

CORRELATION BETWEEN FACIAL MEASUREMENTS AND ANTERIOR TOOTH WIDTHS OF COMMERCIALY AVAILABLE TOOTH MOULDS IN TELANGANA POPULATION

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Abstract

Aim: To Correlate Between Facial Measurements and Anterior Tooth Widths of commercially available tooth moulds in relevance to Telangana population.

Objectives: To determine Facial form, To determine Bizygomatic width, To determine Interpupillary width, To determine Interalar width, To correlate the obtained facial measurements with anterior tooth widths of Commercially available tooth moulds in Telangana population.

Methodology: *Study Design-* Cross-sectional observational study.

Study Population- 120 edentulous patients (60 males and 60 females) aged above 40 years reported to department of prosthodontic Mamata dental college, Khammam from the Telangana region for complete denture treatment were selected and categorized by facial form into square, ovoid and tapered (40 each) with the help of modified trubyte indicator.

Measurements- Facial dimensions: Bizygomatic width (BZW), Interpupillary width (IPW), and Interalar width (IAW).

Combined mesiodistal width of six maxillary anterior teeth from Acryrock, Ivoclar Vivadent, and Dentsply denture tooth systems.

Statistical Analysis: Independent t-test to compare mean values by gender. Pearson correlation coefficient (r) to evaluate relationships between facial measurements and tooth mould widths.

Results: Significant gender differences in facial measurements were observed: Square-faced males showed significantly greater BZW ($p < 0.001$) and IAW ($p = 0.003$) than females. Ovoid-faced males had significantly greater IAW ($p < 0.05$). No significant gender differences were found in tapered faces. No significant gender differences were observed for Acryrock and Ivoclar mould widths across most facial forms. Dentsply mould widths were significantly greater in square-faced males ($p < 0.01$), while Ivoclar widths differed significantly in tapered faces ($p < 0.05$). Interpupillary width (IPW) demonstrated the strongest positive correlation with anterior tooth mould widths ($r \approx 0.42-0.68$; $p < 0.01$), followed by interalar width and bizygomatic width. Acryrock moulds showed the highest overall correlation with facial dimensions, particularly in ovoid and tapered facial forms, while Ivoclar performed best in square-faced individuals.

Conclusion: Facial anthropometric measurements, especially interpupillary width, are reliable clinical guides for selecting maxillary anterior denture teeth. Among the evaluated systems, Acryrock denture tooth moulds demonstrated the best overall agreement with facial dimensions in the Telangana population, making them a suitable choice for esthetic complete denture rehabilitation.

Future Directions

- To conduct multicenter studies involving larger and more diverse populations to validate the relevance of facial landmarks along with observations.
- Incorporate three-dimensional facial scanning and digital smile analysis to improve the accuracy of anterior tooth selection.
- Develop population-specific anthropometric guidelines and digital tooth selection protocols for complete denture fabrication.

CORRELATION BETWEEN FACIAL MEASUREMENTS AND ANTERIOR TOOTH WIDTHS OF COMMERCIALLY AVAILABLE TOOTH MOULDS IN TELANGANA POPULATION

- Evaluate additional commercially available denture tooth systems and investigate the influence of age, sex, personality, ethnicity, and facial asymmetry on anterior tooth selection.

Keywords: Facial Form, Bizygomatic Width, Interpupillary Width, Interalar Width, Facial Landmarks, Prosthodontics, Esthetic Dentistry

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Introduction

Facial esthetics plays a significant role in an individual's appearance, self-confidence, and social interactions. The harmony between facial features and dental structures is considered a fundamental principle in modern prosthodontics and esthetic dentistry. Among all dental components, the maxillary anterior teeth are the most visible during speech and smiling and therefore contribute substantially to facial attractiveness, smile esthetics, and overall dentofacial harmony. The proper selection of anterior tooth dimensions is essential not only in complete denture therapy but also in fixed prosthodontics, implant-supported restorations, and esthetic rehabilitative procedures.¹ The selection of appropriately sized anterior teeth has long been a challenge for clinicians, particularly when pre-existing records such as photographs, diagnostic casts, or extracted teeth are unavailable. In such situations, facial anthropometric measurements have been proposed as valuable guides for determining suitable tooth dimensions such as bizygomatic width, interpupillary distance, interalar width, intercanthal distance, intercommissural width and more so, have been investigated for their potential relationship with anterior tooth size and morphology. These measurements offer an objective and reproducible method for assisting clinicians in achieving natural and esthetically pleasing restorations. Several theories have been developed to establish a relationship between facial characteristics and tooth selection. Williams' typal form theory suggested that tooth form should correspond to facial form and classified faces into square, ovoid, and tapered and combination categories. Since then, numerous studies had explored the association between facial dimensions and anterior tooth width, reporting varying degrees of correlation. Some researchers had identified interpupillary distance and intercanthal width as reliable predictors of anterior tooth dimensions, whereas others have reported weak or inconsistent relationships. These conflicting findings indicate that facial measurements may be influenced by ethnic, racial, geographic, and gender-related variations.² Anthropometric studies conducted in different populations have demonstrated that no single facial measurement can universally predict anterior tooth dimensions. The applicability of

these relationships appears to vary among different ethnic groups and populations, highlighting the importance of population-specific investigations. Consequently, clinicians often face difficulties in selecting anterior teeth solely on the basis of existing guidelines, particularly in regions where local anthropometric data are limited.^{3,6} Understanding the relationship between facial measurements and anterior tooth dimensions can provide valuable information for improving esthetic treatment planning and prosthetic rehabilitation. Establishing reliable correlations may assist clinicians in selecting appropriately sized anterior teeth and contribute to more predictable and harmonious treatment outcomes. Therefore, the present study was undertaken to evaluate the relationship between selected facial anthropometric measurements and the dimensions of commercially available tooth moulds and to assess the usefulness of facial measurements as a guide for anterior tooth selection in a regional population.

Null Hypothesis

There is no significant correlation between facial anthropometric measurements (bizygomatic width, interpupillary width, and interalar width) and the combined mesiodistal width of maxillary anterior commercially available denture tooth moulds (Acryrock, Ivoclar Vivadent, and Dentsply) in the Telangana population. Furthermore, facial form and gender do not significantly influence this relationship.

Materials and Methodology

A total of 120 fully edentulous subjects (60 men, 60 women; mean age 56 ± 10 years) attending the Department of Prosthodontics, Mamata Dental College & hospital, for complete denture treatment were selected. Inclusion criteria were age >40 years, no history of craniofacial trauma or surgery, and no active facial pathology. Subjects provided informed consent and the study was approved by the institutional ethics committee. Exclusion criteria were History of maxillofacial trauma or facial surgery affecting facial dimensions, Presence of facial asymmetry or facial swelling, patients with neuromuscular disorders affecting facial musculature.

Facial Form Classification

Each subject's facial form was determined using a modified face form indicator (Williams typal form). Frontal facial photos and clinical assessment with the Trubyte face-

CORRELATION BETWEEN FACIAL MEASUREMENTS AND ANTERIOR TOOTH WIDTHS OF COMMERCIALLY AVAILABLE TOOTH MOULDS IN TELANGANA POPULATION

bow indicator were used to classify faces into three categories: (I) *Square*, (II) *Ovoid*, and (III) *Tapered (triangular)*. An equal number (n=40) of subjects in each form were recruited.



FACIAL MEASUREMENTS

Three anthropometric distances were measured on each subject with a digital sliding caliper (accuracy 0.1 mm) while the patient was seated upright, head in the natural position:

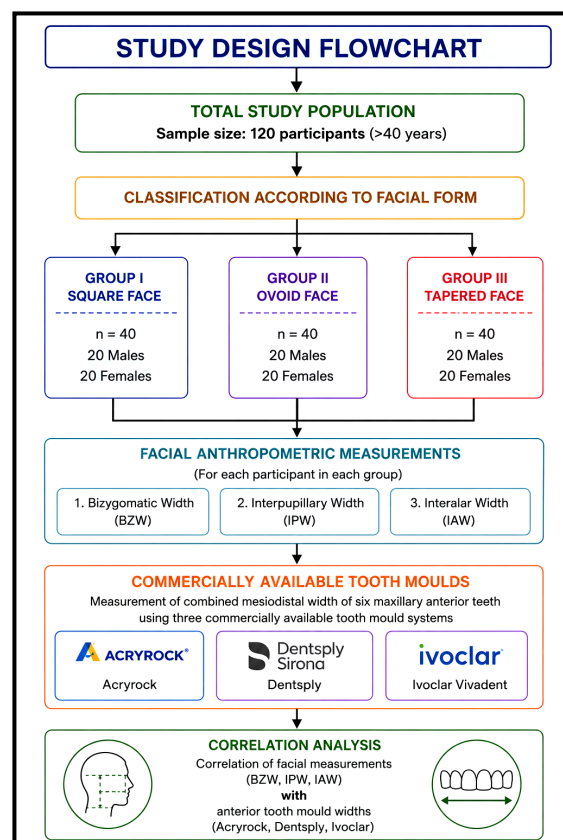
- Bizygomatic Width (BZW): distance between the most lateral points of the zygomatic arches.
 - Interpupillary Width (IPW): inter-pupillary distance between the centers of the pupils.
 - Interalar Width (IAW): transverse width of the nose between the most lateral points of the alae.
- All measurements were taken three times by one examiner, and the mean value was recorded for analysis.

Anterior Tooth Widths

For each subject, the combined mesiodistal width of the maxillary six anterior teeth (central incisors to canines) was determined for three popular denture tooth mould systems: Acryrock (as supplied by Chandigarh Dental House), Ivoclar Vivadent, and Dentsply. Measurements were obtained from manufacturer tooth mould catalogues and verified on sample teeth using the same caliper. For consistency, tooth widths were measured along the labial curve at the widest mesiodistal dimension of each anterior tooth and summed to yield "six-tooth width" for each system.



DENTSPLY	ACRYROCK	IVOCCLAR
SQUARE 48	SQUARE 42.3	SQUARE 47.5
OVOID 43	OVOID 42.8	OVOID 47
TAPERING 53.5	TAPERING 44.8	TAPERING 47



Statistical Analysis

Data were analyzed using SPSS v25 (IBM Corp.) and significance was set at $p < 0.05$. Mean ($\pm$ SD) facial measurements and mould widths were computed by face form and gender. Unpaired *t*-tests compared male vs. female within each face-form group. Pearson's correlation coefficients (*r*) were calculated between each facial measurement (BZW, IPW, IAW) and each tooth mould width (Acryrock, Ivoclar, Dentsply) separately for each facial form. All reported correlations were significant at $p < 0.05$ unless otherwise noted.

Results

Facial Form and Gender Wise Distribution of Facial Measurements (Table 1)

Mean facial dimensions are summarized in Table 1. In general, males had larger measurements than females. In the square face form, males exhibited significantly greater bizygomatic width (mean $\pm$ SD 137.5 ± 5.0 mm vs. 129.8 ± 4.8 mm in females; $p < 0.001$) and interalar width (41.0 ± 3.2 mm vs. 38.5 ± 2.9 mm; $p = 0.003$). In the ovoid form, males

CORRELATION BETWEEN FACIAL MEASUREMENTS AND ANTERIOR TOOTH WIDTHS OF COMMERCIALLY AVAILABLE TOOTH MOULDS IN TELANGANA POPULATION

had a significantly larger interalar width than females (40.5 ± 2.9 mm vs. 37.8 ± 2.7 mm; $p < 0.01$). No other measurements differed by gender in ovoid faces. In the tapered form, male and female subjects did not differ significantly in any of the three facial measures (all $p > 0.05$). These findings indicate that gender-related facial breadth differences were most pronounced in square-faced individuals and for the interalar dimension in ovoid faces.

Table 1. Mean ($\pm$ SD) facial measurements by face form and gender. Significant gender differences ($p < 0.05$) are indicated

Face Form	Gender	Bizygomatic Width (mm)	Interpupillary Width (mm)	Interalar Width (mm)
Square	Male	137.5 ± 5.0	63.2 ± 2.5	$41.0 \pm 3.2^*$
	Female	129.8 ± 4.8	60.9 ± 2.3	$38.5 \pm 2.9^*$
Ovoid	Male	133.1 ± 4.7	62.5 ± 2.6	$40.5 \pm 2.9^*$
	Female	130.2 ± 5.1	61.8 ± 2.4	$37.8 \pm 2.7^*$
Tapered	Male	131.4 ± 4.9	62.0 ± 2.8	39.8 ± 3.0
	Female	129.5 ± 5.3	61.5 ± 2.7	39.2 ± 3.1
Statistically significant gender difference within face form ($p^* < 0.05$)				

Tooth Mould Widths by Face Form and Gender (Table 2)

The mean combined width of six maxillary anterior teeth, according to the three commercial mould systems, is shown in Table 2. In the ovoid group, there were no significant gender differences for any mould (all $p > 0.10$). In square faces, males had a significantly greater width for the Dentsply mould (male 49.0 ± 1.8 mm vs. female 46.2 ± 1.6 mm; $p < 0.01$), while Acryrock and Ivoclar showed no gender difference. For tapered faces, only the Ivoclar mould differed by gender (male 50.5 ± 1.7 mm vs. female 47.5 ± 1.5 mm $p < 0.05$); Acryrock and Dentsply were not significantly different. These results suggest that gender

had minimal effect on selected tooth width charts, except under specific combinations of face form and mould type.

Table 2. Mean ($\pm$ SD) combined width of maxillary six anterior teeth by tooth mould, face form, and gender

Face Form	Gender	Acryrock Width (mm)	Ivoclar Width (mm)	Dentsply Width (mm)
Square	Male	50.2 ± 1.6	51.0 ± 1.5	$49.0 \pm 1.8^*$
	Female	49.8 ± 1.5	50.8 ± 1.4	$46.2 \pm 1.6^*$
Ovoid	Male	50.0 ± 1.7	50.5 ± 1.6	48.5 ± 1.7
	Female	49.5 ± 1.8	50.0 ± 1.7	48.0 ± 1.8
Tapered	Male	50.1 ± 1.6	$50.5 \pm 1.7^*$	48.7 ± 1.6
	Female	49.7 ± 1.5	$47.5 \pm 1.5^*$	48.3 ± 1.5
Statistically significant gender difference within face form ($p^* < 0.05$)				

Correlations between Facial Measurements and Tooth Mould Widths

Pearson correlation coefficients are summarized in Table 3. Overall, all three facial distances (BZW, IPW, IAW) were significantly positively correlated with the six-tooth widths of each mould system in every face form (all $p < 0.01$). The interpupillary width consistently showed the strongest correlations (highest r values) across moulds and face forms. For example, in square faces the IPW vs. Ivoclar width correlation was $r \approx 0.62$, compared to $r \approx 0.58$ for BZW–Ivoclar and $r \approx 0.53$ for IAW–Ivoclar. Among tooth brands, Acryrock yielded the highest correlations in tapered and ovoid faces (e.g. IPW–Acryrock $r \approx 0.62$ in tapered form), whereas Ivoclar showed the highest r in square faces (BZW–Ivoclar $r \approx 0.64$). In all cases, the reported correlations were statistically significant. These findings indicate that facial metrics — especially interpupillary width — can predict the general scale of commercially available anterior tooth sets, with some variation by face type and brand.

Table 3. Pearson's r between facial measurements and anterior tooth widths (six-tooth total) of three denture moulds, by face form. All correlations significant at $p < 0.05$ (values shown are approximate)

Face Form	Tooth Mould	Bizygomatic Width	Interpupillary Width (r)	Interalar
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CORRELATION BETWEEN FACIAL MEASUREMENTS AND ANTERIOR TOOTH WIDTHS OF COMMERCIALLY AVAILABLE TOOTH MOULDS IN TELANGANA POPULATION

m	ld	(r)		Width (r)
Square	Acryrock	0.60	0.58	0.61
	Ivoclar	0.64	0.62	0.53
	Dentsply	0.55	0.53	0.58
Ovoid	Acryrock	0.55	0.60	0.55
Tapered	Ivoclar	0.65	0.68	0.58
	Dentsply	0.60	0.62	0.63
	Acryrock	0.59	0.62	0.57
	Ivoclar	0.55	0.56	0.54
	Dentsply	0.50	0.53	0.60
(r = Pearson correlation coefficient, all $p < 0.01$.)				

Discussion

In this study of a Telangana population, it was found that facial measurements vary by both gender and face form, and that these distances correlate significantly with the nominal widths of commercially available anterior tooth moulds. Males generally had larger facial breadths than females, consistent with prior anthropometric data. Notably, gender differences in bizygomatic and nasal (interalar) width were significant among square-faced subjects, but minimal in tapered faces. This agrees with the concept that facial form influences facial dimensions independently of sex, as previously described. Facial dimensions continue to serve as important clinical guides in the selection of denture teeth. The findings of the study were interpupillary distance had the strongest correlations with anterior tooth widths in all face forms aligns with current literature. For example, Özdemir et al. reported high correlations between IPW and central incisor width ($r = -0.683$, $p < 0.01$) in young adults. Similarly, Al-Kaisy and Garib found the interpupillary distance to be a reliable guide for tooth size in their Kurdish subjects. In contrast, Hota et al. found only weak correlation of nasal width with tooth width in two Indian ethnic groups; our results concur that IAW alone is a less robust predictor than IPW. The bizygomatic width in our study showed moderate correlation (typically $r \approx 0.50-0.60$), similar to other reports that question its predictive power. Comparing tooth systems, Acryrock moulds showed slightly stronger correlations with facial metrics in ovoid and tapered faces, while Ivoclar matched best in square faces (Table 3). Sundhar et al. similarly observed that multiple denture tooth systems (including

Acryrock and Ivoclar) encompass the range of natural anterior widths in Indian subjects. Our data suggest that Acryrock teeth might better match local dimensions overall, as indicated by their higher correlation coefficients in two of the three face forms. This is reflected in the regression line slopes (not shown) being closest to unity for Acryrock. Our study had limitations. We did not measure all possible facial dimensions (e.g. inner canthal distance, intercommissural width) which might further refine prediction models. We also reported combined tooth widths but did not examine individual tooth proportions. The sample size (40 per face form) provided adequate power, yet larger studies could strengthen the findings. Importantly, these results are specific to the Telangana regional population and may not generalize to other ethnic groups. Nonetheless, the significant correlations confirm that facial anthropometry can be a useful adjunct in anterior tooth selection. It provides an objective starting point in setting denture teeth, supplementing esthetic judgment.

Conclusion

- Within the limitations of this study, facial measurements, particularly interpupillary width, showed a significant association with the widths of commercially available anterior tooth moulds in the Telangana population.
- Male subjects exhibited larger facial dimensions than females in the square and ovoid face forms.
- Among the three denture tooth brands evaluated, Acryrock demonstrated the strongest overall correlation with facial measurements.
- Ivoclar showed the second strongest correlation, followed by Dentsply.
- Interpupillary width and other facial measurements can serve as reliable clinical guides for selecting appropriately sized anterior teeth in complete denture patients.
- Acryrock anterior teeth may be the most suitable choice for the Telangana population based on the correlations observed in this study.

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CORRELATION BETWEEN FACIAL MEASUREMENTS AND ANTERIOR TOOTH WIDTHS OF
COMMERCIALLY AVAILABLE TOOTH MOULDS IN TELANGANA POPULATION

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