Original Article

Facial esthetic perception between skeletal Class III patients treated with conventional and surgery-first orthognathic approaches

Arthur Cunha[a]; Tainá Manso[b]; Jorge Faber[c]; Flavia Artese[d]; José Augusto M. Miguel[d]

ABSTRACT

Objectives: To compare the profile attractiveness of skeletal Class III patients treated with either a surgery-first approach (SFA) or a conventional surgery approach (CSA), as perceived by surgeons, orthodontists, and laypersons.

Materials and Methods: Thirty-four patients were assigned to either the SFA or CSA group retrospectively based on the surgical protocol performed and were evaluated by three distinct groups: oral and maxillofacial surgeons, orthodontists, and laypersons (n = 23 per group). Profile images before (T1) and after orthodontic-surgical treatment (T2) were analyzed using a 5-point Likert scale. Then participants answered the following question: "Which surgical technique was used, CSA or SFA?" Statistical analyses including the Spearman correlation coefficient, the Friedman test, the κ test, independent *t*-tests, and one-way analysis of variance were conducted to assess correlations and comparisons among evaluator groups ($P < .05$).

Results: A high and positive correlation ($r = 0.86$, $P < .001$) was demonstrated for scores between surgeons and orthodontists, and a low correlation was demonstrated between laypeople and specialists ($r = 0.55$, $P = .01$ and $r = 0.48$, $P = .03$). No statistically significant relationships were found between esthetic perceptions and the surgical approach regardless of the level of expertise of the evaluators, and it was also not possible to differentiate between the surgical approaches used.

Conclusions: In this study, we indicate that the choice of orthognathic surgical protocol, whether surgery-first or conventional, did not significantly influence the perceived facial profile attractiveness of skeletal Class III patients. These findings support the clinical viability of the SFA protocol, particularly in cases where treatment time or patient preference are factors in decision-making. (*Angle Orthod*. 2026;96:224–230.)

KEY WORDS: Orthodontics; Orthognathic surgery; Visual perception; Esthetics; Malocclusion; Angle Class II

INTRODUCTION

Orthodontic patients often seek treatment to improve dental and facial esthetics, aiming for greater popularity and better social relationships.[1] Attractive teeth are frequently associated with intelligence, popularity, and increased job opportunities compared with a less attractive dentition.[2] As a result, facial appearance plays a significant role in psychosocial well-being, as individuals are often judged more by their looks than by their character.[2] Orthognathic surgery is the best alternative for correcting facial esthetics and severe deformities. Patients often seek these procedures due to appearance and psychosocial concerns. However, the conventional approach (orthodontics-first) has drawbacks, including long treatment time, chewing issues, and profile worsening during presurgical orthodontics.[3]

In recent years, the surgery-first approach (SFA) has gained popularity among surgeons and orthodontists. This technique involves predicting and simulating dental alignment, incisor decompensation, and arch coordination before surgery, without prior orthodontic preparation.[4] More recently, it has also been used in conjunction with

[a] PhD Student, Clinic of Orthodontics, State University of Rio de Janeiro, Rio de Janeiro, RJ, Brazil.
[b] Resident, Clinic of Orthodontics, State University of Rio de Janeiro, Rio de Janeiro, RJ, Brazil.
[c] Researcher and Professor, Postgraduate Dental Program, University of Brasília, Brazil.
[d] Associate Professor, Clinic of Orthodontics, State University of Rio de Janeiro, Rio de Janeiro, RJ, Brazil.
Corresponding author: Dr José Augusto M. Miguel, Clinic of Orthodontics, State University of Rio de Janeiro, UERJ, Boulevard 28 de Setembro, 157 Vila Isabel, Rio de Janeiro, RJ 20551-030, Brazil (e-mail: jamiguel66@gmail.com)

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clear aligners.[4] SFA has been well accepted by patients and has shown functional and psychosocial results comparable with the conventional surgery approach (CSA).[5–8] Still, no consensus exists as to whether one technique yields superior outcomes over the other, particularly regarding facial attractiveness at the end of treatment. Also, no gold standard protocol exists for the evaluation of facial esthetics and attractiveness.

The Likert scale is widely used in psychosocial research and has shown good reliability.[9] It has been applied in various health studies to measure patient satisfaction.[10] This scale typically uses 5–7 points, in which raters indicate their level of agreement or satisfaction.[9] To date, no authors of studies have compared the esthetic outcomes of CSA and SFA using the Likert scale applied to photographic records.

Therefore, the aim of this study was to compare perceived facial profile attractiveness between skeletal Class III patients treated with either the SFA or CSA. The null hypothesis was that no significant difference would be found between the two groups in terms of esthetic perception. The expected outcome was to verify whether the surgical protocol influences profile attractiveness as judged by professionals and laypersons, thus providing evidence to guide clinical decision-making in orthognathic treatment planning.

MATERIALS AND METHODS

This observational study was designed to compare images of patients with skeletal Class III malocclusion treated with CSA and SFA. The study was approved by the Ethical Committee of the Rio de Janeiro State University (51444621.0.0000.5259). Sample size calculation was based on a moderate effect size (Cohen's $d = 0.6$), with a significance level of 5% and a power of 80%, aiming at detecting a mean difference of at least 0.82 points among groups of evaluators, with a standard deviation of 1.02 points for each group (BioEstat 5.0).[11]

Sample size calculation determined that 15 patients per group were required. Inclusion criteria were (1) skeletal Class III malocclusion, (2) negative Wits appraisal (<-1 mm), (3) chin asymmetry < 4 mm, (4) permanent dentition excluding third molars, (5) completion of surgical orthodontic treatment, (6) low to moderate curve of Spee, and (7) availability of complete posttreatment photographs. Patients with systemic diseases, genetic syndromes, cleft lip and palate or other craniofacial anomalies, or a history of craniofacial trauma were excluded.

Patients were matched based on age, gender, and skeletal discrepancy (Wits appraisal). All participants provided written informed consent before inclusion in the study. In addition to agreeing to participate, each patient authorized the use of their facial photographs for scientific analysis and publication purposes. The evaluators were divided into three groups: (1) oral and maxillofacial surgeons (OMSs), (2) orthodontists, and (3) laypeople, who assessed the esthetic outcomes of patients who underwent orthognathic surgery. Only evaluators with more than 5 years of professional experience in their respective fields were included. Participants who failed to complete any part of the questionnaire were excluded from the analysis.

The questionnaires were presented to evaluators via a PowerPoint presentation (Microsoft Office 2007, Redmond, Wash) displayed on a 15-inch LED notebook screen. Standardized lateral profile photographs were shown with the Frankfurt horizontal plane simulated. All images were scanned in JPEG format (1:1 ratio, 300 dpi) and standardized using Photoshop CS6 (Adobe Systems, San Jose, Calif). Presurgical (T1) and posttreatment (T2) images were randomly ordered using an online randomization tool (http://www.random.org/lists/). All profile photographs were taken under standardized conditions: using the same camera, distance, background, and ambient lighting. Patients were instructed to maintain natural head position, with lips at rest. Facial esthetics were evaluated using a 5-point Likert scale (1 = *very unpleasant*; 2 = *unpleasant*; 3 = *acceptable*; 4 = *pleasant*; 5 = *very pleasant*). Subsequently, evaluators answered the following question: "Which surgical technique was used?" with three options: (1) conventional surgery, (2) surgery-first, or (3) "I am not able to distinguish between the protocols." After being informed about the study objectives and signing the informed consent form, the evaluation session was conducted.

The evaluation sessions lasted between 6.0 and 20.0 minutes (mean $= 12.5 \pm 3.46$), a duration considered acceptable to minimize evaluator fatigue and ensure response reliability.[12] Statistical analyses were performed using JAMOVI software (version 1.6.16; Sydney, Australia), with a significance level set at 5%. For intrarater reliability testing, six patients (three from each technique) were evaluated twice randomly, and the Wilcoxon signed rank test was used. The Kolmogorov-Smirnov test was applied to verify the data distribution, and not all variables showed a normal distribution; thus, tests for nonparametric data were applied to all variables. The same test was used to compare initial values for age and Wits between CSA and SFA patients.

Spearman's correlation coefficient and Friedman tests were applied to assess correlations among variables and compare score distributions between evaluator categories. One-way analysis of variance and independent *t*-tests were used to compare scores related to esthetic perception of patients. The κ test was used to evaluate interrater agreement. The κ coefficient was interpreted following Landis and Koch's guidelines:

Table 1. Patient Characteristics: Ages, Malocclusion Severity, and Sex of Participants, and Duration of Evaluator Assessments[a]

	Conventional (16)	Surgery-First (18)	*P* Value
Age	24.0 (19.0/28.3)	22.0 (19.3/28.3)	.36[b]
Wits	−6.45 (−9.42/−3.07)	−7.70 (−10.2/−4.10)	.71[b]
Assessment duration (min)	14.0 (12.8/15.5)	13.0 (10.3/15.0)	.65[b]
Sex			$\chi^2 = 0.13$, $P = .71$[c]
Female	7	9	
Male	9	9	

[a] Note. Values are presented as median and interquartile range.
[b] Independent *t*-test.
[c] χ^2 test.

values between 0.41 and 0.60 indicate moderate agreement, between 0.61 and 0.80 substantial agreement, and above 0.81 reflect almost perfect agreement. Additionally, the frequency of correct and incorrect treatment modality was evaluated for each group.

RESULTS

Intraexaminer agreement showed no statistically significant difference between the Likert assessments for each group of participants (OMS, orthodontists, and laypeople; $P > .05$), indicating consistency in evaluations. Descriptive statistics and statistical comparisons for age and dentoskeletal features are reported in Table 1. No statistically significant differences were found between the two groups for age distribution of CSA 24.0 (19.0–28.3) years and SFA 22.0 (19.3–28.3) years and Wits appraisal of CSA −6.45 (−9.42 to −3.07) mm and SFA −7.70 (−10.2 to −4.10) mm. This confirmed baseline compatibility between the two groups. Figure 1 presents the median scores assigned to CSA and SFA cases by each evaluator category. No statistically significant differences were found between the two surgical protocols, indicating that facial profile attractiveness was perceived similarly regardless of the technique used.

The data evaluating interexaminer agreement (OMS, orthodontists, and laypeople) were interpreted by Spearman's correlation coefficient and the Friedman test, with both exhibiting the same pattern. For Spearman's correlation, a positive and high correlation ($r = 0.86$, $P < .001$) was demonstrated between surgeons and orthodontists, and a low correlation was demonstrated between laypeople and orthodontists or surgeons ($r = 0.55$, $P = .01$ and $r = 0.48$, $P = .03$, respectively). These results, illustrated in Figure 2, indicated a high level of agreement for facial attractiveness between OMS and orthodontists but a lower level of agreement between laypeople and the two professional groups. Interexaminer agreement assessed by the Friedman test showed no statistically significant difference between OMSs and orthodontists ($P = .75$), indicating strong alignment between these specialties. However, laypersons differed significantly from both orthodontists ($P = .02$) and surgeons ($P = .04$), suggesting a divergence in perception of facial attractiveness among nonprofessional evaluators (Table 2).

Interexaminer agreement for identifying the surgical technique followed a similar pattern. No statistically significant difference was found between OMSs and orthodontists ($P = .08$), indicating general agreement between specialties. In contrast, laypersons differed significantly from both groups ($P < .001$), as most of their responses indicated they were unable to distinguish between the protocols (Table 3).

No statistically significant differences were found in the esthetic perception scores given by the three evaluator

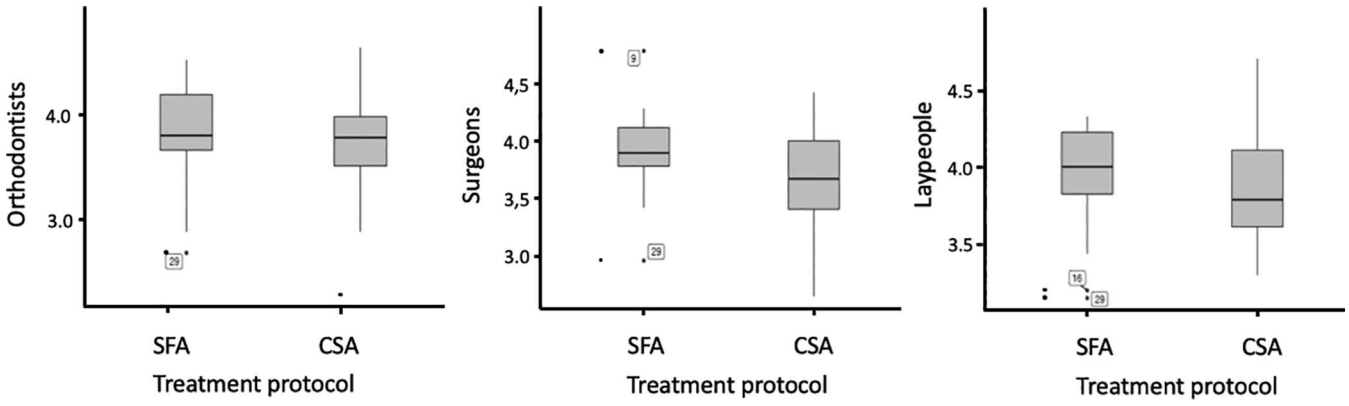

Figure 1. Box plots with median and interquartile range for scores for each technique for each group of evaluators: (a) surgeons, (b) orthodontists, and (c) laypeople. No statistical differences were observed for scores between techniques.

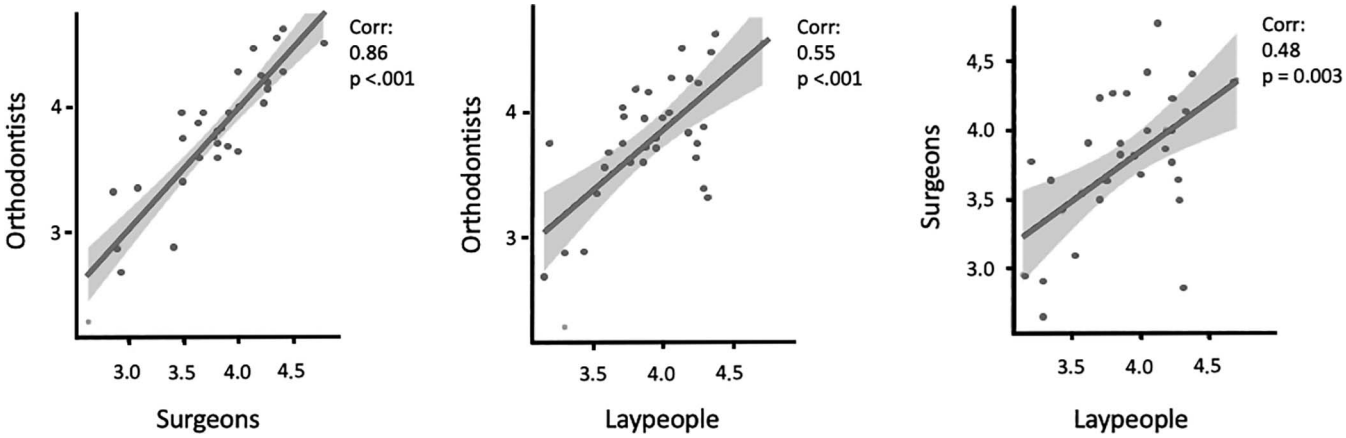

Figure 2. Scatterplot of esthetic perception scores for patients among evaluators. Correlation was assessed using the Spearman test.

groups ($P > .05$) nor when analyzed separately ($P > .05$; Table 4). The κ test for interrater agreement on esthetic perception showed a high level of agreement between specialists (91%, $\kappa = 0.89$, $P < .001$). The agreement between orthodontists and laypeople was moderate (59%, $\kappa = 0.41$, $P = .007$), while the agreement between laypeople and surgeons was slightly lower (65%, $\kappa = 0.37$, $P = .017$).

When the κ test was applied to assess agreement between orthodontists and surgeons regarding the type of surgical protocol performed, the agreement rate was 62% ($\kappa = 0.04$, $P = .77$), indicating minimal agreement beyond chance. This low κ value suggested that the two specialties had difficulty consistently identifying the surgical approach based on facial profile alone. When all three groups were analyzed together, the agreement remained extremely low ($\kappa = 0.007$), as shown in Table 5. The κ test could not be applied to the layperson group due to the high frequency of "I am not able to distinguish between the protocols" responses. Additionally, Fisher's exact test revealed no significant difference in the distribution of responses between orthodontists and surgeons ($P = .79$), reinforcing the challenge in visually identifying the surgical technique across professional evaluators.

DISCUSSION

Historically, the primary focus of orthodontic and surgical treatments was on hard tissue and teeth. However, soft tissue compatibility has become a critical concept for more precise diagnosis and optimal treatment planning. In this study, we compared the profile esthetic results of skeletal Class III patients treated with CSA and SFA using a Likert scale. The results revealed no significant differences between the raters' evaluations of attractive profiles. With this study, we are the first to compare the profile characteristics of attractive patients between these two orthognathic treatment protocols.

Both orthognathic surgery protocols resulted in treatment outcomes with comparable levels of facial profile attractiveness across all evaluator groups, suggesting that the choice of surgical approach does not significantly impact perceived esthetics. Nonetheless, facial attractiveness remains a subjective construct, influenced by variables such as age, gender, culture, and personality.[13] Additionally, individual variation in soft tissue thickness and morphology, often unrelated to skeletal structure, can affect perception.[14] In this study, patients were matched by age, sex, and skeletal discrepancy to minimize bias and enhance the reliability of esthetic evaluations."

Perceptions of facial attractiveness are influenced by factors such as age, professional background, and clinical experience.[14] Dental professionals are generally more critical of esthetic discrepancies than laypersons,[15] and older orthodontists may be more tolerant of skeletal Class III profiles due to greater clinical exposure.[16] Additionally, variables such as sex, educational level, social

Table 2. Comparisons (Analysis of Variance for Nonparametric Data) Between Evaluator Responses for Esthetic Perception of Patients

		Statistic	*P* Value
Surgeons	Orthodontists	0.315	.754
Surgeons	Laypeople	2.017	.048
Orthodontists	Laypeople	2.332	.023
			$P = .049$[a]

[a] Friedman test. Statistically significant at $P < .05$.

Table 3. Comparison (Analysis of Variance for Nonparametric Data) Between Evaluator Responses for the Type of Surgical Protocol Performed

		Statistic	*P* Value
Surgeons	Orthodontists	1.73	0.088
Surgeons	Laypeople	18.01	$<.001$
Orthodontists	Laypeople	16.28	$<.001$
			$P < .001$[a]

[a] Friedman test. Statistically significant for $P < .05$.

Table 4. Comparison of Scores Given Among Surgeons, Orthodontists, and Laypeople Regarding Esthetic Perception of Patients[a]

		Surgeons	Orthodontists	Laypeople	*P* Value[b]
Conventional	(n = 16)	3.06 ± 0.68	3.13 ± 0.61	3.38 ± 0.50	>.05
Surgery-First	(n = 18)	3.39 ± 0.60	3.28 ± 0.68	3.50 ± 0.51	>.05
P value[c]		.16	.47	.48	

[a] Note. Values are presented as mean ± standard deviation.
[b] One-way analysis of variance.
[c] Independent *t*-test.

status, geographic location, and cultural background can shape esthetic preferences.[17] To control for these confounding factors, evaluators in this study were matched by age, sex, educational level, and had a minimum of 5 years of clinical experience in their respective specialties.

The data evaluating interexaminer agreement in this study were highly correlated between OMSs and orthodontists but lower when compared with laypeople. From this perspective, authors of several studies have demonstrated different assessments between general dentists and laypeople.[18–21] For example, Kokich et al.[18] observed that orthodontists were generally more critical than laypeople and general dentists in detecting esthetic discrepancies. Conversely, Reis et al.[19] found that orthodontists rated smile attractiveness in Class III patients more favorably than laypeople. In contrast, Bou Wadi et al.[21] reported that laypeople were more critical than dentists when evaluating Class III profiles. However, authors of other studies indicated that overall esthetic perception often aligned between clinicians and laypersons.[20]

In this study, evaluators were generally unable to distinguish between the surgical protocols used, underscoring the comparable esthetic outcomes of SFA and CSA. Similarly, authors of previous studies have found no significant differences in facial esthetic improvements between the two approaches.[22,23] However, some authors reported distinct soft tissue changes in SFA patients compared with CSA.[24] From the patient's perspective, these findings may aid in weighing the costs and benefits of each technique, as perceptions of treatment outcomes can vary between protocols.

While the CSA protocol is often preferred by clinicians due to its perceived predictability and stability,[25] the SFA offers advantages such as reduced overall treatment time and the avoidance of facial and functional deterioration associated with presurgical decompensation, all while maintaining comparable postsurgical skeletal stability.[26] However, concerns about relapse following SFA remain, as outcomes can vary depending on patient-specific characteristics.[5] Other authors have also highlighted that the instability of occlusion after surgery caused by premature occlusal contact, especially in SFA, is related to a strong likelihood of more severe postsurgical mandibular advancement.[27] Thus, SFA should not be viewed as universally applicable but, rather, indicated for selected cases with appropriate clinical conditions.

In this study, some limitations must be acknowledged. First, the sample size, although determined by power analysis, may have still limited the detection of subtle differences in esthetic perception. Second, the evaluation of facial attractiveness inherently involves a degree of subjectivity, even when using validated tools such as the Likert scale. Despite including raters from three distinct groups—orthodontists, surgeons, and laypersons—individual perceptions may still vary based on personal and cultural factors. However, it is important to note that both patients and evaluators were Brazilian and represented a range of ethnic backgrounds, which added to the diversity of the sample and enhanced

Table 5. Frequency of Correct and Incorrect Predictions by Evaluators Regarding the Surgical Protocol Performed[a]

	Surgeons		Orthodontists		
Response	Correct	Incorrect	Correct	Incorrect	Laypeople
Conventional	6 (17.6%)	4 (11.8%)	2 (5.9%)	3 (8.8%)	–
Surgery-first	14 (41.2%)	9 (26.5%)	15 (44.1%)	13 (38.2%)	–
Do not know	1 (2.9%)		1 (2.9%)		–
			62%		%[b]
			k = 0.04		k = 0.007
			P = .77[c]		*P* value[bd]
			P = .79[e]		

[a] % agreement.
[b] Not applicable due to low agreement.
[c] Cohen's kappa between specialties.
[d] Fleiss' κ between the three evaluators' groups.
[e] Fisher' exact test between specialties.

the relevance of these findings within the local population. Authors of future studies with larger, different samples, and alternative rating methodologies could further validate these results.

The low agreement among evaluators in identifying the surgical protocol suggested that SFA and CSA yielded highly similar esthetic outcomes. Even professionals had difficulty distinguishing between them, and most laypeople could not tell the difference. This reinforces that both techniques are equally acceptable from an esthetic standpoint. The clinical relevance of this finding lies in demonstrating that both protocols can produce similarly attractive facial results when appropriate case selection is applied. This supports the notion that SFA is a viable treatment option without compromising esthetic expectations. Such insight is valuable for patient counseling, where final facial appearance is often a critical factor in decision-making. Additionally, in clinical practice, these results provide additional justification for considering SFA in cases where shorter treatment duration or immediate surgical correction is prioritized.

CONCLUSIONS

- In this study, we demonstrated no noticeable differences in esthetics of the facial profile of Class III patients between conventional orthognathic surgery and the SFA.
- Regardless of the level of training of the evaluators, it was not possible for them to differentiate the surgical technique used. These findings suggest that both approaches can be equally effective in achieving satisfactory facial esthetics in selected Class III cases.
- The findings reveal notable differences in the accuracy of surgery type identification among surgeons, orthodontists, and laypeople.

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