

Effect of Gender and Facial Profiles on Gingival Display at Smile

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ABSTRACT

Objective: To determine the effect of gender and facial profile on gingival display during smiling among patients presenting to the Dental Outpatient Department (OPD).

Methodology: This descriptive cross-sectional study was conducted at the Institute of Dentistry, Liaquat University of Medical and Health Sciences (LUMHS), Jamshoro, over six months. A total of 188 participants aged 18–53 years with intact maxillary anterior teeth and healthy periodontal tissues were enrolled through consecutive sampling. Gingival display was assessed using standardized photogrammetric analysis from frontal photographs captured during maximum smile, while lateral photographs were used to classify facial profiles as straight, convex, or concave. Gingival display was categorized as ideal (1 mm), acceptable (2–3 mm), or excessive (>3 mm). Data were analyzed using SPSS version 23. Associations were assessed using the Chi-square test, with $p \leq 0.05$ considered statistically significant.

Results: The mean age of participants was 32.18 ± 7.31 years, with females comprising 54.8% of the sample. Gingival display during smiling was observed in 96.8% of participants and was more frequent in females than males, although the difference was not statistically significant ($p=0.057$). A significant association was found between facial profile and gingival display ($p=0.049$). Acceptable gingival display was the predominant pattern in both males (41.0%) and females (50.5%) without a significant gender difference ($p=0.143$). Excessive gingival display occurred almost exclusively among participants with a convex facial profile, demonstrating a significant association with facial profile ($p=0.025$).

Conclusion: Gingival display within the aesthetically acceptable range was highly prevalent. Facial profile was significantly associated with gingival display patterns, whereas gender showed no significant influence. Convex facial profiles demonstrated a greater tendency toward excessive gingival display.

Keywords: Gingival display, facial profile, smile, gender, esthetics.

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Introduction

The smile of individuals is extensively regarded as one of the most influential elements of attractiveness of face, playing a fundamental role in social interaction, self-confidence, and psychological well-being. According to the growing esthetic awareness among peoples, the clinicians have increasingly focused not only on tooth alignment and color but also on the harmony between the teeth, lips, and surrounding gingival tissues during smile.

Studies show that smile aesthetics accounts for approximately 25–31% of overall facial attractiveness,^{1,2} with gingival display representing one of the key factors shaping how a smile and face are perceived.¹ Tissues of the gums are the key part of smiling design, developing a frame around each tooth, which mostly called as pink aesthetics.^{3,4} During the smiling, the upper and lower lips form a line running from one corner of the mouth to the other, recognized as the smile line or the inter-

commissural line, that can be categorized vertically as low, average, or high in relation to the maxillary teeth.³

The gingival display during smiling has been shown to differ significantly between genders in the maxillary anterior region, with females generally exhibiting greater gingival exposure than males in the incisor region.⁵ Owing to these differences, it is important for prosthodontists to consider gender-based variations when planning esthetic smile rehabilitation. Ideally, 1 mm of gingival display during smiling is considered most aesthetically pleasing, although 2–3 mm is also regarded as acceptable.⁶ Gingival display exceeding 3 mm is considered excessive and is commonly referred to as a gummy smile, a non-pathological esthetic condition that affects approximately 10% of individuals aged 20–30 years and is more prevalent among women.^{7,8} Furthermore, a consistent gender-based pattern has been reported across different populations, with excessive gingival display occurring in approximately 14% of women and 7% of men.⁹ This difference is more pronounced in younger individuals, likely because the upper lip descends with age due to reduced muscle tone, resulting in decreased gingival display later in life.⁹ A recent cross-sectional survey conducted in the Kurdistan region of Iraq also reported an overall prevalence of excessive gingival display of 4.8%, with a significantly higher prevalence among females (6.43%) than males (2.29%).¹⁰

On the other hand, the facial profile typically categorized as straight, convex, or concave,¹¹ characterizes another cornerstone of facial and dental diagnosis, suggesting the anteroposterior relationship between the maxilla, mandible, and the soft tissues overlying. Subsequently lip posture, length, and mobility are directly influenced by the underlying skeletal framework, which is reasonable to hypothesize that the types of facial profile may also influence the level of gingival tissue exposed during smile.¹² Regardless of this possible relationship, and although gender-based differences in the display of gingiva are well recognized individually, relatively no studies have determined facial profile and gender together as combined determinants of gingival display within the same patient cohort, specifically using standardized photogrammetric measurement methods. Based on this gap in the existing literature, present study aims to assess the gender and facial profile effects on the level of gingival display detected during smiling among individuals presenting for dental treatments, in order to explore the clinically meaningful evidence that can guide

more individualized esthetic diagnosis and planning of treatment.

Methodology

This descriptive cross-sectional study was conducted at the Institute of Dentistry, Liaquat University of Medical and Health Sciences (LUMHS), Jamshoro, over a period of six months after obtaining ethical approval from the Ethical Review Committee of LUMHS (Ref. No. LUMHS/REC/120 and approval of the study synopsis by the College of Physicians and Surgeons Pakistan (CPSP). (A non-probability consecutive sampling technique was used.

The sample size of 188 participants was calculated using the WHO sample size calculator based on a reported prevalence of gingival display of 39.5%, a margin of error of 7%, and a 95% confidence level.¹³

Participants aged 18–53 years, of either gender, with intact maxillary anterior teeth, healthy periodontal and gingival tissues, well-developed dentition, and attending the Dental Outpatient Department (OPD) of LUMHS were included. Patients with crowns or bridges involving the maxillary anterior teeth, malocclusion (including spacing or crowding), previous or ongoing orthodontic treatment, advanced systemic diseases (such as renal, cardiac, or hepatic failure), Kennedy's Class IV partial edentulism, facial deformities (including cleft lip and palate), a history of orthognathic surgery, neuromuscular disorders (e.g., facial palsy or Parkinsonism), or facial asymmetry were excluded.

After recording demographic and clinical information, written informed consent was obtained from all participants, and confidentiality was strictly maintained throughout the study.

A standardized photogrammetric technique was used to assess gingival display. Frontal and lateral photographs were captured by the principal investigator using an iPhone camera with standard camera settings, positioned approximately 4 feet from the participant. Participants were seated upright in a dental chair and instructed to produce their maximum smile. Gingival display was initially recorded as either visible or not visible and subsequently measured in millimeters from frontal photographs using a digital scale. Gingival display was classified as ideal (1 mm), acceptable (2–3 mm), or excessive (>3 mm). Lateral photographs were used to classify facial profiles as straight, convex, or concave based on angular measurements. Patient satisfaction with

smile esthetics was assessed using a 5-point Visual Analog Scale (VAS).

Data were entered into a predesigned proforma and analyzed using SPSS version 23. Categorical variables were expressed as frequencies and percentages, whereas continuous variables were presented as mean $\pm$ standard deviation. The association of gender and facial profile with gingival display was assessed using the Chi-square test, with a p-value ≤ 0.05 considered statistically significant.

Results

The mean age of the 188 participants was 32.18 ± 7.31 years. Of the participants, 103 (54.8%) were females and 85 (45.2%) were males. Nearly half of the participants had a straight facial profile (48.4%), followed by convex (41.0%) and concave (10.6%) facial profiles. Most participants had healthy gingival and periodontal status. Regarding smile aesthetics, 94 (50.0%) participants were satisfied, 48 (25.5%) were very satisfied, and 46 (24.5%) reported a neutral level of satisfaction (Table I).

Table II: Distribution of the patients according to gender, facial profile and aesthetic satisfaction. (n=188)

Variables	N	%
Gender		
Male	85	45.2
Female	103	54.8
Total	188	100.0
Facial profile		
Straight	91	48.4
Convex	77	41.0
Concave	20	10.6
Total	188	100.0
Aesthetic satisfaction in cases		
Very satisfied	48	25.5
Satisfied	94	50.0
Neutral	46	24.5
Total	123	100.0

Overall, gingival display during smiling was observed in 182 (96.8%) participants, whereas 6 (3.2%) participants showed no gingival display (Figure 1).

Gingival display during smiling was present in 81 (43.1%) males and 101 (53.7%) females. Among the six participants without gingival display, five were males and one was female. Although gingival display was more common in females than males, the difference was not statistically significant ($p = 0.057$). According to facial profile, gingival display was most frequently observed in participants with a straight profile (45.7%), followed by convex (41.5%) and concave (9.6%) profiles. This

association was statistically significant ($p = 0.049$) (Table II).

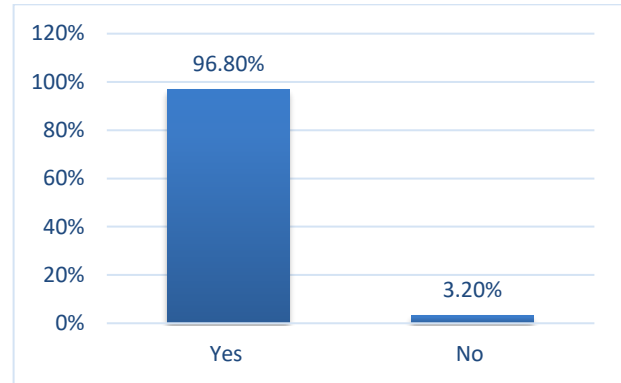


Figure 1. Gingival display at smile, when patient is at rest.

Table II: Gingival display according to gender and facial profile. (n=188)

Gingival display at smile					p-values
Variables		Yes	No	Total	
Gender	Male	80	5	85	0.057
		42.6%	2.7%	45.2%	
	Female	102	1	103	
		54.3%	0.5%	54.8%	
Facial profile	Straight	86	4	90	0.049
		45.7%	2.1%	47.9%	
	Convex	78	0	78	
		41.5%	0.0%	41.5%	
	Concave	18	2	20	
		9.6%	1.1%	10.6%	

Table III: Gingival display pattern to gender and facial profile. (n=188)

		Gingival display pattern			p- values
Variables		Ideal	Acceptable	Excessive	
Gender	Male	8	77	0	0.143
		4.3%	41.0%	0.0%	
	Female	5	95	3	
		2.7%	50.5%	1.6%	
Facial profile	Straight	9	81	0	0.025
		4.8%	43.1%	0.0%	
	Convex	1	74	3	
		0.5%	39.4%	1.6%	
	Concave	3	17	0	
		1.6%	9.0%	0.0%	

Regarding the pattern of gingival display, the acceptable gingival display (2–3 mm) was the most common pattern in both males (76; 40.4%) and females (96; 51.1%), with no significant gender difference ($p = 0.143$). According to facial profile, the acceptable gingival display pattern was most frequently observed in participants with straight (43.1%) and convex (39.4%) profiles. In contrast, excessive gingival display (>3 mm) was observed almost

exclusively in participants with a convex facial profile (1.6%) and was absent in those with straight or concave profiles. The association between facial profile and gingival display pattern was statistically significant ($p = 0.025$) (Table III).

Discussion

Smile esthetics has become an increasingly important concern in modern dentistry, influencing not only clinical treatment decisions but also individuals' confidence and social interactions. Therefore, understanding how gingival display correlates with underlying facial patterns and gender characteristics is important for providing truly personalized and esthetically satisfying treatment. The present study was conducted to evaluate the effect of gender and facial profile on gingival display during smiling.

In this study generally, the gingival display at smile was present in the vast majority of the cases, while only few cases 6/188, did not show gingival display and among them 5 were males and 1 was female, indicating higher gingival display in women compared to men (0.057), whereas according to the facial profile, gingival display was most common among individuals with straight facial profile (45.7%), followed by convex (41.5%) and concave profile (9.6%), with significant difference statistically ($p=0.049$). In the comparison of this study Khan F et al¹⁴ reported a relatively small proportion of cases (37.8%) with gingival display when smiling, while consistently they found significantly more likely to display gingiva compared to males, with female to male ratio of 2:1, the findings inconsistent with our findings. In another study by Das G et al¹³ also reported that he gingival display was present in 158 (39.5%) of all cases and was absent in 242 (60.5%) cases, with females being more than twice the likelihood of display of gingiva when smiling compared to the male cases ($p=0.001$). Moreover in their study, the gingival display on smiling was seen in a slightly higher proportion of those with a convex facial profile (66/150, 44.0%) compared to those with a straight profile (92/250, 36.8%), but without significant difference ($p=0.154$).¹³ There was some difference in the significance across the studies, which may be because, in present study, very few individuals were without gingival display compared to the above relevant studies; this difference may be due to variation in populations or the sample selection criteria of the studies.

Moreover, this study analyzed gingival display patterns as ideal, acceptable, and excessive based on gingival

display measurements. In both genders, the acceptable gingival display pattern was the most common, occurring in 76 males (40.4%) and 96 females (51.1%). Excessive gingival display was observed only among women (3 cases), although the difference was not statistically significant ($p = 0.143$). This pattern was similar to that reported by Faraj SH et al.¹⁰, who found that excessive gingival display was significantly more common among women. According to facial profile, the acceptable gingival display pattern was also the most common overall, particularly among individuals with straight (43.1%) and convex (39.4%) facial profiles. In contrast, excessive gingival display was observed almost exclusively in the convex facial profile group (1.6%) and was absent in both straight and concave facial profiles ($p = 0.025$), indicating a significant association between facial profile and gingival display pattern.

These findings were supported by orthodontic literature explaining the underlying mechanism: in a convex profile, the lower lip sits more than 2mm behind the E-line and the maxillary central incisors more dominant and prominent compared to concave or the straight profiles, that brings the gingival margin closer to the upper lip during smiling and predisposes convex-profile cases toward greater exposure of gingiva. In the support of our findings, Aspalli S et al¹⁵ conducted the study on 32 cases with healthy periodontal subjects, aged 18 to 50 years, to evaluate the papilla height and proportion across concave, convex, and straight facial profiles, and they found mean papilla proportion of the right central incisor was $34.93\% \pm 5.40$ for convex, $34.64\% \pm 7.38$ for straight, and $37.58\% \pm 8.27$ for the concave profiles. On the other hand, a Saudi Arabian study evaluate the smile attractiveness and reported that among dental professionals, 61% rated a 1-mm low lip line as the most attractive smile, whereas 52.7% of laypeople considered a 2-mm low lip line most attractive, with a similar pattern of male smile ratings.¹⁶ According to a study on how smile arc and gingival display jointly affect smile attractiveness, the authors reported that the that both factors had statistically significant effects on perceived attractiveness (gingival display: $P=0.001$), for gingival display the attractiveness ratings were varied significantly across rater groups ($P=0.001$), and a significant communication existed between smile arc and the gingival display.¹⁷ According to an Iranian study the optimal gingival display across different facial vertical patterns found that preferred gingival display diverse by facial type and gender' as normal-faced females were rated most attractive with 2 mm display, normal-faced

males scored highest at 0 mm, according to long-faced models, the both genders showed consistent ratings across most display values (0–6 mm), while the short-faced females were rated most attractive with 0 mm.¹⁸ In aligns to this series Das G et al¹³ reported that when gingival display was assessed in relation to facial profile: among individuals showing gingival display, 58% had a straight facial profile, while convex facial profile was in 42%. However, Akhare PJ et al.¹⁹ demonstrated that neither laypersons nor orthodontists found significant differences in their ratings of gingival display across the three photographic groups, indicating that the effect of gingival display on smile esthetics was not dependent on facial form. Furthermore, both groups considered a gingival display of 0–2 mm to be acceptable. Most of the studies discussed above differ from the present study in several aspects, particularly with respect to their objectives and sample selection criteria. To the best of our knowledge, there are no closely comparable studies in the literature that have specifically assessed the relationship between facial profile patterns (straight, convex, and concave) and gingival display classification based on quantitative gingival display measurements. Only a limited number of studies have investigated related parameters, such as papillary height and gingival zenith position, across different facial profiles.

The present study also has several limitations, including the very small number of cases with excessive gingival display, recruitment from a single institution, and the use of photogrammetric measurements, which may vary slightly from direct clinical measurements. In addition, potential confounding factors, including participants' age, ethnicity, and previous dental or orthodontic treatment history, were not accounted for and may have introduced bias. Therefore, future multicenter studies with larger sample sizes, balanced representation across gingival display classifications, and longitudinal study designs are recommended to generate more generalizable and clinically applicable findings.

Conclusion

Study revealed that the gingival display within the aesthetically acceptable range was highly frequent across the study population with its significant presence among females and insignificant pattern between both genders, while the facial profile observed to a significant determinant, with convex profiles showing a distinct tendency toward excessive gingival display, while straight and concave profiles were linked to the more favorable,

ideal-to-acceptable patterns along with aesthetic satisfaction level in most of the individuals. Overall findings highlight facial profile assessment as a clinically meaningful tool for anticipating gingival display outcomes, and support its incorporation into routine esthetic assessments.

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