

**A Comparative Professional Assessment Of Facial Profile Attractiveness In Class III And Class II Individuals: An Eye Tracking Study**

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## Abstract

### Introduction

In modern society attention to physical appearance, particularly of the face, has become a critical aspect.<sup>[1]</sup>The facial profile plays an important role when determining facial attractiveness. Facial harmony of orthodontic patients is clinically judged by Orthodontists to assess the facial profile.<sup>[2]</sup>Perception has been defined

as the process by which patterns of environmental stimuli are organized and interpreted; a variety of physical, physiological, and social factors influence it (Giddon, 1995).<sup>[3]</sup>

In the past, the esthetic facial profile was described very subjectively, and the figure of Greek God

Apollo of Belvedere was referred to describe the concept of beauty. But, over a period of time there has been a change in the standards of beauty possibly due to the mixing of races, global media, customs, religion and age; with stronger traits compared to the straight lines from the Greeks.<sup>[4]</sup>

To understand the perception of facial profile attractiveness several studies have been conducted.<sup>[5]</sup> The orthodontic treatment needs are determined on profile analysis. Based on the studies conducted to determine facial profile preferences in the public it was shown that ethnicity had a strong influence on judging facial attractiveness.<sup>[6]</sup> Nowadays there is an increase in the percentage of people seeking orthodontic treatment to improve their facial and dental esthetic appearance.

As shown by many studies the primary reason for seeking orthognathic surgery is esthetic improvement and esthetic orthognathic surgeries, which alters the facial profile appearance, should be based on ethnic preferences on facial esthetics.<sup>[7]</sup> Research has shown that laypersons range of acceptable facial profiles is wider when compared to that of professional groups.

Several methods are used in the past to evaluate facial profile attractiveness including silhouettes,<sup>[8]</sup> full-face and profile photographic transparencies<sup>[9]</sup>, self-drawings of facial profiles<sup>[10]</sup>, and patients standardized facial photographs.<sup>[11]</sup> Recently, these methods have changed to photograph modification using a computer software including warping the scanned images of treated patients, digital image morphing, etc.

It is a common practice in recent years to use computer software tools to assist in surgical-orthodontic treatment planning and soft tissue prediction.<sup>[12]</sup> The profile view displays the predicted facial soft tissue generated by the program. The treatment planning decisions are based on the understanding of orthodontists and oral surgeons as to

what an attractive facial profile should look like, such as 1-jaw or 2-jaw surgery, to address patient's esthetic concerns and the skeletal-dental discrepancies.<sup>[13]</sup>

In adults, there are multiple ways in which dento skeletal Class II and class III malocclusion can be treated. One of the treatments is camouflage and another option is surgical management, which can often improve the occlusion, dento facial pattern, and profile esthetics.<sup>[14]</sup> The first step towards developing a surgical-orthodontic treatment plan is having a consensus between orthodontists and oral surgeons in their perceptions of facial profile attractiveness. Although for treatment planning various lateral cephalometric analyses have been developed as references, the perception of facial profile attractiveness is complex, can be subjective, and varies between clinicians. Johnston *et al.*<sup>[15]</sup> reported that although concern and awareness of profile appearance is more in Class III patients, yet the likelihood to undergo facial profile changes was more evident in the Class II profile patients.

Studies shown that, in Chinese individuals there was no consensus in professional opinion about the most attractive male profile. While orthodontists preferred a flatter profile, oral surgeons preferred a fuller profile.

The aims of this study were to determine the perception of Indian facial profile attractiveness by orthodontists and oral surgeons in an Asian community and whether the clinician's age, sex, clinical specialty, and number of years in clinical practice were influential factors in the assessment.

## Materials and Methodology

The perception of facial profile attractiveness is complex, can be subjective, and varies between clinicians, though various lateral cephalometric analyses have been developed as references for treatment planning. Treatment planning decisions to address the patient's esthetic

concerns is affected by the perception of orthodontists and oral surgeons as to what constitutes an attractive facial profile.

The present study was conducted on the photographs of four individuals enrolled for orthodontic treatment in department of orthodontics, Vishnu dental college, Bhimavaram. Informed consent from the patients and ethical committee clearance were obtained

### Criteria for Selection of Photographs

#### Inclusion Criteria

- Same ethnicity, race between 20-25 years of age.
- Absence of obvious facial characteristics or style features that would distract the evaluators and effect the results (scars, birthmarks, unusual hair or make-up).
- Absence of deviated dental characteristics, facial asymmetry and gross anomalies.

- Patients who posed for the photographs with eyes open and lips in rest position

#### Exclusion Criteria

- Cleft lip and palate
- Craniofacial anomalies
- Obvious facial asymmetry

The profile picture with class II and class III profile of the male and female subjects with no pronounced dentofacial deformity were selected and categorized into four groups. Group A consists of female class II profile image (Fig 1.), group B consists of female class III profile image (Fig 2.), group C consists of male class II profile image (Fig 3.) and group D consists of male class III profile image (Fig 4.)

Group A	Class II female profile image
Group B	Class III female profile image
Group C	Class II male profile image
Group D	Class III male profile image

#### Image Taking

All the photographs were taken from a standard distance of 4 feet by fixing the camera to the tripod with the subjects sitting erect and looking forward with clinical Frankfort horizontal plane parallel to the floor

#### Image Editing

The captured photographs were converted to JPEG format. These photographs were then imported into commercially available photo editing software (Adobe photoshop). Loop (Fig 5.) and puppet wrap (Fig 6.) tools are used to edit the chosen photograph into desired image (Fig 7.)

The profile pictures of the subjects in group A and C were first altered with Photoshop software (Adobe

Systems) to create 3 additional images simulating the treatment outcome of mandibular advancement surgery, increasing the chin-neck length by 1.0, 2.0, and 3.0 standard deviations. Similar procedure was carried out for the nasolabial angle simulating the treatment outcome of maxillary set back, nasolabial angle was digitally altered to create 3 additional profile types, simulating increases of the nasolabial angle by 2.0, 4.0, and 6.0 standard deviations. The pretreatment profile was used as the starting point for all alterations. Similarly, the profile pictures in group B and D were altered simulating the treatment outcome of mandibular set back and maxillary advancement at the rate of 2mm to create 6 additional images in each group by taking pretreatment image as the

starting point.

The profile images to be assessed were arranged along- side each other (Fig 8.) on a power point slides with two groups on each slide. Pretreatment profile is placed in the center so that it offers clear options for the participants to judge a set of profiles. The maximum achievable maxillary skeletal correction was on the far left and the profile with the maximal mandibular skeletal correction was on the far right.

Twenty orthodontists and 20 oral surgeons from Indian community ranked each set of 7 profiles on a scale of 1 (very attractive) to 7 (least attractive) after arranging these images. These images were evaluated without repeated ranking at the same session with 7 profiles of each sex placed side-by-side. The clinicians were also asked to indicate the most influential of the following profile features: (1) forehead, (2) nose, (3) upper lip, (4) lower lip, (5) chin, (6) upper and lower lip and (7) upper lip, lower lip and chin.

### **Statistical Analysis**

All statistical analyses were carried out by using SPSS (Version 11.0, SPSS). Since the data does not follow normal distribution curve, non-parametric test was used. Chi square test was used to assess the most influential factor for an attractive profile between orthodontist and oral surgeon.

Mann-Whitney U test was used for comparison of median rank scores for each profile between orthodontist and oral surgeon. Spearman correlation test was used to determine the perpetual trends between the orthodontist and oral surgeon. The intra-class correlation coefficient was used in identifying the intragroup correlation between orthodontist and oral surgeon.

### **Results**

A total of 40 clinicians assessed the profile images. Twenty Orthodontist and twenty Oral surgeons.

Most clinicians indicated that their assessments were influenced by the upper-lower lip and chin relationship. No significant difference was found between orthodontist and oral surgeon in terms of the influential profile feature ( $p = 0.888$ , chi square test). Overall correlation was positive between the orthodontists and oral surgeons in terms of profile perception but there is no statistical significance.

According to VAS score, profile A7 in group A was considered as most attractive by both orthodontist and oral surgeon indicating a positive correlation between them in assessing the female class II profile. The correlation between the rank scores of both groups was strong ( $r = 0.091, p = 0.704$ ). However, profile A3 was considered as the least attractive profile with a positive correlation by both the clinicians ( $r = 0.192, p = 0.418$ )

When ranking the female profile with class III pattern, oral surgeons preferred B2 and orthodontists preferred B7 as the most attractive profile showing slight negative correlation between them in assessing the female class III profiles ( $r = -0.235, p = 0.319$ )

In group C, profile images C7 was considered as most attractive by oral surgeons and the same profile image was marked as attractive by orthodontist with a slight variation in their perceptions while assessing the class II male profile. The correlation between both the clinicians was positive ( $r = 0.290, p = 0.216$ )

When ranking the class III male profile, both the clinicians preferred profile image D7 as most attractive and profile image D3 as least attractive with a negative coefficient of correlation ( $r = -0.153, p = 0.52$ )

### **Discussion**

In this study, class II and class III profile images of both the genders were used to create multiple images to be shown to the judges. Adult patients were included in the study instead of teenagers because of a recent

increasing interest of adults in seeking orthodontic treatments and the fact that the final result of the teenagers' treatment is judged by their parents.<sup>[16]</sup> Furthermore, the modified profiles included images from manipulation of the maxilla and the mandible by two standard deviations to account for the different skeletal Class II and III patterns with an isolated single as well as a double jaw discrepancy.<sup>[17][18]</sup>

By using these profile images, orthodontist and oral surgeon were questioned to know the effect of different treatment options influencing facial attractiveness of these profiles. In contrast to the other studies that investigated facial preferences, we recruited oral surgeons instead of general dentist because oral surgeons are more critical and sensitive than general dentist with respect to orthognathic surgical treatment planning as suggested by Jen Soh et al.<sup>[13]</sup>

For orthodontists, the opinions of oral surgeon on attractiveness of faces are important when developing treatment goals for patients with Class II and class III malocclusions.

Bishara et al<sup>[18]</sup> and Almeida- Pedrin et al<sup>[4]</sup> studied profile changes in patients treated with camouflage therapy, whereas Ng et al<sup>[19]</sup>, looked at facial attractiveness before and after surgical mandibular advancement therapy. These studies showed that posttreatment profiles are considered more attractive compared with pre-treatment profiles. These results correspond to the outcome of our study.

The overall ranking trends of orthodontists and oral surgeons were found to be significantly correlated, indicating that both groups of professionals shared similar perceptions of profile attractiveness.

The accuracy of computer-predicted outcomes of orthognathic surgery has been examined in several studies.<sup>[28]</sup> The most significant area of error in prediction

by computer-prediction programs was the lower lip area. Although these errors were generally less than 2 mm, they could have clinical implications. The mean accuracy of the predictions was relatively high.<sup>[29]</sup> That is why it was warranted to use modified images in this study.

In class II female profiles, profile A7 (mandibular advancement of 6 mm with reduction genioplasty) with most advanced mandibular position and reduction genioplasty was considered more attractive than the untreated profile by both the clinicians. The coefficient of correlation was ( $r = 0.091$ ) indicating a slight positive correlation between the orthodontist and oral surgeon and a P value of 0.007 shows that no statistical significant correlation is present between the clinicians in assessing female class II profile.

This agrees with findings from other studies.<sup>[13,22]</sup> A mandibular advancement of 6 mm was sufficient to increase significantly the appreciation of the profile. However, increases of 9 to 12 mm were significantly more appreciated. Loi et al<sup>[23]</sup> stated that, for the female profile, a straight profile with a reduced lower face height was found to be the most preferred for the Japanese female profile judged by a Japanese sample population.

In class III female profiles, oral surgeons preferred B2 (mandibular setback of 4mm and maxillary advancement of 4 mm) and orthodontist preferred B7 (mandibular setback of 6mm) as the most attractive profile than the pretreatment profile image B4. The coefficient of correlation ( $r = - 0.235$ ) indicates a negative correlation between the orthodontist and oral surgeon while assessing female class III profiles and P value of 0.314 shows that it was not statistically significant. Manipulation of a single jaw per image would help identify whether a maxillary or a mandibular discrepancy was more critical in influencing the perception of facial esthetics. In our study, mandibular setback without

maxillary advancement was preferred by orthodontist whereas mandibular setback with maxillary advancement resulting in a change in the nasolabial angle was preferred by the oral surgeon.

However, according to Cox et al<sup>[24]</sup>, class III silhouette photographs showed no difference in attractiveness among orthodontist and layperson. In our study, the judges were offered at random a set of photographs with large variations in the profiles. It can be assumed that a large variation in the nasolabial angle interfered with objective assessments showing negative association between orthodontist and oral surgeons while assessing female class III profile.

In class II male profiles, profile image C7 was considered as most attractive by oral surgeons and the same profile image was marked as attractive by orthodontist with a correlation coefficient of ( $r = 0.290$ ) indicating slight variation in their perceptions while assessing the class II male profile. Straight profiles are considered more attractive than convex or concave profiles.

Previous studies found that both camouflage therapy and mandibular advancement surgery contributed to a straighter profile.<sup>[25,26]</sup> However, when computer imaging is used to show the change in facial profile that would result from mandibular advancement surgery as a method for correcting a Class II problem, the straighter profile usually looks dramatically better to the orthodontist and oral surgeon. Profiles with a chin-neck length of 54 and 57 mm were equally judged as most attractive. This was in accordance with the study conducted by Aylin Gozde et al.<sup>[14]</sup>

When ranking the class III male profile, both the groups preferred profile image D7 (mandibular advancement of 6 mm) is more attractive than pre-treatment profile by both orthodontist and oral surgeon. The coefficient of

correlation was ( $r = -0.153$ ) indicating a slight variation in their perceptions while assessing male class III profiles. In our study mandibular setback without maxillary advancement was preferred by orthodontist and oral surgeon. These results indicate that in treatment of a Class III patient, the outcome of mandibular setback was considered more attractive than bi-jaw surgery. Nevertheless, the outcomes of both treatment approaches were considered better than an untreated Class III profile. This is in agreement with the results obtained by Soh et al<sup>[13]</sup>, Mantzikos<sup>[27]</sup>, Maganzini et al<sup>[28]</sup> (Chinese participants), Trehan et al (Indian raters), which ranked the concave facial profile with a mandibular prognathism as the worst profile.

It is obvious from this study that class II profiles with mandibular retrusion were perceived to be less attractive than class III profiles with mandibular protrusion. This finding is similar to the findings of a previous study suggesting that the retrusion of either jaw is more critical than the protrusion of jaws in evaluations by both orthodontists and patients.<sup>[16]</sup> There was also no significant difference between men and women in this study, a finding that agrees with several other studies showing the absence of a significant influence of sex on profile images. Although the intra group relation shown that it is statistically not significant the overall correlation coefficient was found to be statistically significant with a P value of 0.000

In this study most of the clinicians indicated that their assessments were influenced by the upper-lower lip and chin relationship. And there was no significant difference found between orthodontists and oral surgeons. Czarnecki et al, when evaluating the role of the nose, lips and chin in obtaining a balanced facial profile, also found similar results and concluded that straight profiles, with the menton slightly prominent, are more accepted to

white male faces than to white female faces.

In this study, VAS was used as measurement instruments. According to Maple et al,<sup>[29]</sup> this scale permits a quick measurement, easy reading and greater freedom in data analysis. The VAS has proven to be a reliable and valid form of rating facial attractiveness. Even though minor differences were seen, the overall results from this VAS seemed to agree.

### Limitations of the Study

- Small sample size.
- Gender and Clinical experience of the clinicians were not considered.

### Conclusion

While assessing class II and class III profiles upper lip, lower lip and chin were the most influencing factors in both male and females. Straight profile was perceived to be more attractive with an overall positive correlation among orthodontist and oral surgeons. The following are further conclusions that can be drawn from the study

1. The least attractive profile judged by both the clinicians is the baseline class II and class III pre-treatment profile.
2. There exists a positive correlation in assessing the class II profiles with mandibular retrognathism between the judges.
3. Orthodontists preferred single jaw surgery with mandibular setback while the oral surgeons preferred bi-jaw surgery with mandibular set back and maxillary advancement while assessing the class III profile images.
4. There was a slight negative correlation while assessing the class III profiles with mandibular prognathism.

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COLOR PLATE 1: MATERIALS



Fig. 1: Group A



Fig. 2: Group B

COLOR PLATE 2: MATERIALS



Fig. 3: Group C



Fig. 4: Group D

COLOR PLATE 3: MATERIALS



Fig. 5: Image editing with loop tool



Fig. 6: Image editing with rubber wrap tool



Fig. 7: Alterations done at desired points

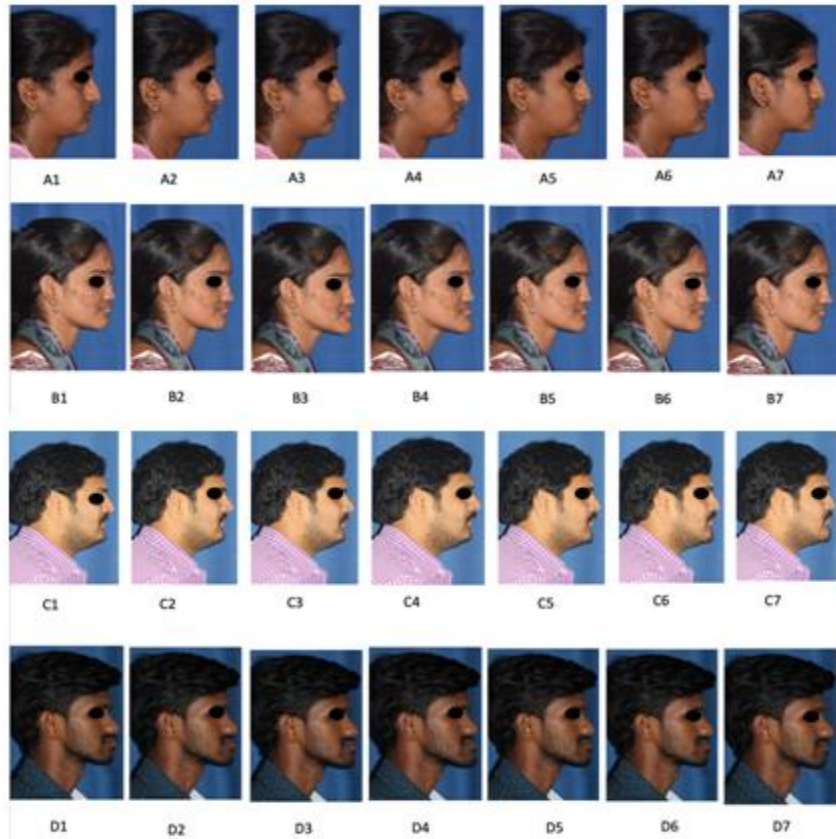


Fig. 8: Arrangement of images for rating

Table 1: Most influencing factor considered in profile assessment

Profile feature	Orthodontists N=20	Oral Surgeons N=20	Total N=40	P value
Fore head	0	0	0	0.888
Nose	1	1	2	
Upper lip	0	0	0	
Lower lip	0	0	0	
chin	7	9	16	
Upper and lower lip	2	1	3	
Upper lip, lower lip and chin	10	9	19	

**Table1.** Shows that upper lip – lower lip and chin relationship were considered as the most influencing factors by orthodontist and oral surgeons while assessing

the profile pictures and there is no statistically significant difference between them with a p value of 0.888

**Table2.** Descriptive statistics and correlation values for orthodontist and oral surgeons

	Orthodontist (N=20)			Oral surgeon (N=20)			Correlation coefficient	P value
	Mean	Median	Mode	Mean	Median	Mode		
Most attractive in group A	5.95	6.5	7	6.15	7.0	7	0.091	0.704
Attractive in group A	4.95	5.0	5	4.6	5.0	6	0.186	0.432
Least attractive in group A	2.10	1.0	1	3.35	3.5	1,4	0.192	0.418
Most attractive in group B	4.70	6.0	7	4.35	4.0	10	0.363	0.116
Attractive in group B	3.95	3.5	2	3.3	2.0	1,2	-0.235	0.319
Least attractive in group B	3.75	4.0	4	4.05	4.0	4	-0.235	0.319
Most attractive in group C	5.5	6.0	6	5.95	6.5	7	0.290	0.216
Attractive in group C	4.45	5.0	7,2,6	4.35	5.0	5,6	0.207	0.38
Least attractive in group C	3.05	2.5	1	2.25	2.0	1	-0.058	0.809
Most attractive in group D	5.8	7.0	7	4.95	7.0	7	-0.153	0.52
Attractive in group D	3.2	1.5	1	4.2	5.0	6	0.042	0.861
Least attractive in group D	4.15	4.0	4	3.95	4.0	4	-0.016	0.947

**Table 2.** Shows the correlation between orthodontist and oral surgeons while assessing the class II and class III profiles.