ORIGINAL ARTICLE

Association Between Mesiodistal Tooth Width and Soft Tissue Facial Profile Convexity among Chinese Adolescents in Jember, Indonesia

Fatihatur Rohmah [1], Ernita Netiani [1], Mellyna Trismi Utami[1], Ali Taqwim[2]
[1] Faculty of Dentistry, Universitas Jember, Jember, Indonesia
[2] School of Dentistry, Faculty of Medicine, Universitas Jenderal Soedirman, Purwokerto, Indonesia

Correspondence e-mail to: ali.taqwim@unsoed.ac.id

ABSTRACT

Background: *Tooth size and soft tissue facial profile are influenced by genetic, sexual, and ethnic factors. Understanding their relationship is important for orthodontic diagnosis, particularly in specific ethnic populations.* ***Methods:*** *A cross-sectional study was conducted on 50 Chinese adolescents (25 males, 25 females) aged 17-18 years. Mesiodistal tooth width from maxillary and mandibular central incisors to first molars was measured on dental casts. Soft tissue facial profile convexity was assessed using standardized lateral facial photographs. Sex differences were analyzed using independent t-tests, while associations were evaluated using Pearson correlation and linear regression (α = 0.05).* ***Results:*** *Males exhibited significantly larger mesiodistal tooth widths than females in both arches (p < 0.05). No significant sex differences were observed in facial profile convexity (p > 0.05). A weak but statistically significant negative correlation was found between mesiodistal tooth width and facial profile convexity (r = −0.35 maxilla; −0.34 mandible), accounting for 12.2% of the variance.* ***Conclusion:*** *Mesiodistal tooth width demonstrated a weak association with soft tissue facial profile convexity among Chinese adolescents in Indonesia, indicating that mesiodistal tooth width alone has limited predictive value for facial profile morphology and supporting the multifactorial basis of facial esthetics.*

Key words: *Mesiodistal tooth width; soft tissue facial profile; facial convexity; Chinese ethnicity*

Hubungan Lebar Mesiodistal Gigi dan Kecembungan Profil Jaringan Lunak Wajah pada Remaja Tionghoa di Jember, Indonesia

Fatihatur Rohmah [1], Ernita Netiani [1], Mellyna Trismi Utami[1], Ali Taqwim[2]
[1] Fakultas Kedokteran Gigi, Universitas Jember, Jember, Indonesia
[2] Kedokteran Gigi, Fakultas Kedokteran, Universitas Jenderal Soedirman, Purwokerto, Indonesia

Alamat korespondensi ke: ali.taqwim@unsoed.ac.id

ABSTRAK

Latar Belakang: *Ukuran gigi dan profil jaringan lunak wajah dipengaruhi oleh faktor genetik, jenis kelamin, dan etnis. Pemahaman mengenai hubungan antara lebar mesiodistal gigi dan profil jaringan lunak wajah penting dalam penegakan diagnosis ortodontik, khususnya pada populasi etnis tertentu.* ***Metode:*** *Penelitian potong lintang dilakukan pada 50 remaja etnis Tionghoa (25 laki-laki dan 25 perempuan) berusia 17-18 tahun. Lebar mesiodistal gigi dari insisivus sentral hingga molar pertama rahang atas dan bawah diukur pada model studi. Derajat kecembungan profil jaringan lunak wajah dinilai melalui foto lateral wajah yang terstandarisasi. Perbedaan berdasarkan jenis kelamin dianalisis menggunakan uji t independen, sedangkan hubungan antarvariabel dianalisis menggunakan uji korelasi Pearson dan regresi linear (α = 0,05).* ***Hasil:*** *Subjek laki-laki memiliki lebar mesiodistal gigi yang secara bermakna lebih besar dibandingkan perempuan pada kedua rahang (p < 0,05). Tidak ditemukan perbedaan bermakna derajat kecembungan profil jaringan lunak wajah antara laki-laki dan perempuan (p > 0,05). Ditemukan korelasi negatif yang lemah namun bermakna secara statistik antara lebar mesiodistal gigi dan kecembungan profil wajah (r = −0,35 rahang atas; −0,34 rahang bawah), dengan kontribusi sebesar 12,2% terhadap variasi profil wajah.* ***Kesimpulan:*** *Lebar mesiodistal gigi menunjukkan hubungan yang lemah dengan derajat kecembungan profil jaringan lunak wajah pada remaja etnis Tionghoa di Indonesia. Temuan ini menunjukkan bahwa lebar mesiodistal gigi saja memiliki nilai prediktif yang terbatas terhadap morfologi profil wajah serta mendukung bahwa estetika wajah bersifat multifaktorial.*

Kata kunci: *Lebar mesiodistal gigi; profil jaringan lunak wajah; kecembungan wajah; etnis Tionghoa*

INTRODUCTION

Malocclusion remains one of the most prevalent oral health problems globally and represents a significant public health concern, particularly in developing countries such as Indonesia. Untreated malocclusion may adversely affect masticatory function, temporomandibular joint health, periodontal status, and facial esthetics. These functional and esthetic impairments may ultimately lead to a reduction in oral health–related quality of life, especially during adolescence and early adulthood [1,2].

Adolescence represents a critical phase of craniofacial development characterized by progressive maturation toward adult morphology. During late adolescence, craniofacial growth markedly decelerates and dentoalveolar relationships become increasingly stable, allowing dentofacial parameters—such as tooth size and soft tissue facial profile—to be evaluated within a stable developmental framework that is clinically relevant for orthodontic assessment and facial esthetic analysis [3,4].

Craniofacial growth and dental morphology exhibit substantial inter-individual variability influenced by genetic background, sex, environmental factors, and ethnicity [3,5,6]. Tooth size, particularly mesiodistal tooth width, is a fundamental parameter in orthodontic diagnosis and treatment planning because it directly affects space analysis, arch coordination, and occlusal relationships [7,8]. Numerous studies have consistently demonstrated sexual dimorphism in tooth dimensions, with males generally exhibiting larger mesiodistal tooth widths than females [9–11].

Extensive evidence also indicates ethnic-related differences in tooth size and craniofacial morphology, with Asian populations, including Chinese subgroups, presenting characteristic dentofacial patterns that necessitate population-specific normative data for accurate orthodontic diagnosis and treatment planning [12,13]. Dentofacial morphology plays an important role in facial esthetics; therefore, assessment of the soft tissue facial profile—which reflects the integrated influence of skeletal, dentoalveolar, and soft tissue components—is clinically essential. Accordingly, the facial profile convexity angle, defined by landmarks including the glabella, lip contour, and soft tissue pogonion, serves as a clinically relevant indicator of facial harmony [14–17].

Indonesia comprises diverse ethnic groups with distinct dentofacial characteristics. Jember, as a multiethnic region including Javanese, Madurese, Chinese, and Arab populations, provides a suitable context for population-based dentofacial research. This study focused on the Chinese ethnic group because dentofacial morphology is influenced by genetic and ethnic factors, while normative data and evidence regarding the association between mesiodistal tooth width and soft tissue facial profile convexity in Indonesian Chinese populations remain limited. Accordingly, this study aimed to evaluate the association between mesiodistal tooth width and soft tissue facial profile convexity among Chinese adolescents in Jember, Indonesia.

METHODS

Study Design and Participants

This cross-sectional observational study was conducted at Santo Paulus Catholic Senior High School, Jember, Indonesia. A total of 50 Chinese adolescents (25 males and 25 females) aged 17-18 years were recruited using purposive sampling. This age criterion was applied to minimize growth-related confounding factors, as craniofacial growth and the development of permanent dentition are largely completed at this stage [3,4]. This study was approved by the institutional ethics committee, and informed consent was obtained from all participants and their parents/guardians. Participants were eligible for inclusion if both parents were of Chinese descent, had complete permanent dentition excluding third molars, and exhibited no dental caries, restorations, severe attrition, or dental anomalies. In addition, individuals with a history of orthodontic treatment or dentofacial trauma were excluded to ensure homogeneity of the study sample.

Dental Cast Measurement

Maxillary and mandibular impressions were taken using alginate and poured with dental stone. Mesiodistal tooth width from central incisors to first molars was measured using a digital caliper (accuracy 0.01 mm) following standardized odontometric procedures (Fig.1).

Soft Tissue Facial Profile Assessment

Standardized lateral facial photographs were obtained with participants positioned in Natural Head Position (NHP), with the Frankfort horizontal plane parallel to the floor, lips at rest, and teeth in intercuspal position. The camera-to-subject distance was standardized at 60 cm under uniform lighting conditions to enhance measurement reliability [18]. Soft tissue facial profile convexity was measured as the angle formed by the intersection of imaginary lines connecting the glabella, the most prominent point of the lip contour, and the soft tissue pogonion (symphysis) (Graber's method) [3]. Measurements were performed using a protractor on printed photographs (Fig.2).

Figure 1. Mesiodistal tooth width measurement on maxillary and mandibular dental casts using a digital caliper following standardized odontometric procedures.
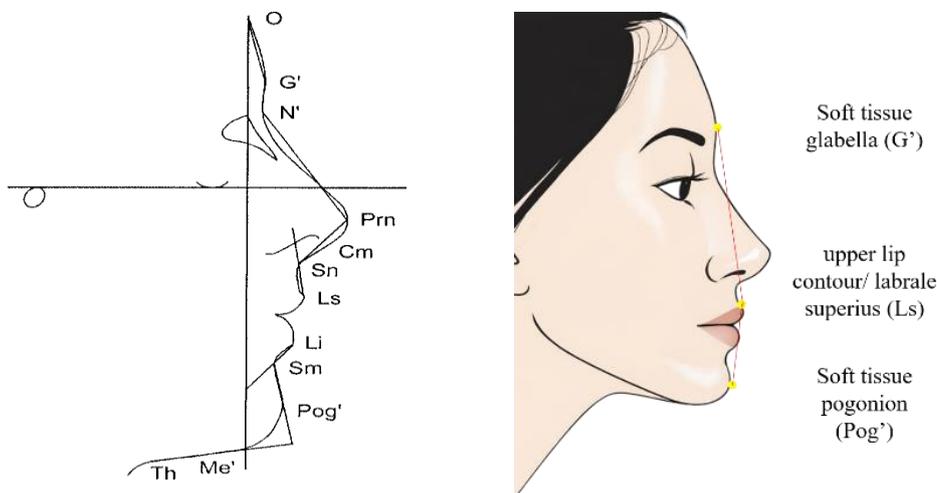

Figure 2. Assessment of soft tissue facial profile convexity using Graber's method, defined as the angle formed by the intersection of imaginary lines connecting three anatomical landmarks: the glabella (G'), the most prominent point of the upper lip contour (Ls), and the pogonion (Pog'), on a standardized lateral facial profile.

Reliability Assessment
To assess intra-examiner reliability, 20% of the samples were randomly selected and re-measured after a two-week interval. Intra-class correlation coefficients (ICC) demonstrated excellent reliability for both mesiodistal tooth width and facial profile measurements (ICC > 0.90).

Statistical Analysis
The collected data was subjected to statistical analysis. The data was subsequently processed and analyzed using the SPSS software package version 22. Normality of data distribution was assessed prior to analysis. Independent t-tests were used to assess sex differences in mesiodistal tooth width and facial profile convexity. Pearson correlation analysis evaluated the relationship between mesiodistal tooth width and facial profile convexity, followed by linear regression to determine the proportion of variance explained. Statistical significance was set at $p < 0.05$ (95 %).

RESULTS

Male participants demonstrated significantly larger mean mesiodistal tooth widths in both maxillary and mandibular arches compared with females (p < 0.05), with moderate effect sizes (Cohen's d = 0.62–0.71). No significant sex differences were observed in soft tissue facial profile convexity (p > 0.05) (Table 1 and 2).

Table 1. Comparison of mean mesiodistal tooth width between males and females

Variable	Sex	N	Mean ± SD (mm)	*p*-value
Maxillary mesiodistal tooth width	Males	25	99.14 ± 4.91	0.02*
	Females	25	96.16 ± 4.96	
Mandibular mesiodistal tooth width	Males	25	97.79 ± 4.70	0.04*
	Females	25	94.99 ± 4.43	

Table 2. Comparison of mean soft tissue facial profile convexity

Variable	Sex	N	Mean ± SD (°)	*p*-value
Soft tissue facial profile convexity	Males	25	154.88 ± 9.46	0.74
	Females	25	155.68 ± 8.09	

Correlation analysis revealed a weak but statistically significant negative association between mesiodistal tooth width and soft tissue facial profile convexity for both maxillary (r = −0.35, p = 0.01) and mandibular (r = −0.34, p = 0.02) arches. Mesiodistal tooth width explained 12.2% of the variance in soft tissue facial convexity, indicating a weak predictive value (Table 3).

Table 3. Correlation between mesiodistal tooth width and soft tissue facial profile convexity

Variable	Pearson's *r*	*p*-value	R²
Maxillary mesiodistal width vs facial profile convexity	−0.35	0.01*	0.122 (12.2%)
Mandibular mesiodistal width vs facial profile convexity	−0.34	0.02*	

DISCUSSION

The present study demonstrated significant sexual dimorphism in mesiodistal tooth width among Chinese adolescents in Jember, with males exhibiting larger tooth dimensions than females in both maxillary and mandibular arches. This finding is consistent with extensive evidence from diverse populations, including Western Australian adolescents, Middle Eastern cohorts, and various Asian groups, which consistently report greater mesiodistal tooth dimensions in males [9–11]. These differences have been attributed to genetic factors, sex-linked hormonal influences on odontogenesis, and differential craniofacial growth patterns [3,5]. The consistency of sexual dimorphism across ethnic groups underscores the importance of incorporating sex-specific normative data into orthodontic diagnosis and space analysis, including Chinese populations in Indonesia.

In contrast, no significant sex differences were observed in soft tissue facial profile convexity. This result aligns with previous studies in Indonesian and non-Indonesian populations, suggesting that soft tissue facial profile characteristics are not strongly determined by sex alone once craniofacial growth approaches maturity [13–15]. Instead, facial profile convexity reflects a complex interaction among skeletal pattern, dentoalveolar position, and soft tissue thickness, which may attenuate sex-related differences in late adolescence.

A key finding of this study was the weak but statistically significant negative association between mesiodistal tooth width and soft tissue facial profile convexity. Adolescents with larger mesiodistal tooth dimensions tended to exhibit slightly flatter or less convex facial profiles. However, the low coefficient of determination (R² = 12.2%) indicates that mesiodistal tooth width explains only a small proportion of the variability in facial profile convexity. Similar weak associations have been reported in studies involving non-Chinese populations, including Indonesian Javanese adolescents and Middle Eastern samples, supporting the notion that tooth size alone has limited influence on soft tissue facial morphology [19–21].

From a biomechanical and dentoalveolar perspective, larger tooth dimensions may indirectly influence facial profile through compensatory changes such as incisor inclination or arch form adaptation rather than directly altering soft tissue contours. In contrast, skeletal relationships, vertical facial pattern, sagittal jaw position, and inherent soft tissue characteristics play a more dominant role in shaping facial profile convexity [3,14]. These findings reinforce the multifactorial nature of facial esthetics and support previous conclusions that odontometric parameters should not be used in isolation to predict soft tissue facial outcomes.

When contextualized within an ethnic framework, the present findings contribute population-specific data on Chinese adolescents in Indonesia, a group for which dentofacial normative data remain limited. Comparisons with studies conducted

in other Indonesian ethnic groups, such as Javanese adolescents, indicate that although absolute tooth dimensions and facial profile norms may vary across ethnicities, the underlying relationship between tooth size and facial profile morphology shows similar patterns [15,16,20]. This suggests that while ethnicity influences baseline craniofacial characteristics, the functional relationships among dentofacial components may be relatively consistent across populations.

Beyond clinical implications, these findings also have anthropological relevance. The Chinese population in Indonesia represents a unique subgroup shaped by ancestral genetic background and long-term environmental adaptation. Documenting dentofacial characteristics and their interrelationships in this group contributes to a broader understanding of craniofacial diversity in Southeast Asia and supports the use of population-specific data in both clinical orthodontics and anthropological research.

Several limitations should be acknowledged. The relatively small sample size and restriction to a single ethnic group and geographic area may limit generalizability. In addition, the use of two-dimensional photographic analysis precludes detailed three-dimensional assessment of soft tissue morphology, and skeletal parameters such as sagittal jaw relationships and incisor inclination were not evaluated. Future studies incorporating larger, multiethnic samples, three-dimensional imaging modalities, and comprehensive skeletal analyses are warranted to further elucidate the determinants of soft tissue facial profile morphology.

CONCLUSION
Mesiodistal tooth width was significantly larger in male than in female Chinese adolescents in Jember, confirming sexual dimorphism in tooth size within this population. A weak but statistically significant negative association was observed between mesiodistal tooth width and soft tissue facial profile convexity, indicating limited predictive value of tooth size for facial profile morphology. These findings highlight the multifactorial nature of facial esthetics and underscore the need for comprehensive orthodontic assessment that integrates dental, skeletal, and soft tissue parameters.

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CONFLICT OF INTEREST
The authors declare that there is no conflict of interest related to this study.

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