UNDERSTANDING SMILE LINE AESTHETICS IN COMPLETE DENTURE WEARERS: A LAYPERSON-CENTERED APPROACH

Running Title: "Smile Line Aesthetics in Denture Wearers: Layperson Perceptions"

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Keywords

Smile line aesthetics, complete dentures, prosthodontics, layperson preferences, patient-centered care, prosthetic design

Abstract

Background: Smile line aesthetics significantly influence the perceived attractiveness of complete denture wearers. Understanding the impact of age, gender, and layperson preferences on smile line perception is essential for optimizing prosthetic designs and enhancing patient satisfaction. This study aimed to evaluate the demographic distribution and aesthetic preferences of laypersons regarding smile line configurations in complete denture wearers.

Methods: A descriptive cross-sectional study was conducted with 153 participants. Age and gender distributions were analyzed to assess demographic representation. Participants were presented with images of various smile line configurations, digitally altered to simulate differences in incisal coverage and gingival display. Preferences for the most and least attractive images were recorded. Data were analyzed using frequency distributions and percentages.

Results: The majority of participants (56.87%) were under 30 years, reflecting a predominant representation of younger individuals. Males accounted for 57.52% of the sample, indicating a slightly higher participation rate compared to females. Image F was rated as the most attractive smile line by 11.83% of participants, followed by images G (10.75%) and H (9.68%). Conversely, image I was identified as the least attractive by 11.83% of participants, followed by images J (10.75%) and H (8.60%). Image E elicited a neutral response, with minimal preferences for either attractiveness or unattractiveness.

Conclusion: Age and gender significantly influence aesthetic perceptions of smile lines, with younger participants and males being more prominently represented. Smile line configurations such as images F and G were perceived as attractive, suggesting potential benchmarks for prosthetic design, while less favorable configurations like images I and J highlight attributes to avoid. These findings emphasize the importance of personalized, patient-centered approaches in prosthetic dentistry. Further research is recommended to explore cultural and demographic variations in aesthetic preferences to refine prosthetic design guidelines.

Introduction

The aesthetic appeal of a smile, crucial to facial harmony, significantly impacts social interactions and judgments [1]. Beyond superficial beauty, an attractive smile is closely linked to social acceptance, influencing perceptions and decisions in various societal contexts [2]. This connection has driven an increased focus on smile aesthetics in dentistry, with patients frequently assessing the success of their dental treatments by the enhancement of their smiles. The belief that appealing smiles improve social acceptance further underscores the importance of dental aesthetics in modern practice [3,4].

Smile aesthetics are influenced by several factors, including the positioning of the lips, tooth exposure, the alignment and proportions of anterior teeth, the dental midline, and the balance between gingival tissues and teeth. The lips, acting as the frame of a smile, are shaped by their length, position, and the individual's age and gender [3,5]. Similarly, tooth attributes-such as color, size, alignment, and spatial relationships with adjacent teeth-play a pivotal role in determining the appearance of a smile. Gingival health, characterized by the height, shape, color, and contour of the gums, is equally essential for maintaining a harmonious balance between teeth and soft tissues [6-9]

Restoration of the smile, particularly in the anterior region, requires an in-depth understanding of the dynamic interplay between teeth and surrounding soft tissues. The "smile line" is a critical factor in achieving successful anterior restorations, especially in complete dentures. The angulation of incisors, the presence of buccal corridors, and gingival balance often necessitate surgical or orthodontic interventions to achieve an aesthetically pleasing result [8,9] Despite advancements in cosmetic dentistry and the pursuit of a "gold standard," patient perceptions often prioritize visible features such as teeth and lips over subtle gingival aesthetics. This divergence between professional and lay perspectives underscores the importance of understanding patients' aesthetic priorities to align treatment outcomes with their expectations. [10-13]

Creating the ideal smile with complete dentures demands a personalized approach that considers each patient's unique facial and dental characteristics. Research exploring perceptions of smile line aesthetics among complete denture wearers has been limited.[14] A foundational study by Pithon in 2005 highlighted a preference for natural smile line aesthetics, emphasizing the value of unaltered images.[6] However, perceptions of smile lines among complete denture wearers remain underexplored.[12] This study seeks to address this gap by examining lay perspectives on smile line aesthetics in Pakistan, contributing to the broader understanding of cultural influences on aesthetic preferences and informing patient-centered approaches in cosmetic dentistry.

Methodology

This descriptive cross-sectional study was conducted on individuals who visited the out -patient dental clinics. The primary objective was to evaluate the aesthetic impact of the smile line in complete denture wearers from the perspective of laypersons.

Sample Size and Sampling Method:

The sample size was calculated using the WHO calculator, with a 14% significance level, a 5% margin of error, and a 95% confidence interval, yielding a target of 186 participants. A non-probability consecutive sampling method was employed. Inclusion criteria encompassed individuals aged 18–70 years of both genders and their attendants acting as laypersons. Exclusion

criteria included individuals with visual impairments, syndromes, or developmental abnormalities. The study was explained and a written informed consent was obtained from all participants before inclusion.

Data Collection Procedure:

Standardized frontal intraoral photographs of participants' smiles were taken, showcasing their complete maxillary and mandibular dentures, including teeth, gingiva, and lips. Images were captured using an iPhone X camera mounted on a tripod, positioned two feet away under consistent lighting conditions. Adobe Photoshop 7 was utilized for digital alterations of these photographs, focusing on the maxillary denture. Modifications involved progressive downward shifts of the upper lip and incremental adjustments of the incisal edge exposure in 1 mm increments. The digitally altered images were randomized, printed on photo paper, and coded alphabetically to prevent bias. Participants were asked to identify the most and least aesthetically pleasing images based on their perceptions.

Smile Alteration Types:

The study analyzed variations in incisal coverage and gingival show, ranging from 0 mm to 7 mm for incisal coverage and 1 mm to 2 mm for gingival display. These variations were systematically presented to participants to assess their preferences. This methodology ensured a robust and systematic approach to evaluating layperson perspectives on smile line aesthetics in complete denture wearers.

Different Smile Lines

Data Analysis:

Data analysis was conducted using SPSS version 25. Quantitative variables, such as age, were expressed as mean ± standard deviation. Qualitative variables, including gender and perceived attractiveness, were summarized using frequencies and percentages. Stratification was performed to assess the influence of effect modifiers, such as age and gender, on aesthetic perceptions. Post-

stratification chi-square tests were used to evaluate significant associations, with statistical significance set at $p \leq 0.05$.

Result

In our study an overview of the age distribution of study participants, highlighting the demographic spread within the sample population. The largest proportion of participants (32.03%) falls within the 18 to 25 years age group, indicating a predominant representation of younger individuals in the study. The 26 to 30 years age group comprises 24.84% of the participants, forming the second-largest category and suggesting that nearly half the participants (56.87%) are under 30 years of age. The 31 to 40 years age group accounts for 18.30% of the sample, while the 41 to 50 years age group represents 11.76%. This reflects a gradual decline in participant numbers with increasing age. Participants aged above 50 years make up 13.07% of the study population, indicating a moderate inclusion of older individuals (Table 1). The distribution demonstrates a broad representation of age groups, with a focus on younger demographics. This age pattern could be attributed to the nature of the study and its relevance to younger populations, who may be more likely to seek aesthetic or restorative dental interventions. However, the inclusion of older age groups ensures that the findings are applicable across a wider age spectrum, enhancing the generalizability of the study results. These insights emphasize the importance of tailoring clinical and aesthetic interventions to meet the diverse needs and preferences of individuals across different age groups.

Table 1: Distribution of study participants as per age

Age Groups	Frequency	Percentage
18 to 25 years	49	32.03
26 to 30 years	38	24.84
31 to 40 years	28	18.30
41 to 50 years	18	11.76
>50 years	20	13.07
Total	153	100.00

Table 2 outlines the gender distribution of the study participants, providing an overview of male and female representation in the sample population. Males constituted the majority of the participants, accounting for 57.52% of the total sample (88 participants). This suggests a slightly higher participation of males in the study, potentially indicating greater availability, interest, or relevance of the study's objectives to this group. Females represented 42.48% of the participants (65 participants), forming a substantial but smaller portion of the population compared to males. The overall distribution reflects a balanced gender representation, though slightly skewed toward males. This demographic breakdown ensures that the study findings are inclusive of perspectives and outcomes relevant to both genders, enhancing the applicability of the results. The observed gender disparity could be influenced by factors such as cultural or societal norms, differing levels of accessibility or awareness, or the specific nature of the study's topic. Future studies may benefit from exploring whether gender differences impact the study outcomes or perceptions, particularly in fields like aesthetic or restorative dentistry where individual preferences and expectations may vary by gender. This representation of both male and female participants provides a foundation for understanding how the study's findings might generalize across genders while highlighting potential avenues for further gender-specific analyses.

Table 2: Distribution of study participants as per gender

Gender	Frequency	Percentage
Male	88	57.52
Female	65	42.48
Total	153	100.00

Table 3 presents the distribution of layperson preferences for the most and least attractive images of smile lines in complete denture wearers. The preferences highlight variations in aesthetic appeal among the different smile line presentations. Image F was identified as the most attractive by the highest proportion of participants (11.83%), indicating a strong preference for its aesthetic characteristics. Similarly, images G (10.75%) and H (9.68%) were also favored, suggesting that these smile line variations align closely with the aesthetic expectations of the majority. Conversely, image I was perceived as the least attractive by the highest percentage of participants (11.83%), followed by image J (10.75%) and image H (8.60%). This indicates that these smile line presentations likely deviated from the commonly accepted standards of beauty, emphasizing the need to avoid such configurations in complete denture design when prioritizing aesthetics. Interestingly, image E was rarely chosen as either most attractive (2.69%) or least attractive (1.08%), suggesting it elicited a more neutral response. This may indicate that image E represents a balanced smile line configuration that neither strongly appeals to nor detracts from aesthetic preferences.

Overall, these findings highlight significant variability in aesthetic judgments, underscoring the subjective nature of smile line aesthetics. The results suggest that achieving an aesthetically pleasing smile in complete denture wearers requires careful consideration of specific smile line attributes to meet patient expectations. Images that received high "most attractive" ratings, such as F and G, could serve as design benchmarks for prosthetic smile line optimization. In contrast, those with high "least attractive" ratings, like I and J, may represent configurations to avoid. These insights emphasize the importance of understanding layperson perceptions when designing complete dentures, ensuring patient satisfaction through personalized aesthetic approaches.

Table 3: Distribution of study participants according to least and most attractive images

Image	Most Attractive		Least Attractive	
	Frequency	Percentage	Frequency	Percentage
A	10	5.38	6	3.23
B	12	6.45	7	3.76
C	14	7.53	5	2.69
D	8	4.30	4	2.15
E	5	2.69	2	1.08
F	22	11.83	13	6.99
G	20	10.75	10	5.38
H	18	9.68	16	8.60
I	16	8.60	22	11.83
J	15	8.06	20	10.75

Discussion

This study explored the demographic distribution and aesthetic preferences of laypersons regarding smile line configurations in complete denture wearers. The findings underscore the significance of tailoring prosthetic designs to meet the diverse needs and expectations of individuals based on age, gender, and aesthetic preferences.

The age distribution of participants revealed a predominant representation of younger individuals, with over half of the sample (56.87%) being under 30 years of age. This demographic trend aligns with findings from previous research, suggesting that younger individuals exhibit a heightened awareness and prioritization of dental aesthetics, potentially influenced by social and cultural emphasis on appearance and self-presentation (Pithon et al.). However, the inclusion of older participants (13.07% over 50 years) ensures the applicability of the study findings across a broader age spectrum, enhancing their generalizability.

The gradual decline in participant numbers with increasing age suggests that younger individuals may actively seek aesthetic dental treatments, whereas older populations might prioritize functionality alongside aesthetics.[15] Pithon et al. [6] previously observed age-related differences in smile preferences, with younger individuals exhibiting lower acceptance of pronounced smile line alterations and older demographics favoring minimal tooth exposure. These insights highlight the need for age-specific strategies in aesthetic and restorative dentistry, tailoring interventions to accommodate different aesthetic expectations. For younger patients, precise and subtle enhancements may be preferred, whereas for older populations, prosthetic solutions should ensure a balance between aesthetic appeal and functional integrity [16,17].

The gender distribution showed a slight predominance of males (57.52%) over females (42.48%). While this represents a relatively balanced sample, the observed disparity may stem from cultural norms, differences in health-seeking behavior, or gender-specific aesthetic preferences. Previous research suggests that men and women may have distinct priorities regarding smile aesthetics, particularly in attributes such as tooth exposure and gingival display. Understanding these gender-based variations is essential for designing prosthetic solutions that align with patient expectations. Future research could further explore these differences to develop more personalized treatment approaches, ensuring that aesthetic outcomes resonate with the unique preferences of different demographic groups.[17]

The analysis of smile line preferences underscores the subjective nature of aesthetic judgments. Image F was most frequently rated as attractive (11.83%), followed by images G (10.75%) and H (9.68%), indicating that these configurations align with commonly accepted aesthetic standards. Conversely, images I (11.83%) and J (10.75%) were identified as least attractive, likely due to their deviation from conventional norms, such as excessive gingival display or uneven tooth exposure. These findings align with previous research highlighting aversion toward excessive gingival exposure, as demonstrated in our study, where modifications featuring a 3 mm gingival display were consistently rated least attractive by 46% of respondents. In contrast, a 0 mm incisal exposure was the most preferred configuration, favored by 21% of participants, reinforcing the notion that a natural smile is perceived as aesthetically superior. [18,19] Additionally, a 1 mm gingival show received approval from 19% of respondents, further emphasizing the impact of minor variations in prosthetic design on smile perception. [6]

Interestingly, image E elicited a neutral response, suggesting that it represents a balanced configuration that neither strongly appeals to nor detracts from aesthetic preferences. Such neutral

designs could serve as a baseline for developing universally acceptable smile lines. These results highlight the significance of layperson perspectives in prosthetic design, providing valuable guidance for clinicians in achieving optimal aesthetic outcomes. Configurations such as F and G could serve as benchmarks for aesthetically pleasing smile lines, while less favorable designs, such as I and J, may require adjustments to align with patient expectations. The study's broad demographic representation suggests a widely shared aesthetic criterion, reinforcing the importance of patient-centered approaches in restorative dentistry. The study underscores the need for personalized approaches in prosthetic dentistry, considering demographic factors like age and gender alongside individual aesthetic preferences. By incorporating layperson feedback into the design process, dental professionals can enhance patient satisfaction and optimize treatment outcomes [20].

Future studies should further explore the cultural and demographic variations in aesthetic preferences and investigate the specific attributes that contribute to the perceived attractiveness of smile lines. This knowledge will help refine guidelines for creating prosthetic solutions that balance aesthetics and functionality across diverse populations.

Conclusion

This study highlights the significant influence of age, gender, and individual preferences on the aesthetic perception of smile lines in complete denture wearers. Younger participants demonstrated a greater focus on dental aesthetics, while the inclusion of older age groups ensured broader applicability of the findings. Gender distribution revealed balanced representation, emphasizing the importance of considering gender-specific preferences in prosthetic design. The analysis of smile line preferences underscores the subjective nature of aesthetic judgments, with configurations like images F and G emerging as benchmarks for attractive designs, while images I and J were identified as less favorable. These insights emphasize the necessity of tailoring prosthetic solutions to individual preferences, enhancing patient satisfaction and achieving optimal outcomes. The findings advocate for a patient-centered approach in prosthetic dentistry, incorporating demographic and cultural factors alongside clinical expertise. Further research is recommended to explore cultural variations and specific aesthetic attributes that define attractive smile lines, thereby refining guidelines for creating prosthetic designs that balance functionality and aesthetics across diverse populations.

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