049) for dental research (01 july2024 to 30 Jan. 2025).The study employed non-probability purposive sampling on 100 patients, including both genders without maxillary canine restorations, Angle Class I occlusion, and no facial abnormalities. Sample size was calculated to ensure adequate precision for descriptive estimates and sufficient power for correlational analyses. For estimation of a mean, the conventional formula $n=(Z1-\alpha/2\sigma / E)2$ was used; assuming an anticipated standard deviation of 2.0 mm and a desired 95% CI half-width of 0.4 mm yielded $n \approx 97$. Exclusion criteria included alterations to anterior teeth size, spacing, gingival issues, orthodontic treatment, complete anodontia, and facial surgery. All the patients were clearly told verbally and in written form about the nature of study and their consent to become part of the study was taken. The three parameters, ICD, IAW, and IPD of each patient were determined with a digital vernier caliper(Fig.1). The ICD was determined with caliper in such a way that the caliper doesn't apply pressure on the proposed points of our interest and is just in contact with the medial angle of the palpebral fissure(Fig.2) Similarly IAW was determined by placing the recording parts of the caliper just in contact with the outer surface of the nose(Fig3). The IPD is measured with help of wooden tongue spatula, the mid points of pupil were marked on spatula & that distance is measured with vernier calipers(Fig4).

Data was analyzed using R software version 4.3.1. Quantitate variables (IAW,ICD & IPD) was presented as mean & standard deviations. Qualitative variables like sex were presented as frequency and percentages. Pearson correlation coefficient was used to find out correlation between maxillary anterior teeth width with IAW, ICD & IPD. Effect modifiers like age and genders will be stratified by using post stratified Pearson correlation coefficient. $P \leq 0.5$ was considered significant.

RESULT

The study involved 100 participants with an average age of 29.95 years (SD ± 6.83). In terms of gender distribution, 40 participants were female (40%) and 60 were male (60%). Most common age group was 26-40(n=65, 65%).

The mean inter-canthal width was 35.62 mm (SD ± 2.22), while the mean inter-pupillary distance was 61.44 mm (SD ± 4.35). The mean inter-alar width was 40.62 mm (SD ± 5.35), and the total width of the upper teeth was 47.02 mm (SD ± 3.30).

Table 1 There was a moderate positive correlation between CWMT and ICD, with a correlation coefficient of 0.48 (95% CI: 0.31, 0.62; $p < 0.001$). Similarly, CWMT and IPD showed a correlation coefficient of 0.42 (95% CI: 0.24, 0.57; $p < 0.001$). The strongest correlation was found between CWMT and IAW, with a correlation coefficient of 0.61 (95% CI: 0.47, 0.72; $p < 0.001$). All correlations showed statistical significance based on Pearson's correlation test.

Table 2 Among females, there was a strong positive correlation between CWMT and ICD ($r = 0.59$, 95% CI: 0.34, 0.76, $p < 0.001$). In males, the correlation between CWMT and ICD was moderate ($r = 0.46$, 95% CI: 0.23, 0.64, $p < 0.001$). For IPD, females showed a moderate correlation with CWMT ($r = 0.40$, 95% CI: 0.10, 0.63, $p = 0.01$), while males had a slightly stronger correlation ($r = 0.44$, 95% CI: 0.21, 0.63, $p < 0.001$). In terms of IAW, females demonstrated a weaker correlation with CWMT ($r = 0.37$, 95% CI: 0.06, 0.61, $p = 0.02$), whereas males exhibited a very strong correlation ($r = 0.75$, 95% CI: 0.61, 0.84, $p < 0.001$). All correlations showed statistical significance according to Pearson's correlation test.

DISCUSSION

The study investigated link between facial measurements and the total width of maxillary teeth (CWMT) among 100 participants, with most participants falling in the 26–40 age group.

The results show that CWMT was moderately

Fig 1 to Fig 4

Table 1: Correlation between combined width of maxillary teeth with ICD, IPD and IAW

Variable 1	Variable 2	Correlation co-efficient	Statistic	P. value	95% CI for correlation
CWMT	ICD	0.48	5.40	<0.001	0.31, 0.62
CWMT	IPD	0.42	4.53	<0.001	0.24, 0.57
CWMT	IAW	0.61	7.61	<0.001	0.47, 0.72

* ICD, intercanthal distance; IPD, inter-pupilary distance; IAW, interalar width

Table 2: Correlation between combined width of maxillary teeth with ICD, IPD and IAW stratified by gender

Gender	Variable 1	Variable 2	Correlation co-efficient	Statistic	P. value	95% CI for correlation
Female	CWMT	ICD	0.59	4.47	<0.001	0.34, 0.76
Male	CWMT	ICD	0.46	3.93	<0.001	0.23, 0.64
Female	CWMT	IPD	0.4	2.65	0.01	0.1, 0.63
Male	CWMT	IPD	0.44	3.76	<0.001	0.21, 0.63
Female	CWMT	IAW	0.37	2.43	0.02	0.06, 0.61
Male	CWMT	IAW	0.75	8.58	<0.001	0.61, 0.84

* ICD, intercanthal distance; IPD, inter-pupilary distance; IAW, interalar width, **Pearson correlation test

correlated with ICD and IPD, and strongly correlated with IAW. These findings suggest that facial dimensions, particularly IAW, play a key role in predicting the width of maxillary teeth. The strong correlation with IAW may be attributed to the close anatomical relationship between nasal and dental structures. The moderate correlations with ICD and IPD reflect the role that horizontal facial proportions might have in influencing dental arch width, albeit to a lesser degree than IAW. These facial dimensions, particularly ICD, IPD, and IAW, could be useful as biometric landmarks in the selection of teeth for prosthetic or orthodontic purposes, given their measurable association with dental arch dimensions. Many previous studies reported positive correlation between these landmarks[8-12].

When stratified by gender, the correlations between CWMT and facial measurements varied. Among females, the correlation with ICD was stronger than in males, which could be due to gender-based differences in craniofacial proportions, as females often exhibit smaller but proportionally aligned facial features. In contrast, the correlation between CWMT and IAW was substantially higher in males. This might indicate that the nasal width and dental arch dimensions are more closely linked in males, possibly reflecting gender differences in nasal structure and the maxillary bone.

Our results revealed a significant association between the facial measurements and the total width of maxillary anterior teeth, with IAW showing the strongest association. This finding aligns with studies such as those by George and Bhat[12], who also found a relationship between facial landmarks and dental proportions, suggesting the relevance of facial dimensions in tooth selection. The close anatomical relationship between the nasal base and the maxillary arch may explain why IAW, more than ICD or IPD, Acts as a dependable indicator of maxillary tooth width.

The moderate correlations observed between CWMT and ICD/IPD indicate that while these parameters can provide useful guidelines, they may not be as robust as IAW in predicting tooth width, especially in diverse populations like ours. Similar findings were reported by Deogade et al[10], who found that although ICD and IAW had significant correlations with the combined width of anterior teeth, they may not always serve as precise predictors, particularly for edentulous patients.

Stratifying the data by gender further revealed interesting variations. Males showed a stronger correlation between IAW and CWMT, likely reflecting anatomical differences in craniofacial structures.

CONCLUSION

The findings revealed statistically significant correlations in overall sample and both gender genders and all age groups between CWMT and various facial dimensions, specifically the inter-canthal distance (ICD), inter-pupillary distance (IPD), and inter-alar width (IAW). Notably, the strongest correlation was observed between CWMT and IAW. ICD, IPD and IAW can use be used for selection of upper anterior teeth as biometric landmarks.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
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AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

Conception or Design:	GA, HR, MAG, MHA, HI, MAW
Acquisition, Analysis or Interpretation of Data:	GA, HR, MAG, MHA, HI, MAW
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All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.