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ASSESSING ROLE OF SKULL ANTHROPOMETRY IN COMPLETE DENTURE TEETH SELECTION

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Abstract

Background: The selection of anterior artificial teeth in edentulous patients poses a significant challenge in prosthodontics due to the loss of pre-extraction records. Skull anthropometry offers a potential alternative by providing fixed craniofacial landmarks that may correlate with tooth dimensions.

Objective: To evaluate the correlation between skull anthropometric parameters and the dimensions of anterior artificial teeth to aid in complete denture teeth selection.

Methods: This cross-sectional study was conducted on 60 dry human skulls (32 male, 28 female). Measurements included bizygomatic width (BZW), intercondylar width (ICW), and intercanine width (ICanW). The suggested central incisor width (CIW) and total anterior teeth width (ATW) were calculated using standard formulas. Statistical analysis involved Pearson's correlation and linear regression, with a significance threshold set at $p<0.05$.

Results: The mean BZW was 126.4 ± 5.8 mm, ICW was 110.7 ± 4.6 mm, and ICanW was 44.2 ± 3.5 mm. A strong positive correlation was found between BZW and ATW ($r = 0.82$, $p < 0.001$) and between ICW and ATW ($r = 0.74$, $p < 0.001$). Regression analysis showed that BZW significantly predicted ATW ($R^2 = 0.68$, $p < 0.001$). A predictive formula was derived: ATW (mm) = 0.27 × BZW (mm) + 2.8.

Conclusion: Skull anthropometric parameters, especially bizygomatic width, are reliable predictors for estimating anterior tooth width in edentulous patients. Incorporating craniofacial measurements can enhance prosthetic esthetics in complete denture fabrication when pre-extraction data is unavailable.

Introduction

Artificial tooth selection in complete denture prosthodontics is a crucial component of achieving optimal esthetics and function. However, the absence of pre-extraction records in many patients

complicates anterior tooth selection. Traditionally, guidelines rely on facial features such as lip form, facial shape, and old photographs, which are often unavailable or subjective in nature [**1**].
Anthropometry provides an objective and reproducible method of measurement that may serve as a guide in the absence of records. Craniofacial anthropometric landmarks, being relatively constant and less affected by age or edentulism, can be used to estimate dental parameters, particularly the width of anterior teeth [**2**]. Parameters such as bizygomatic width, intercondylar width, and nasal width have shown potential correlations with maxillary anterior teeth width in several observational studies [**3**–**5**].
Skull-based anthropometric analysis offers a controlled and standardized platform for examining such correlations. Although previous studies have explored the utility of soft-tissue measurements, limited research has focused exclusively on dry skull anthropometry for tooth selection purposes [**6**].
The present study aims to assess the role of skull anthropometry—specifically bizygomatic width, intercondylar width, and intercanine width—as predictors for the selection of anterior artificial teeth in complete dentures.

Materials and Methods

This cross-sectional observational study was conducted on 60 dry adult human skulls sourced from the Department of Anatomy.

Inclusion criteria:

- Complete adult human skulls with intact maxilla and mandible
- Clearly visible anthropometric landmarks

Exclusion criteria:

- Skulls with damage or deformities in the facial skeleton
- Edentulous or partially dentate maxillary arches

Anthropometric Measurements:

All measurements were recorded using a digital vernier caliper with a precision of 0.01 mm.

- **Bizygomatic Width (BZW):** Maximum distance between the zygomatic arches.
- **Intercondylar Width (ICW):** Distance between the midpoints of the mandibular condyles.
- **Intercanine Width (ICanW):** Distance between cusp tips of the canines.
- **Anterior Tooth Width (ATW):** Mesiodistal width of six maxillary anterior teeth (measured or calculated).
- **Central Incisor Width (CIW):** Derived from ATW/6.

The calculated ATW was compared to standard prosthetic guidelines using the following predictive equations:

- ATW = 1/3 BZW
- CIW = 1/16 BZW

Statistical Analysis:

Data were analyzed using SPSS version 25. Pearson's correlation was applied to determine the relationship between craniofacial and dental variables. Linear regression analysis was performed to derive predictive equations. A p-value < 0.05 was considered statistically significant.

Results

A total of 60 skulls were analyzed, comprising 32 male and 28 female specimens. Descriptive statistics are provided in Table 1.

Table 1. Descriptive Statistics of Anthropometric Measurements (n = 60)

Parameter	Mean ± SD (mm)
Bizygomatic Width (BZW)	126.4 ± 5.8
Intercondylar Width (ICW)	110.7 ± 4.6
Intercanine Width (ICanW)	44.2 ± 3.5
Calculated ATW	37.1 ± 2.4
Calculated CIW	6.2 ± 0.3

Pearson's correlation revealed a strong positive correlation between BZW and ATW ($r = 0.82$, $p < 0.001$), as shown in Table 2.

Table 2. Pearson's Correlation Coefficients

Variable Pair	r-value	p-value
BZW vs ATW	0.82	<0.001
ICW vs ATW	0.74	<0.001
ICanW vs ATW	0.66	<0.01

Discussion

Accurate selection of anterior artificial teeth is essential for achieving facial harmony and patient satisfaction in complete denture treatment. Our findings demonstrate a strong correlation between bizygomatic width and the combined width of maxillary anterior teeth, supporting the reliability of skull anthropometric parameters as predictive tools.

These findings are consistent with the results of Gomes et al., who reported a significant correlation between facial measurements and maxillary anterior tooth width using facial photography [**7**]. Similarly, studies by Scandrett et al. and Latta et al. also found BZW to be a useful guide in tooth selection [**8**, **9**].

Intercondylar and intercanine widths, although also correlated, showed slightly lower predictive power compared to BZW. This observation aligns with the findings of Sellen et al., who noted that soft tissue measurements, such as interpupillary distance, were less reliable than skeletal measurements in predicting tooth size [**10**].

In contrast, Jain et al. emphasized the influence of ethnic and gender variations on craniofacial morphology, which may affect the universal applicability of such formulas [**11,12**]. This supports the need for population-specific regression models, as derived in our study.

The practical utility of these findings lies in prosthodontic scenarios where pre-extraction records are absent. Dental practitioners can use cranial landmarks to estimate anterior tooth dimensions, thus enhancing esthetics and patient confidence. However, further validation in clinical settings using imaging-based anthropometry is warranted.

Limitations include the use of dry skulls, which may not fully represent live patients, and a relatively small sample size. Nevertheless, this study lays the groundwork for further anthropometric research in prosthodontics.

Conclusion

This study confirms that skull anthropometric parameters, especially bizygomatic width, show a strong correlation with maxillary anterior teeth width. A regression-based formula derived from these measurements can serve as a valuable aid in anterior tooth selection during complete denture fabrication. Incorporating such objective methods may improve esthetic outcomes in edentulous patients lacking prior dental records.

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