ORIGINAL ARTICLE POJ 2026:18(1) 42-49

Revisiting Smile Esthetics: Role of Facial Type and Buccal Corridor Area in Perceived Attractiveness

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Abstract

Introduction: Smile esthetics plays a pivotal role in orthodontic treatment planning, with the buccal corridor being a key determinant of smile harmony. This study aimed to evaluate esthetic perceptions of the buccal corridor area ratio (BCAR) across different facial types among orthodontists, orthodontic patients, and laypersons and to determine the influence of BCAR variations on smile attractiveness.

Methodology: This "cross-sectional analytical study utilizing a digital stimulus perception design" included 279 participants, equally divided into orthodontists, orthodontic patients, and laypersons. Standardized frontal smiling images were digitally modified to represent three facial types (mesofacial, brachyfacial, dolichofacial) and five BCAR levels (1%, 5%, 10%, 15%, 20%). Perception scores were recorded using VAS scale. Data were analyzed using SPSS version 26. Mean perception scores were compared using ANOVA with post-stratification to control for effect modifiers such as age and gender. A p-value ≤ 0.05 was considered statistically significant.

Results: A significant association was found between facial type, BCAR levels, and perception scores. At lower BCARs (1% and 5%), dolichofacial faces received higher scores from patients, while brachyfacial faces were rated more favorably by laypersons and orthodontists. Orthodontists preferred mesofacial types overall, but rated brachyfacial smiles more positively as BCAR increased. Laypersons were more sensitive to BCAR changes in female models than male models. Patients consistently rated dolichofacial types with larger BCARs more favorably. Stratification by age showed higher perception scores in participants over 40 years across most groups.

Conclusions: Orthodontists are more sensitive to variations in buccal corridor size compared to patients and laypersons. BCARs below 15% are generally perceived as esthetically acceptable by all groups. Elimination or reduction of buccal corridors should be considered when BCAR exceeds this threshold, supporting the integration of patient esthetic expectations into clinical decision-making.

Keywords: Smile aesthetics, BCAR, facial types, attractiveness

Date of Submission: 15-Jul-2025 **Date of Final Revision:** 22-Jun-2026 **Date of Approval:** 29-Jun-2026

Introduction

Facial aesthetics significantly influence societal perceptions, with individuals possessing attractive features often being associated with favorable social, athletic, and leadership traits.[1] Within the realm of physical attractiveness, dentofacial elements particularly the smile hold considerable importance. Smile aesthetics play a vital role in facial beauty, affecting social acceptance, self-perception, and interpersonal confidence.[2,3] Numerous components contribute to smile attractiveness, including tooth dimensions, shade, gingival exposure, the smile arc, midline symmetry, and the visibility of teeth

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while smiling.[4] Another integral determinant is the individual's facial type, which is categorized into mesofacial, brachyfacial, and dolichofacial types based on the facial index (FI). This classification influences the proportional balance between the face and the smile.[5] A particularly debated aspect of smile aesthetics in orthodontics is the buccal corridor—the lateral dark space visible between the posterior teeth and mouth corners during smiling. Although its ideal width remains controversial, it is widely acknowledged that the buccal corridor is shaped by both facial morphology and dental arch form.[6]

Face types have been classified as Mesofacial, Brachyfacial (Short face syndrome) dolichofacial (Long face syndrome) later two affecting the muscle strength biting force TMJ airways dental architecture smile attractiveness and facial harmony. Huang et al. conducted a study to assess buccal corridor width in layman, patients and orthodontic perceptive among different facial types through altered facial images and concluded that orthodontists rated smiles with a 20% BCAR the least attractive across all facial types. In contrast, laypersons favored broader corridors in brachyfacial and mesofacial profiles, while patients preferred dolichofacial faces with moderately wide buccal corridors.[7]

To explore similar perceptions in the Pakistani population, a pilot study was conducted involving 60 participants, including 20 orthodontists, 20 orthodontic patients, and 20 laypersons, with an average age of 29.58 ± 6.01 years. Males constituted 58.33% of the sample. When evaluating a 15% buccal corridor, the average attractiveness scores were 3.85 ± 0.81 for laypersons, 4.09 ± 0.83 for patients, and 4.21 ± 0.78 for orthodontists. For the 20% corridor, the scores were 3.8 ± 0.83, 3.90 ± 0.76, and 4.15 0.83, respectively. This pilot study has opened ways for future research.

Hence to ensure quality patient centered orthodontic care it is crucial to understand the underline mythology of facial attractiveness through facial typing and BCAR in our own ethnic context. The aim of this study is to revisit simile aesthetic and attractiveness by highlighting the role of buccal corridor and facial type. This finding aim to support orthodontic practitioners in integrating culturally relevant aesthetic expectations into their treatment planning.

Methodology

This "cross-sectional analytical study utilizing a digital stimulus perception design was carried out at Punjab Dental Hospital and de'Montmorency College of Dentistry, Lahore, over a period of six months, from March 2, 2023, to September 2, 2023. Approval was obtained from the Institutional Review Board and from CPSP (IRB) prior to commencement of the research.

Sample size estimation was performed using PASS 15 software, based on findings from a pilot study. The mean scores for a 15% buccal corridor width were reported as 3.85 ± 0.81 (laypersons), 4.09 ± 0.83 (patients), and 4.21 ± 0.78 (orthodontists), with a pooled standard deviation of 0.806. To achieve a study power of 80% and a 95% confidence level, (Type I error) a total of 279 participants were required (93 in each group). A non-probability convenience sampling method was employed, as commonly applied in perceptual studies of this nature.[8,9,10]

Participants were divided equally into three groups: Laypersons: Individuals who have no history of and are not seeking orthodontic treatment selected from the outpatient department. Orthodontic Patients: Participants who had registered for but had not yet started orthodontic treatment were included. Those undergoing treatment or affiliated with healthcare professions were excluded. Orthodontists: Postgraduate

orthodontic residents with a minimum of one year of clinical experience were included. Residents with less than one year of experience were excluded to maintain consistency in professional judgment.

Two adult models (one male and one female), aged between 17 and 25 years, were selected based on the following criteria: normal occlusion, ideal smile arc and line, healthy gingival status, no facial hair or makeup, and facial convexity between 165°–175° to ensure balance and symmetry. Trained post smile frontal & lateral photographs were taken under standardized conditionsto ensure image consistency.

Digital editing of the photographs was done using Adobe Photoshop CC v16.0 to correct minor facial blemishes without altering anatomical landmarks. Based on facial index (FI), each model's image was modified into three facial types—brachyfacial (FI 80%), mesofacial (FI 87%), and dolichofacial (FI 94%). For each facial type, five variations of buccal corridor area ratio (BCAR) were created: 1%, 5%, 10%, 15%, and 20%. This resulted in 15 digitally altered images per model as shown in Figure I & II.

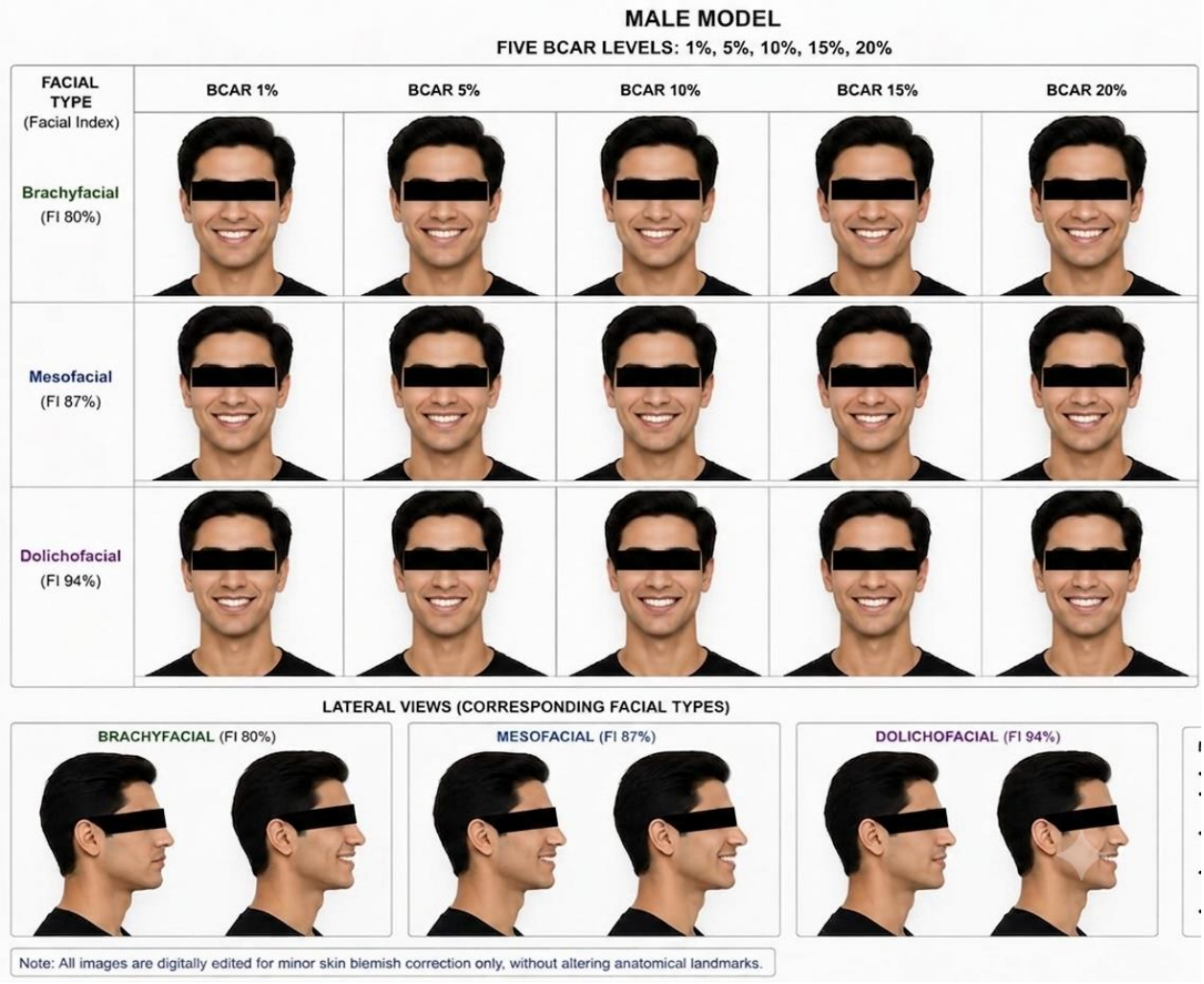

Fig. I: Digitally altered image Male Model

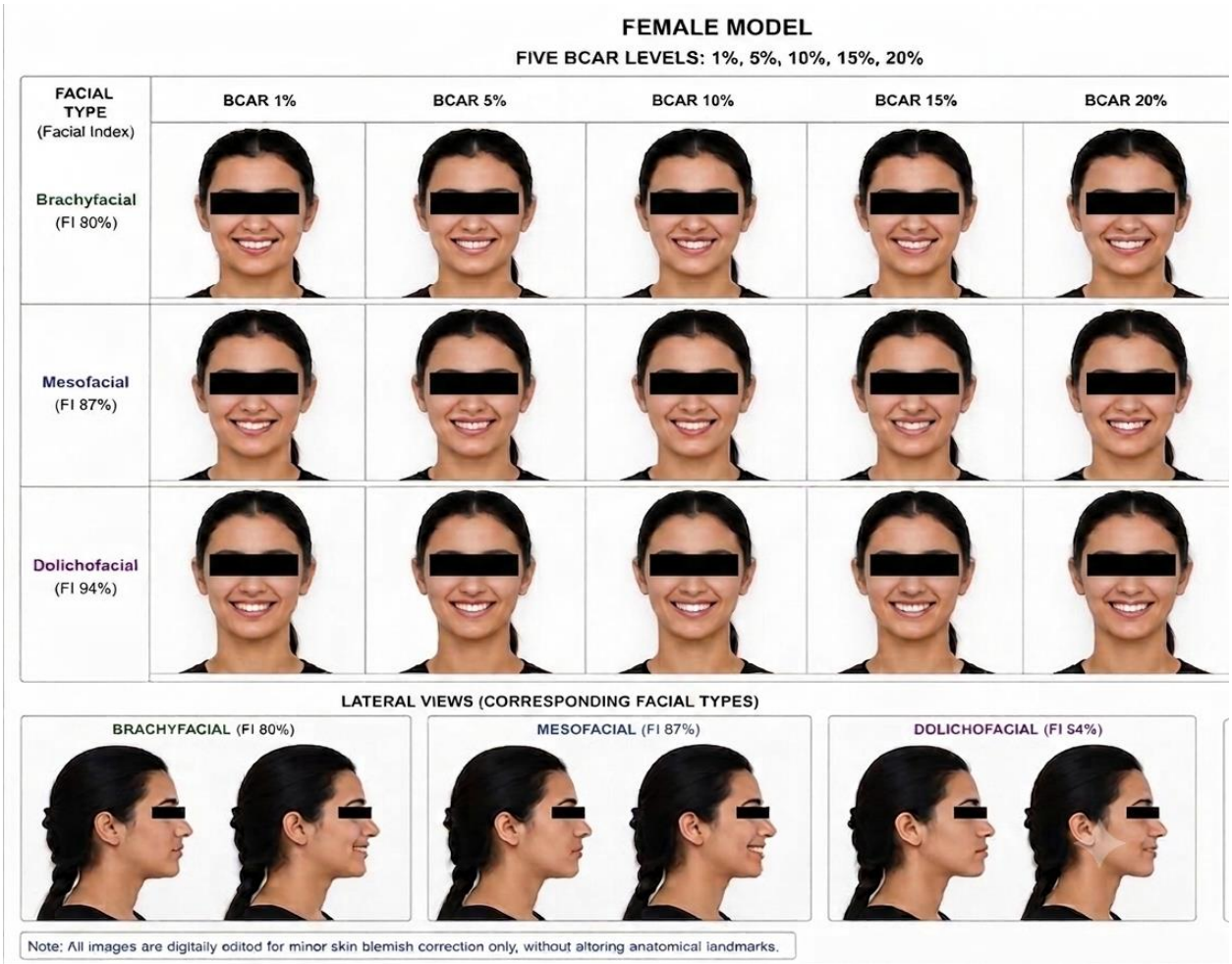

Fig. II: Digitally altered image Female Model

Buccal corridor areas were measured bilaterally using the pen tool in the software, calculating the pixel-based area for accuracy.

The modified images were presented using Microsoft PowerPoint (Microsoft, Redmond, WA) in two phases. First, 15 images were shown in random order, each for 12 seconds. In the second phase, images were grouped according to BCAR (shown in the order: 10%, 20%, 1%, 5%, and 15%) and displayed for 45 seconds per slide. Slide transitions were set using the "Drape" animation. The male model's set followed the female's. Reviewers were not permitted to revisit slides once they had moved on. At the end Unaltered images were shown for comparative assessment. Perceived attractiveness of each smile was assess through Visual Analog Scale (VAS) after standardized instructions to participants. Score 1 very unattractive on left and score 5 very attractive on right.

Statistical Analysis:

All statistical analyses were performed using IBM SPSS Statistics version 26.0. The Shapiro-Wilk test was applied to assess the normality of continuous variables, including age and perception scores. Depending on the distribution, quantitative data were summarized either as mean ± standard deviation (SD) or median with interquartile range (IQR), while categorical data such as gender were reported using frequencies and percentages. Comparisons of perception scores among the three study groups—laypersons, orthodontic patients, and orthodontists—were made using analysis of variance (ANOVA). Stratification was carried

out to control for potential confounding variables like age and gender. A post-stratification ANOVA was used to assess the statistical significance of intergroup differences, and a p-value of ≤ 0.05 was considered statistically significant.

Result

The study included 279 participants, with an equal distribution of 93 individuals in each of the three groups. The mean age of laypersons was 31.84 ± 8.4 years, orthodontic patients had a mean age of 32.31 ± 8.21 years, and orthodontists had a significantly higher mean age of 43.63 ± 2.54 years. The difference in age across the groups was statistically significant ($p < 0.001$). Shown in Table-I

Study Group	N	Mean Age (Years)	Standard Deviation (SD)
Laypersons	93	31.84	8.40
Orthodontists	93	43.63	2.54
Orthodontic Patients	93	32.31	8.21

Table-I: Distribution of Age among Study Groups

Gender distribution among the groups showed no significant variation, with a p-value of 0.187. Perception scores were analyzed according to different facial types and buccal corridor area ratios (BCAR). In the group with a 1% BCAR, orthodontic patients rated brachyfacial smiles significantly lower compared to laypersons, with mean scores of 3.96 ± 0.85 and 4.49 ± 0.5, respectively ($p < 0.001$). For dolichofacial faces at the same BCAR, patients gave higher scores than laypersons, with mean ratings of 4.52 ± 0.5 and 3.89 ± 0.82, respectively, which was also statistically significant ($p < 0.001$). No significant differences were observed in perception scores for mesofacial faces at this BCAR level ($p = 0.987$).

A similar trend was noted for the 5% BCAR group. Patients consistently gave lower scores to brachyfacial smiles than laypersons, with mean values of 3.9 ± 0.82 and 4.46 ± 0.5, respectively ($p < 0.001$). On the other hand, in dolichofacial faces, patients continued to rate smiles more favorably than laypersons, with mean scores of 4.51 ± 0.5 and 4.1 ± 0.79, respectively ($p < 0.001$). This pattern was observed across subsequent BCAR categories of 10%, 15%, and 20% as well. Overall, both orthodontists and laypersons tended to assign higher perception scores to brachyfacial smiles, whereas orthodontic patients showed a clear preference for dolichofacial facial types. As shown in Table-II.

BCAR (%)	Facial Type	Laypersons (Mean ± SD)	Orthodontists (Mean ± SD)	Patients (Mean ± SD)	p-value
1	Brachyfacial	4.49 ± 0.50	4.46 ± 0.50	3.96 ± 0.86	<0.001
1	Mesofacial	4.57 ± 0.50	4.59 ± 0.49	4.56 ± 0.50	0.903
1	Dolichofacial	3.89 ± 0.83	4.42 ± 0.50	4.52 ± 0.50	<0.001
5	Brachyfacial	4.46 ± 0.50	4.46 ± 0.50	3.90 ± 0.82	<0.001
5	Mesofacial	4.53 ± 0.50	4.52 ± 0.50	4.52 ± 0.50	0.986
5	Dolichofacial	4.10 ± 0.79	4.49 ± 0.50	4.51 ± 0.50	<0.001
10	Brachyfacial	4.54 ± 0.50	4.49 ± 0.50	3.56 ± 0.52	<0.001
10	Mesofacial	3.53 ± 0.50	3.49 ± 0.50	3.52 ± 0.50	0.905
10	Dolichofacial	4.11 ± 0.85	4.47 ± 0.50	4.51 ± 0.50	<0.001
15	Brachyfacial	4.45 ± 0.50	4.51 ± 0.50	4.08 ± 0.82	<0.001
15	Mesofacial	3.96 ± 0.83	4.04 ± 0.82	4.13 ± 0.77	0.350
15	Dolichofacial	4.00 ± 0.78	4.42 ± 0.50	4.56 ± 0.50	<0.001
20	Brachyfacial	4.48 ± 0.50	4.10 ± 0.82	4.00 ± 0.85	<0.001
20	Mesofacial	4.16 ± 0.85	4.13 ± 0.84	4.00 ± 0.79	0.373
20	Dolichofacial	4.03 ± 0.77	4.49 ± 0.50	4.56 ± 0.50	<0.001

Table-II: Comparison of Perception Scores According to Buccal Corridor Area Ratio (BCAR), Facial Type and Study Group

Stratification by Age:
Age-stratified analysis demonstrated significant differences in smile attractiveness perception across various buccal corridor area ratios (BCARs) and facial types. Participants aged >40 years generally assigned higher attractiveness scores to dolichofacial smiles compared with younger participants. For example, in dolichofacial faces with a BCAR of 1%, perception scores were consistently higher among participants older than 40 years across all study groups ($p < 0.001$). Conversely, orthodontic patients aged >40 years tended to assign lower scores to brachyfacial smiles, particularly at a BCAR of 10% ($p < 0.001$). Overall, age appeared to influence esthetic perception, with older participants demonstrating greater preference for dolichofacial facial types and wider buccal corridors compared with younger participants

Stratification by Gender:
Gender-based analysis demonstrated significant differences in the perception of smile attractiveness across several facial types and buccal corridor area ratios (BCARs). As shown in Table-II

Discussion

Buccal corridor dimension plays an important role in the aesthetics perception among male and females. Wider buccal corridors vs narrow buccal corridors significantly alter the attractiveness and minimizes smile appeal. While some studies suggests that Buccal corridor dimension have no affect on the smile attractiveness.[11,12] Buccal corridor dimensions were previously assessed through BCLR however recently introduced BCAR has shown better assessment perspective from smile dynamics to treatment philosophy.[13,14] Consequently, orthodontic assessments now advocate for comprehensive facial evaluations to ensure treatments enhance overall facial aesthetics.[15,16]

Our study confirms that buccal corridors significantly influence smile aesthetics, with orthodontists displaying the highest sensitivity to these dimensions. While classic research by Ritter et al.[17] claimed that buccal spaces have no significant impact on smile appeal, our use of the two-dimensional Buccal Corridor Area Ratio (BCAR) demonstrates that aesthetic tolerance is directly modulated by the patient's skeletal facial type.

Our finding that aesthetic tolerance for buccal corridors varies significantly by facial type aligns with the core principles of facial harmony established in anthropometric literature, while adding a new layer of clinical specificity. Traditional facial type research suggests that vertical facial patterns dictate distinct soft-tissue and structural balances. Our study expands on this by showing that macro-facial context directly alters smile micro-esthetics: orthodontists and laypersons preferred broader smiles (lower BCAR) on shorter, brachyfacial profiles to balance horizontal dominance, while patients favored larger buccal corridors on longer, dolichofacial profiles to complement vertical facial elongation.[18,19]

Hence Buccal corridors dimensions assessment through BCAR and patient/ pear perception place and impact full role in the treatment planning and the final treatment outcome. Adjunct procedures likes chilo plasty, lip filler, and botock have gained popularity in the recent years. Moreover paradigm shift from partial to full facial assessment have improved the quality of treatment outcome by minimizing esthetic concerns and promoting juvenile attractive smile.

Conclusion

- Orthodontists notice changes in buccal corridor size much more than patients or laypersons.
- Intervention to reduce buccal corridors is suggested only when the ratio exceeds 15%.

- Lower buccal corridor ratios are deemed aesthetically acceptable by all evaluated groups.
- Specialists must balance their clinical expertise with individual patient aesthetic preferences.
- A full-face evaluation ensures treatments harmonize with overall facial aesthetics for natural outcomes.

Ethical Approval

The study was approved by the Ethical Review Committee of de'Montmorency College of Dentistry, Lahore (No. 746/DCD)

Funding Declaration

This study received no grant from any funding agency, commercial, or not-for-profit sectors.

Conflict of Interest

It is declared that the authors don't have any conflict of interest.

Authors' Contribution

RI: Research Proposal, Article writing, Discussion

AS: Research Designs and Data compilation

MI: Literature Review, Research Discussion

MH: Data Analyze

AA: Data Collection

US: Results Compilation

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