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Original Research Paper

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AGE- AND GENDER-RELATED VARIATIONS IN MAXILLARY AND MANDIBULAR INTERCANINE WIDTH AMONG INDIAN CHILDREN AGED 6–13 YEARS: A CROSS-SECTIONAL INSTITUTIONAL STUDY

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ABSTRACT

Background: Intercanine width is an important transverse dental arch parameter influencing occlusal development, space analysis, and orthodontic treatment planning. Limited normative data are available for Indian children. **Aim:** To evaluate the effect of age and gender on maxillary and mandibular intercanine widths among Indian children aged 6–13 years. **Materials and Methods:** A cross-sectional study was conducted among 350 healthy children equally distributed into seven age groups. Study casts were prepared from alginate impressions, and intercanine width was measured using a digital Vernier caliper. Data were analyzed using descriptive statistics, one-way ANOVA, independent t-test, and Pearson's correlation ($P < 0.05$). **Results:** Intercanine width increased significantly with age ($P < 0.001$). Age showed positive correlations with maxillary ($r = 0.412$) and mandibular ($r = 0.354$) intercanine widths. Males demonstrated greater mean values than females, with significant differences in selected age groups. **Conclusion:** Intercanine width increases progressively with age. The normative data obtained may aid growth assessment, orthodontic diagnosis, space analysis, interceptive treatment planning, and forensic odontology in Indian children.

KEYWORDS : Dental Arch; intercanine width; Growth and Development; Forensic Dentistry.

INTRODUCTION

Dental arch dimensions are important indicators of craniofacial growth and are essential for orthodontic diagnosis, space analysis, and treatment planning. Among the transverse arch parameters, intercanine width is a key measurement because it reflects anterior arch development, influences tooth alignment, and contributes to the stability of orthodontic treatment. Accurate assessment of intercanine width is therefore valuable for evaluating normal dental arch development and identifying developing malocclusions during childhood.

The mixed dentition period (6–13 years) is characterized by rapid craniofacial growth and significant changes in dental arch dimensions due to the eruption of permanent incisors and canines. During this stage, intercanine width increases to accommodate erupting permanent teeth and establish functional occlusion. Understanding these developmental changes is important for growth assessment, space management, and interceptive orthodontic treatment.

Intercanine width is commonly measured on study casts using a digital Vernier caliper, a reliable and reproducible method for assessing dental arch dimensions. Besides its orthodontic applications, intercanine width is also useful in pediatric dentistry, anthropometry, and forensic odontology for age estimation and human identification.

Dental arch dimensions vary with age, sex, ethnicity, and genetic background, making population-specific normative data essential for accurate diagnosis and treatment planning. Although several studies have investigated intercanine width in different populations, comprehensive age- and gender-specific data for Indian children remain limited.

Therefore, the present cross-sectional study was undertaken to evaluate the influence of age and gender on maxillary and mandibular intercanine widths among Indian children aged 6–13 years using study models. The findings are expected to provide normative data to support growth assessment, orthodontic diagnosis, space analysis, interceptive treatment planning, and forensic applications.

MATERIALS AND METHODS

Study Design and Ethical Approval

A cross-sectional institutional study was conducted in the Department of Pediatric and Preventive Dentistry after obtaining approval from the Institutional Ethics Committee of Nair Hospital Dental College, Mumbai (Approval No. 469/EC/2019). The study adhered to the ethical principles of the Declaration of Helsinki. Written informed consent was obtained from the parents or legal guardians of all participants, and assent was obtained from children older than 7 years wherever applicable.

Study Population and Sample Size

The sample size was calculated based on previous literature considering a significance level ( ) of 5%, study power of 80%, and an expected correlation coefficient of 0.42. A minimum of 43 participants per age group was required; therefore, 50 children were recruited in each group, yielding a total sample of 350 participants.

Healthy children aged 6–13 years attending the Outpatient Department of Pediatric and Preventive Dentistry were recruited consecutively and equally allocated into seven age groups (6.0–6.9, 7.0–7.9, 8.0–8.9, 9.0–9.9, 10.0–10.9, 11.0–11.9, and 12.0–13.0 years).

Eligibility Criteria

Children with bilateral primary or permanent canines, Angle's Class I molar and canine relationship, well-aligned maxillary and mandibular arches, and acceptable facial symmetry were included. Children with grossly decayed, fractured, mobile, or missing canines, previous orthodontic or prosthodontic treatment, a history of dental or facial trauma, systemic conditions affecting tooth eruption or morphology, or those outside the specified age range were excluded.

Study Procedure

Demographic information, including age, gender, and date of birth, was recorded for each participant. Chronological age was calculated from the documented date of birth on the day of examination.

Maxillary and mandibular impressions were made using irreversible hydrocolloid (alginate) impression material with appropriately sized stock trays. Impressions were poured immediately with Type III dental stone to obtain study casts. All casts were inspected for defects before measurements were recorded.

Maxillary and mandibular intercanine widths were measured using a calibrated digital Vernier caliper with an accuracy of 0.01 mm. Intercanine width was defined as the linear distance between the cusp tips of the right and left canines. In teeth exhibiting occlusal wear, measurements were obtained between the centers of the worn cusp surfaces. Separate measurements were recorded for the maxillary and mandibular arches.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 26.0. Continuous variables were expressed as mean ± standard deviation. Data normality was assessed using the Shapiro–Wilk test. Differences among age groups were evaluated using one-way analysis of variance (ANOVA) with post hoc comparisons, while gender differences were assessed using the independent samples *t*-test. Pearson's correlation analysis was performed to determine the relationship between chronological age and intercanine width, and multiple linear regression analysis was used to derive an age estimation equation. Statistical significance was set at $P < 0.05$.

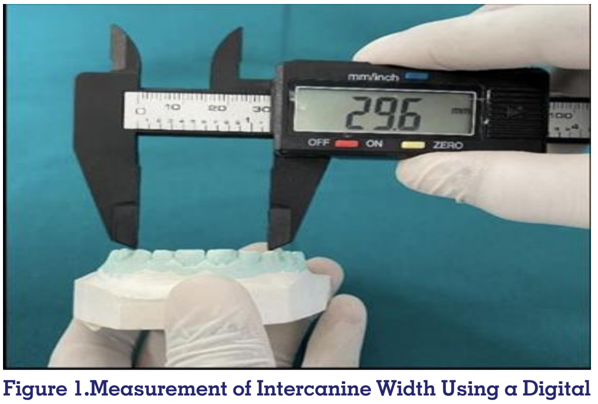


Figure 1.Measurement of Intercanine Width Using a Digital Vernier Caliper

Legend: Representative photograph illustrating measurement of the linear distance between the cusp tips of the right and left canines on a dental study model using a calibrated digital Vernier caliper (accuracy: 0.01 mm)

RESULTS

A total of 350 children aged 6–13 years were included in the study, with 50 participants in each of the seven age groups. Maxillary and mandibular intercanine widths were measured on study models and analyzed according to age and gender.

One-way analysis of variance (ANOVA) demonstrated a statistically significant increase in both maxillary and mandibular intercanine widths with advancing age ($P < 0.001$). The lowest mean values were observed in children aged 6.0–6.9 years, while the highest values were recorded in the 12.0–13.0-year age group. Although the overall trend indicated progressive widening of the dental arches, slight reductions in intercanine width were noted in the 8.0–8.9-year and 11.0–11.9-year age groups, representing physiological variations during the mixed dentition period. Post hoc analysis revealed significant differences between several age-group pairs in both arches.

Pearson's correlation analysis demonstrated a significant positive association between chronological age and intercanine width. Age showed a moderate positive correlation with maxillary intercanine width ($r = 0.412$, $P < 0.001$) and a low positive correlation with mandibular intercanine width ($r = 0.354$, $P < 0.001$), indicating progressive transverse arch development with increasing age.

Gender-wise analysis showed that males had greater mean maxillary and mandibular intercanine widths than females. Independent samples *t*-test demonstrated statistically significant overall gender differences ($P < 0.001$). However, when comparisons were performed within individual age groups, significant gender differences were observed only in selected age groups, whereas most age groups showed comparable intercanine widths between males and females.

Multiple linear regression analysis demonstrated that both maxillary and mandibular intercanine widths were significant predictors of chronological age. The derived regression equation was:

Chronological Age = –2.180 + 0.263 × (Maxillary Intercanine Width) + 0.132 × (Mandibular Intercanine Width)

The regression model indicated that increasing intercanine width was positively associated with chronological age and may be useful for age estimation in children during the mixed dentition period.

TABLES AND FIGURE LEGENDS

Table 1. Pearson's correlation between chronological age and intercanine width.

		Maxillary intercanine width	Mandibular intercanine width
Chronological age	Pearson Correlation r value	.412**	.354**
	p value	.000	.000
	N	350	350

Legend: Pearson's correlation coefficients showing the relationship between chronological age and maxillary and mandibular intercanine widths. Positive correlation coefficients indicate increasing intercanine width with advancing age.

Table 2. Multiple linear regression model for estimation of chronological age using intercanine width.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.427a	.182	.178	1.8331

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	-2.180	1.315		-1.658	.098
Maxillary intercanine width	.263	.053	.315	4.918	.000
Mandibular intercanine width	.132	.057	.148	2.304	.022

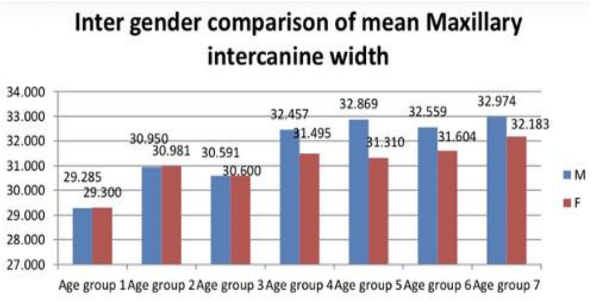
Legend: Multiple linear regression model demonstrating the relationship between chronological age and maxillary and mandibular intercanine widths. Regression coefficients, standard errors, confidence intervals, coefficient of determination (R^2), and significance values are presented.

Figure Legends

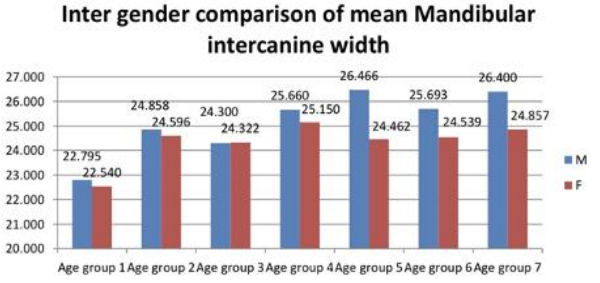
Figure 1 : Measurement of Intercanine Width Using a Digital Vernier Caliper

Legend: Representative photograph illustrating measurement of the linear distance between the cusp tips of the right and left canines on a dental study model using a calibrated digital Vernier caliper (accuracy: 0.01 mm).

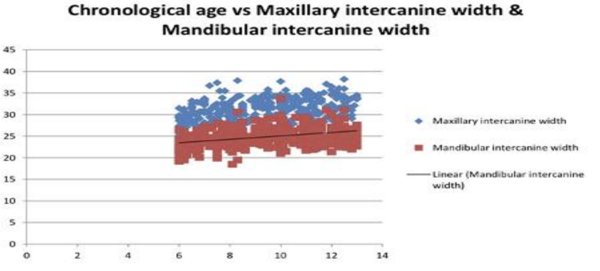
Graphs



Graph 1.Inter gender comparison of mean Maxillary intercanine width



Graph 2.Inter gender comparison of mean Mandibular intercanine width



Graph 3.Chronological age vs Maxillary intercanine width & Mandibular intercanine width

DISCUSSION

The present study evaluated age- and gender-related variations in maxillary and mandibular intercanine widths among Indian children aged 6–13 years. The findings demonstrated a significant increase in intercanine width with advancing age, indicating continuous transverse dental arch development throughout the mixed dentition period. Maxillary intercanine width showed a stronger correlation with chronological age than mandibular intercanine width, suggesting greater transverse adaptation of the maxillary arch during growth.

The progressive increase in intercanine width observed in this study is consistent with previous investigations by Moorrees et al., Bishara et al., and Ribeiro et al., who reported that transverse arch dimensions increase during the eruption of permanent incisors and canines before stabilizing after completion of mixed dentition. The greater increase in the maxillary arch may be attributed to continued skeletal growth and expansion associated with eruption of the permanent dentition. The slight reductions observed in the 8–8.9-year and 11–11.9-year age groups are likely physiological variations related to transitional stages of mixed dentition rather than true reductions in arch dimensions.

Although males demonstrated greater mean intercanine widths than females, statistically significant differences were observed only in selected age groups. This finding suggests that chronological age has a greater influence on intercanine width than gender during mixed dentition. Similar observations have been reported in previous studies and may be explained by differences in skeletal maturation, eruption timing, and pubertal growth patterns.

The regression equation derived in the present study demonstrated a positive relationship between intercanine width and chronological age, indicating that transverse dental arch dimensions may contribute to age estimation. However, this model should be validated in larger and ethnically diverse populations before routine clinical or forensic application.

The normative age- and gender-specific data generated in this study have important clinical implications. They may assist pediatric dentists and orthodontists in growth assessment, space analysis, early diagnosis of developing malocclusion, and interceptive orthodontic treatment planning. In addition, these findings provide baseline odontometric data that may support forensic identification in Indian children.

The principal limitations of this study include its cross-sectional design and recruitment from a single institution, which may limit generalizability. Future multicenter longitudinal studies involving larger and more diverse populations are recommended to establish comprehensive normative standards for intercanine width in Indian children.

CONCLUSION

The present study demonstrated that maxillary and mandibular intercanine widths increase progressively with chronological age in Indian children aged 6–13 years, reflecting normal transverse dental arch development during the mixed dentition period. Age showed a significant positive correlation with intercanine width, with a stronger association observed in the maxillary arch. Although males exhibited slightly greater mean intercanine widths than females, significant gender differences were evident only in selected age groups, indicating that age is a more important determinant of intercanine width during growth. The regression model further highlighted the potential of intercanine width as an adjunctive parameter for chronological age estimation. The age- and gender-specific normative data generated by this study may aid pediatric dentists and orthodontists in growth assessment, space analysis, early orthodontic diagnosis, interceptive treatment planning, and support forensic odontology in the Indian pediatric population.

Clinical Significance

The normative age- and gender-specific intercanine width values established in this study provide a practical reference for evaluating transverse dental arch development in Indian children. These data may assist clinicians in growth assessment, space analysis, early detection of developing malocclusion, interceptive orthodontic treatment planning, and may also serve as baseline odontometric information for forensic age estimation and identification.

Funding: Nil.

Conflict of Interest: The authors declare that there is no conflict of interest.

Ethical Approval: The study was approved by the Institutional Ethics Committee of Nair Hospital Dental College, Mumbai (Approval No. **469/EC/2019**) before commencement of the study.

Informed Consent: Written informed consent was obtained from the parents or legal guardians of all participants. Assent was obtained from children older than 7 years before enrolment.

Data Availability: The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

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