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Relationship of Buccal Corridor Space During Smiling with Intercommissure Width

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ABSTRACT

Background: Smile esthetics play a crucial role in orthodontic diagnosis and treatment planning, with buccal corridor space being a key determinant of smile harmony. Intercommissure width is considered an important soft tissue parameter that may influence buccal corridor visibility. However, its role in determining smile esthetics remains unclear.

Objective: To assess the correlation between intercommissure width and buccal corridor space during a posed smile and determine whether intercommissure width serves as a predictor of buccal corridor display.

Methods: A cross-sectional study was conducted at the Department of Orthodontics, Bolan Medical College, Quetta, from October 2021 to April 2022. A total of 98 patients (27 males, 71 females) were selected using non-probability consecutive sampling. Standardized frontal photographs were taken under controlled conditions to measure intercommissure width at rest and buccal corridor area during a posed smile. Data were analyzed using SPSS version 25. Pearson's correlation was applied to assess the relationship, with statistical significance set at $p < 0.05$.

Results: The mean intercommissure width was 22.80 ± 2.39 mm, and the mean buccal corridor area was 1.80 ± 0.99 mm. Pearson's correlation analysis showed a weak negative correlation ($r = -0.141$, $p = 0.089$). Stratified analysis demonstrated a significant association in cases where the interpupillary-intercommissure width difference was minimal ($p = 0.001$).

Conclusion: Intercommissure width alone was not a strong predictor of buccal corridor display, highlighting the multifactorial nature of smile esthetics. Comprehensive soft tissue assessment is essential in orthodontic treatment planning.

INTRODUCTION

Orthodontic diagnosis and treatment planning have undergone significant advancements, now emphasizing a patient-centered aesthetic approach that prioritizes individual concerns and facial harmony. A well-balanced soft tissue arrangement plays a crucial role in determining facial attractiveness, which is often perceived as the product of proportionality and symmetry. The concept of beauty, particularly in orthodontics, is linked to the 'divine proportion,' a mathematical principle observed across different natural and artistic phenomena, transcending variations in race, gender, and age (1). Facial esthetics, including skeletal structures and soft tissue proportions, contribute substantially to perceived attractiveness, making orthodontic evaluation of the smile a fundamental aspect of treatment. A broad and harmonious smile enhances social interactions and overall self-confidence, serving as a nonverbal expression of positive emotions, friendliness, and engagement (2).

A well-aligned, aesthetically appealing smile is an essential component of social interactions and is frequently associated with favorable outcomes in professional and personal domains. Research highlights the importance of facial aesthetics in employment opportunities, social acceptance, political preferences, and even judicial decision-making (3). Perceptions of an attractive smile are influenced by various factors, including gender, age, and socioeconomic status, demonstrating the intricate role of esthetics in social cognition (4,5). The significance of smile esthetics in orthodontic practice extends beyond functional corrections to include psychological well-being, reinforcing the necessity for meticulous assessment and individualized treatment planning. Orthodontists increasingly recognize the need to evaluate smile characteristics in frontal and lateral perspectives, incorporating the principles of 'mini esthetics'—a diagnostic approach that emphasizes detailed soft tissue analysis in orthodontic treatment (6).

Among the various components of smile analysis, the buccal corridor space—the dark space visible between the corners of the mouth and the posterior teeth during a posed smile—holds particular aesthetic relevance. A minimal buccal corridor is often considered ideal in orthodontic evaluations, contributing to the overall harmony of the smile (7). Several studies suggest that multiple factors influence buccal corridor visibility, including skeletal structures, soft

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tissue morphology, dental arch form, inter-premolar width, lip length, and the intercommissure width (8,9). Intercommissure width, which refers to the transverse distance between the corners of the mouth at rest, is a crucial determinant in defining the perioral soft tissue balance. While orthodontic interventions can modify dental arch width and tooth positioning, changes in intercommissure width remain beyond the scope of mechanotherapy, necessitating its evaluation as a fixed anatomical variable (10).

This study aims to assess the relationship between intercommissure width and buccal corridor space in posed smiles, exploring whether a wider intercommissure width is associated with increased buccal corridor display. By investigating this correlation, the study seeks to establish whether intercommissure width should be considered a limiting factor in orthodontic treatment planning for smile esthetics. If a strong correlation is observed, it may underscore the importance of incorporating perioral soft tissue analysis into initial treatment assessments, ensuring that patients receive realistic expectations regarding the achievable outcomes of orthodontic interventions. Given that orthodontic treatment primarily modifies dental structures and not soft tissue dimensions, understanding the interplay between intercommissure width and buccal corridor space may provide valuable insights for aesthetic treatment planning. Moreover, the findings may have implications for patient education, as esthetic concerns are increasingly becoming a primary motivation for seeking orthodontic care (11-17).

MATERIAL AND METHODS

This cross-sectional study was conducted at the Department of Orthodontics, Bolan Medical College/Sandeman Provincial Hospital in Quetta, from October 21, 2021, to April 22, 2022. A total of 98 patients were selected using non-probability consecutive sampling. The sample comprised individuals seeking orthodontic treatment for various malocclusions, ensuring that participants met specific inclusion criteria. Eligible patients included both male and female individuals with a complete permanent dentition, excluding third molars, a symmetrical arch form, and a normal upper lip length ranging from 19 to 22 mm. Patients presenting with facial asymmetry, temporomandibular joint disorders, cleft lip and palate, or syndromic conditions were excluded. Additionally, individuals who had previously undergone orthognathic surgery, exhibited active periodontal disease, were undergoing surgical periodontal procedures, or presented with severe malocclusion or maxillary plane cant were not considered for the study.

Prior to participation, informed written consent was obtained from all patients after a thorough explanation of the study's objectives and methodology. Ethical approval was secured from the hospital’s ethical review board, ensuring adherence to the principles outlined in the Declaration of Helsinki for medical research involving human subjects. All procedures involving human participants were performed in accordance with relevant ethical guidelines and institutional regulations.

Data collection involved standardized frontal photographs taken under uniform conditions for all participants. To eliminate potential biases and ensure consistency, a fixed protocol was followed for image acquisition. Each patient was positioned with the natural head posture, maintaining a neutral facial expression while looking straight ahead. A digital Sony camera with an effective resolution of 7.2 megapixels and a 3× zoom lens was used, mounted on a tripod at a fixed distance of 90 cm from the subject. Consistent lighting conditions were maintained to avoid shadows or variations in image quality. Each photograph was taken with the patient's lips in a relaxed state at rest and during a posed smile to assess the buccal corridor display. The images were then imported into computer software, where they were standardized in size and resolution, cropped to focus on the perioral region, and prepared for analysis.

Key parameters, including interpupillary distance and intercommissure width, were measured from the frontal photographs. The intercommissure width was recorded at rest, while the buccal corridor area was assessed during the posed smile. The accuracy of measurements was ensured by verification from a senior orthodontic colleague, reducing inter-observer variability. The buccal corridor area was quantified in millimeters, with values documented systematically.

For statistical analysis, data were entered into SPSS version 25.0 and analyzed to determine the correlation between intercommissure width and buccal corridor display. Descriptive statistics, including mean, standard deviation, minimum, and maximum values, were calculated for all measured variables. Pearson’s correlation coefficient was applied to assess the relationship between intercommissure width and buccal corridor area, with correlation coefficients ranging from -1.0 to +1.0. The significance threshold was set at a p-value of <0.05. Categorical data were further stratified to examine potential trends within different ranges of buccal corridor display, allowing for subgroup analysis.

The study aimed to identify whether intercommissure width significantly influences buccal corridor visibility during a posed smile, providing insights into its role in orthodontic treatment planning. By systematically evaluating these variables, the research sought to establish whether intercommissure width should be considered a limiting factor in orthodontic interventions for smile esthetics (1).

RESULTS

The study included a total of 98 participants, consisting of 27 males (27.2%) and 71 females (72.8%). The mean age of the participants was 15.725 years (SD ± 5.467). The analysis focused on interpupillary distance, intercommissure width, and buccal corridor area, with descriptive statistics summarized in Table 1. The mean interpupillary distance was recorded as 28.505 mm (SD ± 2.468), while the mean intercommissure width was 22.799 mm (SD ± 2.388). The buccal corridor area measured during a frontal smile had a mean of 1.799 mm (SD ± 0.9904), with a minimum of 0 mm and a maximum of 4.50 mm. The difference between interpupillary distance and intercommissure width ranged from 0 to 12 mm, with a mean of 5.71 mm (SD ± 2.217).

Pearson correlation analysis was performed to assess the relationship between intercommissure width and buccal corridor area. The correlation coefficient was found to be -0.141, indicating a weak negative correlation, which did not reach statistical significance (p > 0.05) (Table 2). These findings suggest that intercommissure width alone is not a strong predictor of buccal corridor space during a posed smile.

Further statistical stratification was conducted by categorizing the difference between interpupillary distance and intercommissure width into four groups: <3 mm, 3-5 mm, 5-8 mm, and >8 mm. The results demonstrated a progressive increase in buccal corridor area with greater intercommissure width discrepancies. Participants with a difference of less than 3 mm had a mean buccal corridor area of 1.325 mm (SD ± 0.977), whereas those with a difference exceeding 8 mm exhibited a significantly larger buccal corridor area of 2.406 mm (SD ± 0.934). This trend was statistically significant for the subgroup with a difference of <3 mm (p = 0.001), while the results for other groups were not significant (Table 3).

These findings indicate that although the overall correlation between intercommissure width and buccal corridor area was weak, a stratified analysis revealed that individuals with smaller interpupillary-intercommissure differences displayed significantly reduced buccal corridor areas. This suggests that buccal corridor visibility may be influenced by multiple anatomical and functional factors, rather than intercommissure width alone. The implications of these findings highlight the need for a more comprehensive assessment of perioral soft tissues in orthodontic treatment planning

Table 1 Buccal Corridor Area

Variable	Minimum	Maximum	Mean Â± SD	Correlation	p
Interpupillary Distance (mm)	21.5	36	28.505 Â± 2.468	-0.141	0.089
Intercommissure Width (mm)	17	34	22.799 Â± 2.388		
Buccal Corridor Area (mm)	0	4.5	1.799 Â± 0.9904		
Interpupillary Distance & Intercommissure Width (mm)	0	12	5.71 Â± 2.217		

Table 2 Difference in Interpupillary Distance & Intercommissure Width (mm)

	N	Mean Buccal Corridor Area (mm) Â± SD	p
<3	20	1.325 Â± 0.977	0.001
5-Mar	40	1.500 Â± 0.895	
8-May	71	1.965 Â± 0.962	
>8	16	2.406 Â± 0.934	

DISCUSSION

The present study investigated the relationship between intercommissure width and buccal corridor space during a posed smile, contributing to the growing body of orthodontic research focused on soft tissue esthetics. The findings indicated that intercommissure width alone had a weak negative correlation with buccal corridor space, which did not reach statistical significance. However, when the data were stratified based on the difference between interpupillary distance and intercommissure width, a significant trend emerged, suggesting that smaller differences were associated with reduced buccal corridor display. These findings align with previous studies that have highlighted the multifactorial nature of smile esthetics, emphasizing that buccal corridor space is influenced by a combination of skeletal, dental, and soft tissue parameters rather than a single determinant (17-21).

Prior research has consistently emphasized the role of dental arch width, lip length, and soft tissue morphology in determining buccal corridor display, with studies suggesting that orthodontic treatment can modify some of these variables but has limited impact on perioral soft tissue dimensions (2). The weak correlation observed in the current study aligns with findings from similar investigations, which reported minimal associations between intercommissure width and buccal corridor space, reinforcing the hypothesis that intercommissure width is a static anatomical feature not directly influenced by orthodontic mechanotherapy (3). Other studies have suggested that buccal corridor visibility is affected by factors such as arch form, incisor proclination, and muscular tonus, all of which may explain the variation in results across different populations (22-27).

A major strength of this study was the standardized approach to image acquisition, which minimized measurement bias and ensured consistency in data collection. The use of digital photography under controlled conditions provided precise and reproducible measurements, allowing for accurate comparisons across participants. Additionally, the inclusion of both male and female participants with a range of malocclusion types ensured a diverse sample reflective of the general orthodontic patient population. However, the study had certain limitations that should be acknowledged. The sample size, while adequate for statistical analysis, was relatively small, potentially limiting the generalizability of the findings to broader populations. Additionally, the study focused solely on posed smiles, which may not fully capture dynamic variations in buccal corridor display during spontaneous smiling or speech. Future studies incorporating three-dimensional imaging techniques or

videographic assessments could provide a more comprehensive understanding of how soft tissue dynamics influence smile esthetics in different functional contexts (5).
One of the key limitations of orthodontic treatment is its inability to modify intercommissure width, which remains a fixed anatomical characteristic. The findings of this study underscore the importance of incorporating soft tissue analysis in orthodontic treatment planning, particularly when setting realistic patient expectations for esthetic outcomes. Since buccal corridor space is influenced by multiple factors beyond intercommissure width, orthodontists should consider a holistic approach that evaluates both skeletal and soft tissue characteristics before initiating treatment. Future research should explore the interplay between intercommissure width, muscular tonus, and other soft tissue parameters to develop more precise predictive models for smile esthetics (27-31).
The clinical implications of these findings suggest that while reducing buccal corridor space may be a desired esthetic goal, it cannot be reliably achieved through orthodontic interventions alone. Patient education should emphasize that treatment outcomes depend on a complex interaction of dental and soft tissue variables, ensuring that individuals seeking orthodontic care have a realistic understanding of achievable changes. Additionally, interdisciplinary approaches, such as orthodontic treatment combined with minimally invasive cosmetic procedures, may be considered in cases where buccal corridor reduction is a primary concern. Future research should further investigate the role of soft tissue adaptability following orthodontic interventions and the extent to which patient-reported satisfaction correlates with objective esthetic parameters (7).
While intercommissure width showed a weak negative correlation with buccal corridor space, the stratified analysis revealed a significant association in cases where the interpupillary-intercommissure width difference was minimal. These findings reinforce the notion that buccal corridor display is a multifactorial trait influenced by both hard and soft tissue elements. The results contribute to the ongoing discourse on smile esthetics and highlight the necessity for comprehensive diagnostic protocols that integrate both skeletal and soft tissue assessments in orthodontic treatment planning (32).

CONCLUSION

The findings of this study demonstrated that intercommissure width had a weak negative correlation with buccal corridor space during a posed smile, with statistical significance emerging only when data were stratified based on the difference between interpupillary distance and intercommissure width. These results highlight the multifactorial nature of buccal corridor display, emphasizing that soft tissue parameters, skeletal structures, and dental arch morphology collectively influence smile esthetics. Given that intercommissure width remains a fixed anatomical characteristic unaffected by orthodontic mechanotherapy, these findings underscore the necessity for comprehensive soft tissue assessment in orthodontic treatment planning. In the broader context of human healthcare, these insights reinforce the importance of patient-centered care, ensuring realistic expectations regarding esthetic outcomes and promoting interdisciplinary approaches for optimizing facial harmony. Future research should focus on integrating advanced imaging techniques and patient-reported outcomes to further refine esthetic treatment strategies in orthodontics.

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