

An Appraisal of Indian Profile Attractiveness using Digital Image Morphing

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ABSTRACT

Objective: The aim of this study was to compare the perception of male and female Indian facial profile esthetics between dental specialists, dentists, dental students and laypersons.

Need for study: It was necessary to assess the profile preferences of Indian adults, as similar study has not been done till date for the Indian population.

Materials and methods: The facial profile photographs and lateral cephalometric radiographs of an Indian man and a woman were digitized. The digital images were modified using Viewbox 3.1 software to obtain seven facial profiles for each sex. An online and a paper questionnaire was created and a total of 343 subjects assessed the profile attractiveness.

Results: Orthognathic profiles were considered highly attractive for Indian males and females by all the four groups. Bimaxillary protrusion for males and maxillary protrusion for females were found to be least attractive for the Indian population. All groups were highly correlated for the perception of male and female profile esthetics.

Conclusion: Most preferred is orthognathic profile in both sexes. The least attractive profiles were bimaxillary protrusion for males and maxillary protrusion for females. It was found that female mild bimaxillary protrusion cases can be treated without extraction, whereas extraction treatment can be used in similar male cases. While mandible position was more critical for males, it was maxillary position in case of females.

Keywords: Profile attractiveness, Indian, Digital image morphing.

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INTRODUCTION

The secret of beauty and attractiveness has been a quest of humans for as long as we have been civilized. Many women (and some 'metrosexual' men) spend up to one-third of their income on looking good. Why? Because looking good is a universal human preoccupation. We acknowledge that our perception of beauty is as culturally driven, as it is a matter of personal perception. Every culture, at every time in history, is or has been preoccupied with good looks.

Although a concept of 'ideal orthodontic norms' has been accepted widely, public preferences sometimes do not concur with orthodontic standards.¹ Ethnic and racial differences play a major role in diversifying esthetic preferences.¹⁻³ Several factors such as sex, age, education, socioeconomic status and

geographic location also affect the esthetic preferences of the public.^{1,3-6}

The contributions of orthodontic and orthognathic treatment to the esthetic well-being of individuals cannot be ignored. When planning an orthodontic treatment, orthodontic standards must concur with the public's esthetic perceptions and norms. This is very important because facial esthetics has been found to be an important determinant of self and social perceptions.⁷⁻¹³ Profile esthetics is not only one of the motives that encourages most patients to seek orthodontic care but it is also one of the most important objectives of dental treatment.¹⁴⁻¹⁶

Previous methods used to assess facial profile attractiveness included profile line drawings, silhouettes, facial photographs and photographic transparencies.¹⁷⁻²⁰

Maganzini et al³ found that native Chinese laypersons considered male profiles with either dental retrusion or bimaxillary protrusion, in a balanced skeletal relationship to be equally attractive. A study by Mantzikos¹ on the Japanese population, found that a straight profile was ranked the best and mandibular retrognathic and prognathic profiles were ranked poorly. Lew et al²¹ studied the facial profile preferences of Asian teenagers and found that orthognathic and mandibular prognathic profiles were ranked the best and worst, respectively. Cochrane et al²² compared the perceptions between clinicians, dental students and the public in a white community. Significant differences in the perceptions of the three groups were found,

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with a greater tendency for clinicians to rank a skeletal Class I profile as the most attractive.

Ackerman and Proffit²³ provided clinical guidelines for facial profile esthetics. As with all clinical judgments, an element of subjectivity in one's perception of an esthetic profile would be expected. However, the perceptions of patients might not be consistent with those of clinicians,²⁴ so that patients' subjective responses about facial esthetics should be of interest to orthodontists. Such information could facilitate communication between clinicians and patients.

Therefore, the aim of this study was:

- To determine the esthetic preferences of Indian population on facial profile
- To compare the perceptions of male and female Indian facial profile esthetics between orthodontists and maxillofacial surgeons, dentists, dental students and laypersons.

MATERIALS AND METHODS

Profile photographs of an Indian man and an Indian woman having orthognathic profiles with Class I occlusions and normal cephalometric values were taken by using a NIKON D3000 camera with a NIKKOR 18 to 55 lens. The profile photographs were standardized by positioning the patient 5 feet from the camera with the head in natural posture. Natural head posture was determined by the method described by Showfety et al.²⁵ Lateral cephalograms were scanned using an Umax Astra 4000U scanner. The scanned image and color digital photographs were transferred to a Dell Inspiron laptop. Viewbox 3.1 cephalometric software (dHAL software, Kifissia, Greece) was used for generating profile distortions (Fig. 1).

First, color images were superimposed over lateral cephalograms. The original images (M4 of Fig. 2, F5 of Fig. 3), with their respective lateral cephalograms were later used to generate six other manipulated images by altering the hard tissue cephalometric normative values by at least two standard deviations. The facial profile images were digitally manipulated in the anteroposterior plane with little or no changes to the vertical plane. This was carried out so that each morphed profile had a normal vertical proportion. These seven profiles accounted for the possible anteroposterior growth variations of the maxilla and mandible. Each image had only one skeletal or bimaxillary dental component manipulated.



Fig. 1: Morphing with viewbox 3.1

The Indian male and female profiles are as follows (Figs 2 and 3): M1 and F3 (bimaxillary protrusion) represented profiles having advanced maxillary and mandibular anterior alveolar segments with increased maxillary and mandibular incisal inclination to produce upper and lower lip protrusion without altering the anteroposterior position of the mandible. M2 and F4 (protrusive mandible) represented profiles with anterior advancement of the mandible only. M3 and F1 (retrusive mandible) represented profiles with posterior positioning of the mandible only. M4 and F5 (normal profile) represented orthognathic profiles with skeletal Class I basal relationships and Class I incisors with average normative cephalometric values. They were used as the templates from which the other six profiles were derived. M5 and F2 (retrusive maxilla) were digitally constructed profiles with posterior positioning of the maxilla only. M6 and F6 (protrusive maxilla) were digitally constructed profiles with anteriorly advanced maxillae only. M7 and F7 (bimaxillary retrusion) were digitally constructed to represent flatter profiles with upright maxillary and mandibular incisors and less protrusive anterior alveolar segments.

A survey was created online using professional survey solutions (online survey location: http://www.kwiksurveys.com?s=HBIOGG_baa0f230), where the respondents were asked to click and answer a few questions. The same survey was printed and responses were collected locally.

A total of 343 raters (117 females, 226 males; mean age 24.9 ± 5.9 years; 104 online, 239 paper) were asked to evaluate and rank the profiles.

The participants were asked to rank the seven profiles of each sex on a scale of one (very attractive) to seven (least attractive) without any repeat of rank at the same session. The seven profiles of each sex were placed side by side for assessment at the same session. The participants were also asked which feature of the profile was most influential in their overall ranking, by selecting one of these choices: (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.

The participants were divided into four groups:

1. Group OO: Orthodontists and maxillofacial surgeons
2. Group D: Dentists excluding Group OO
3. Group DS: Dental students
4. Group GP: General people.

STATISTICAL ANALYSIS

All statistical analyses were carried out by using SPSS (Version 11.0, SPSS, Chicago, Ill). Rank scores given by Group OO, Group D, Group DS and Group GP for each profile were compared using Kruskal-Wallis tests. Pairwise comparisons were performed with Mann-Whitney U-tests. Mean ranks for each profile and modes for each group were also calculated. Spearman rank correlation coefficients were used to determine the similarity between the perceptions of dental professionals,

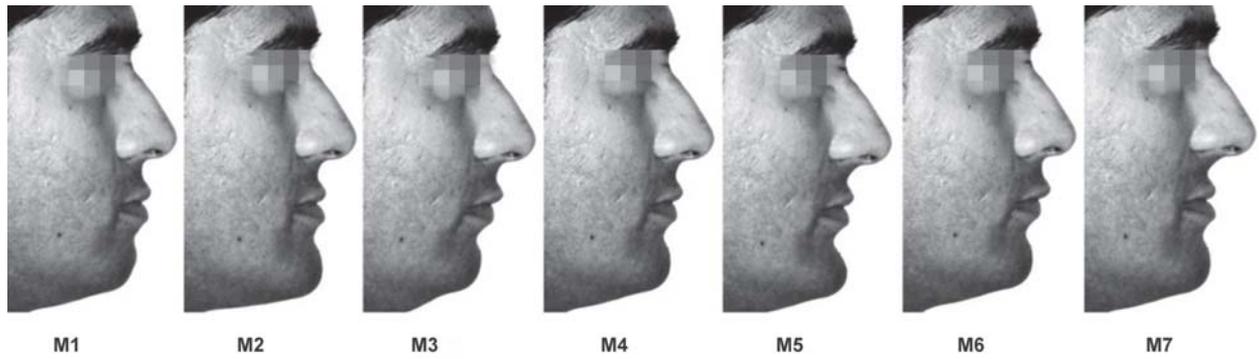


Fig. 2: Male facial profiles—M1: bimaxillary protrusion; M2: protrusive mandible; M3: retrusive mandible; M4: normal profile; M5: retrusive maxilla; M6: protrusive maxilla; M7: bimaxillary retrusion



Fig. 3: Female facial profiles—F1: retrusive mandible; F2: retrusive maxilla; F3: bimaxillary protrusion; F4: protrusive mandible; F5: normal profile; F6: protrusive maxilla; F7: bimaxillary retrusion

dental students and laypersons. Statistical significance was set at $p < 0.05$, unless otherwise adjusted.

RESULTS

The sample consisted of 64 dental professionals (39 orthodontists and 25 oral surgeons), 77 dentists, 80 dental students and 122 laypersons from all over India. The laypersons were well-educated and not employed in hospitals. The online survey fetched a total of 112 responses, out of which, 8 were rejected for being invalid or incomplete. The local survey pooled the rest of the sample.

Table 1 gives the demographic data of our study. Out of the 343 participants, 18.6% were orthodontists and oral surgeons and 34.1% were women. The mean (SD) age of the participants was 25.5(6.05) years. ‘Upper lip, lower lip and chin’ was chosen by the majority (70.2%) as the most influential feature of the

profile in their overall ranking, as shown in Table 2. The mean ranks of dental professionals (DP), dental students (DS), and laypersons (LP) for the profiles are shown in Table 3. The graphs for the mean rankings of male and female profiles are shown in Figures 4 and 5 respectively.

Of the male profiles, the normal profile (M4) and the bimaxillary protrusion (M1) were ranked the most and least attractive respectively, by all four groups. There was no significant difference in the rank scores for bimaxillary protrusion (M1), protrusive mandible (M2), normal profile (M4), retrusive maxilla (M5), protrusive maxilla (M6) and bimaxillary retrusion (M7). Significant differences were found in the rank scores for retrusive mandible (M3) (Table 3 and Fig. 4).

Pairwise comparisons (Table 4) showed that OO ranked M6 slightly more attractive than D ($p < 0.05$). GP considered M5 slightly more attractive than O ($p < 0.05$) and M4 a little

Table 1: Demographic profile of respondents

Characteristic		Group OO (n = 64)	Group D (n = 77)	Group DS (n = 80)	Group GP (n = 122)
Sex	Males	60 (94)	49 (64)	41 (51)	76 (63)
	Females	4 (6)	28 (36)	39 (49)	46 (37)
Age (years)	Mean	29.13	25.87	21.31	24.41
	SD	4.49	3.78	2.7	7.64

Table 2: Most influential profile feature for ranking facial profile esthetics

Feature	Group OO (n = 64)	Group D (n = 77)	Group DS (n = 80)	Group GP (n = 122)	Total (n = 343)
Forehead	0	0	2 (3)	1 (1)	3 (1)
Nose	1 (1)	2 (3)	12 (15)	15 (13)	30 (9)
Upper lip	0	2 (3)	0	6 (5)	8 (2)
Lower lip	2 (3)	0	4 (5)	7 (6)	13 (4)
Chin	6 (9)	8 (10)	8 (10)	28 (23)	50 (14)
Upper lip Lower lip and chin	55 (86)	65 (84)	54 (68)	65 (53)	239 (70)

$\chi^2 = 49.1$; $p < 0.001$ (HS)

Table 3: Mean ranks, SD and modes of male and female profiles given by orthodontists and oral surgeons, dentists, dental students and laypersons

Photograph	Group OO (n = 64)			Group D (n = 77)			Group DS (n = 80)			Group GP (n = 122)			p*
	Mode	Mean	SD	Mode	Mean	SD	Mode	Mean	SD	Mode	Mean	SD	
Males													
M1	7	5.2	2.0	7	5.5	2.0	7	5.1	1.9	7	5.5	2.1	0.13 NS
M2	4	4.0	1.4	5	3.9	1.7	5	3.8	1.9	5	4.0	1.8	0.76 NS
M3	4	4.6	1.7	6	4.8	1.6	7	5.2	1.7	4	4.5	1.6	0.02 S
M4	1	2.3	1.8	1	2.1	1.6	1	2.2	1.5	1	2.6	1.7	0.15 NS
M5	2	4.1	2.0	2	3.7	1.8	3	3.8	1.9	2	3.5	1.9	0.14 NS
M6	3	3.1	1.7	3	3.6	1.5	5	3.6	1.6	3	3.4	1.6	0.19 NS
M7	6	4.5	1.9	6	4.4	1.9	3	4.3	1.9	6	4.7	1.9	0.48 NS
Females													
F1	2	3.0	1.6	2	3.1	1.7	2	3.8	1.9	2	3.7	2.0	0.02 S
F2	4	3.6	1.4	4	3.6	1.4	2	3.0	1.7	4	3.5	1.7	0.7 NS
F3	6	4.7	1.8	6	5.0	1.7	7	4.8	1.7	6	4.8	1.9	0.67 NS
F4	6	5.3	1.3	5	5.2	1.3	6	4.6	1.8	5	4.7	1.5	0.02 S
F5	1	2.5	1.9	1	1.9	1.6	1	2.6	1.7	1	2.4	1.6	0.02 S
F6	7	5.1	2.1	7	5.6	1.5	7	5.5	1.7	7	4.9	2.0	0.15 NS
F7	3	3.9	1.9	3	3.5	1.7	6	3.8	2.0	3	3.8	2.0	0.86 NS

*Kruskall-Wallis test; S: Significant; NS: Nonsignificant

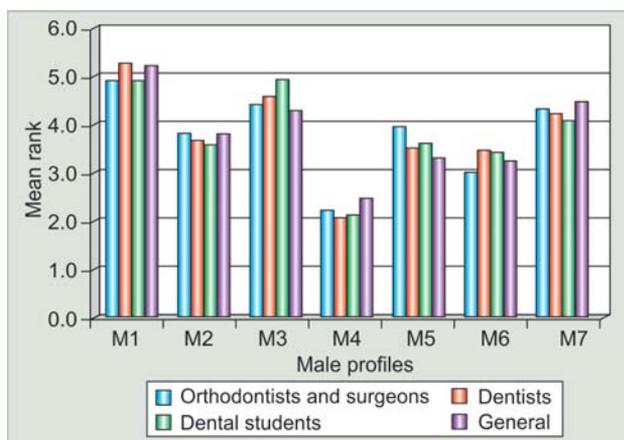


Fig. 4: Comparison of mean ranks for male profiles

less attractive than D ($p < 0.05$). M3 was considered highly unattractive by DS when compared to OO and GP ($p < 0.05$).

Among the female profiles, normal profile (F5) was ranked the most attractive by all four groups whereas protrusive maxilla (F6) was ranked the least attractive. There was no significant difference in the rank scores for retrusive maxilla (F2), bimaxillary protrusion (F3), protrusive maxilla (F6) and bimaxillary retrusion (F7). Significant differences were found in the ranking of retrusive mandible (F1), protrusive mandible (F4) ($P < 0.05$) and normal profile (F6) ($p < 0.05$) (Table 3 and Fig. 5).

Pairwise comparison (Table 5) found that DS ranked F2 and F4 slightly more attractive than OO, whereas F1 was ranked slightly less attractive ($p < 0.05$). D ranked F1 as slightly more

Table 4: Pairwise comparison for male profiles

Photograph	p*-value I & II	I & III	I & IV	II & III	II & IV	III & IV
M1	0.18 NS	0.67 NS	0.27 NS	0.04 S	0.64 NS	0.06 NS
M2	0.85 NS	0.42 NS	0.80 NS	0.60 NS	0.58 NS	0.30 NS
M3	0.58 NS	0.04 S	0.58 NS	0.09 NS	0.21 NS	0.003 S
M4	0.72 NS	0.74 NS	0.13 NS	0.44 NS	0.04 S	0.16 NS
M5	0.16 NS	0.28 NS	0.02 S	0.68 NS	0.40 NS	0.19 NS
M6	0.04 S	0.09 NS	0.30 NS	0.97 NS	0.23 NS	0.38 NS
M7	0.67 NS	0.39 NS	0.66 NS	0.61 NS	0.34 NS	0.13 NS

* Mann-Whitney U-test p-value, S: Significant; NS: Nonsignificant

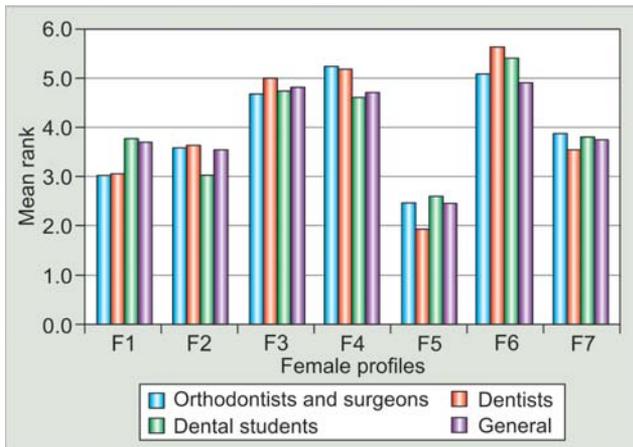


Fig. 5: Comparison of mean ranks for female profiles

attractive than DS and GP ($p < 0.05$). GP ranked F4 slightly more attractive than either OO and D ($p < 0.05$).

High and positive correlations in the ranking of male and female esthetics are shown in Table 6. All the correlations in the ranking of male and female esthetics were significant ($p < 0.05$).

DISCUSSION

The aim of this study was to determine esthetic profile preferences of Indian population. A major part of the survey was online to account for regional variations in the profile preferences. The online survey enabled the authors to get

response from all over the country. Though it can be argued that the online survey would make the study biased by reaching only those who have access to internet, but, in fact, it acts as an advantage for this particular study as it makes sure that those people are targeted who have access to internet. Access to internet would imply a decent socioeconomic status and well-informed respondents.

Physical appearance has been found to be an important determinant of an individual's social status.^{7-10,12} The facial esthetics and functions of a patient are improved by orthodontic and orthognathic treatment. Allowing patients to view possible posttreatment results before treatment, prevents disappointments in expectations. Thus, the patient gets informed about treatment limits. Video imaging method has been used for determining to what extent scientific and social esthetic criteria could be applied to patient. Thus, orthodontic and orthognathic treatment plans could be performed interactively.

Several methods have been used in the literature for determining profile preferences of populations.^{3,26-28} In this study, black and white profile photographs were used to determine the esthetic preferences of the Indian population. Black and white photographs were chosen to avoid any bias occurring due to preferences in skin color, tone or texture of hair color.

Our study included facial profiles of both sexes for assessment. In addition, the generated profiles included images from manipulation of the maxilla, the mandible or a dental

Table 5: Pairwise comparison for female profiles

Photograph	I & II	I & III	p*-value I & IV	II & III	II & IV	III & IV
F1	0.78 NS	0.02 S	0.05 NS	0.02 S	0.03 S	0.78 NS
F2	0.7 NS	0.02 S	0.84 NS	0.02 S	0.97 NS	0.06 NS
F3	0.31 NS	0.99 NS	0.50 NS	0.26 NS	0.69 NS	0.53 NS
F4	0.75 NS	0.04 S	0.01 S	0.05 NS	0.02 S	0.95 NS
F5	0.09 NS	0.30 NS	0.63 NS	0.002 S	0.007 S	0.48 NS
F6	0.33 NS	0.50 NS	0.54 NS	0.70 NS	0.04 S	0.10 NS
F7	0.38 NS	0.67 NS	0.69 NS	0.56 NS	0.64 NS	0.90 NS

*Mann-Whitney U-test
S: Significant; NS: Nonsignificant

Table 6: Karl Pearson's coefficients of mean rank for male and female profile esthetics

	Male profile				Female profile			
	Orthodontists and surgeons	Dentists	Dental students	General	Orthodontists and surgeons	Dentists	Dental students	General
Orthodontist and surgeons	—	0.95, 0.001 HS	0.91, 0.002 S	0.94, 0.002 S	—	0.97, 0.001 HS	0.37, 0.01 S	0.93, 0.002 S
Dentists	—	—	0.90, 0.005 HS	0.96, 0.001 HS	—	—	0.90, 0.005 S	0.97, 0.001 HS
Dental students	—	—	—	0.85, 0.01S	—	—	—	0.90, 0.005 S
General	—	—	—	—	—	—	—	—

Karl Pearson's coefficient, p-value,
S: Significant; Hs: Highly significant

component to account for the different skeletal Class II and III patterns with an isolated single jaw discrepancy. Facial profiles, with vertical disproportions, were not included because many surgical-orthodontic treatment plans would normally include correction of vertical skeletal discrepancies independent of patients' main concerns. Adult laypersons were chosen instead of teenagers because of the recent trend of more adults seeking orthodontic treatment and orthognathic surgery. The manipulated profile images were generated without extreme anteroposterior hard-tissue changes to provide the more realistic soft-tissue profiles encountered clinically. The order of arrangement was different between the male and female profiles to prevent profile pattern recognition during the assessment.

'Upper lip, lower lip and chin' was chosen by the majority (70.2%) as the most influential feature of the profile in their overall ranking, as shown in Table 2. The preference of all four groups varied and the difference was statistically significant. This clearly reflected the effect of difference in conditioning of the four groups because of varying levels of education in the field of esthetics.

Various physical, psychological, and social factors that affect perceptual judgments are related to the development of a personal concept of facial esthetics.²⁹ Several studies have investigated facial esthetic preferences of different races, ethnicities, and cultures and described the differences among them. It was suggested that the profile standards of Ricketts, Steiner and Holdaway do not apply to Africans,³⁰ and that orthodontists and laypersons of African descent prefer more convex bialveolar protrusive profiles than white orthodontists and white laypersons.^{2,31} African's profile preferences are straighter than the norm for their race, but more protrusive than white standards.³² Asians, on the other hand, prefer straight or bimaxillary retrusive profiles with a more protrusive nose in females and a more retrusive chin in males than do white people.^{1,33-36} Hispanics prefer the upper and lower lip positions to be less protrusive than those of whites and the mean protrusion preference among whites is significantly greater than the norm of Ricketts for whites.³⁷

In spite of these findings, there is a general preference among orthodontists and laypersons for an orthognathic profile and orthodontists consider the most pleasing profile to be more forward than do laypeople.³⁸ The respondents in this study also preferred orthognathic profiles. According to the results of this study, the orthognathic profile was the most attractive and preferred one among both males and females. For the males, bimaxillary protrusion was considered the least attractive whereas for the females, maxillary protrusion was considered the least attractive.

Both orthodontists and laypeople are more tolerant of bimaxillary protrusion in women than in men and fuller lips could also enhance extreme retrognathic and prognathic profiles.^{34,39} This agrees with our results; laypeople who rated the profiles liked bimaxillary protrusive female profiles better than males. This finding can be clinically important for females bordering extractions and lead to a decision to treat them without extractions.

Extraction of two maxillary premolars could result in many changes of upper lip and incisor positions, especially in patients with a thin upper lip, in whom an increased nasolabial angle will be most obvious.⁴⁰ The most attractive male profile in our study was straight, followed by the profile with a more prominent maxilla. That can be clinically applicable in borderline patients in deciding between surgical and camouflage treatment of male patients with prognathic maxilla. Also, in male patients with severe crowding, extraction treatment can be better justified. Similar esthetic preferences were found in Turkish population, leading to the same conclusions in treatment protocols.⁴¹

Limiting the manipulation to one jaw per image would permit identifying whether a maxillary or a mandibular problem was more critical in influencing the perception of facial esthetics. It is obvious from this study that profiles with mandibular protrusion or retrusion were perceived to be less attractive than profiles with maxillary retrusion or protrusion in males. Whereas for the Indian females, retrusion of maxilla or mandible was found to be more acceptable than the protrusion of these jaws. The protrusion of maxilla was found to be even more unattractive than the protrusion of mandible. This finding suggests that in Indian population, the position of the mandible is more critical in males than that of the maxilla, whereas the reverse is true for the females.

Another finding of this study is that GP considered M5 slightly more attractive than OO. The general population is more tolerant of a male profile with retrusive maxilla than the orthodontists and maxillofacial surgeons. This should be kept in mind when treating cases with maxillary retrusion in male patients, especially the borderline cases.

Although a single jaw discrepancy might not be commonly encountered in actual clinical situations, many skeletal malocclusions involve both maxilla and mandible. This finding suggests that the perception of a successful surgical outcome might depend more on the corrected anteroposterior position of the mandible than that of the maxilla in double-jaw surgeries.

Though there were some differences in facial profile preferences between different groups that were statistically significant, this did not change the general sequence of preferences of male and female profiles as suggested by the modes for each facial profile. The ideals of both male and female beauty are well-established and are widespread even in laypersons, probably because of the influence of mass media and peer groups.

Although differing across the globe, beauty standards are an important part of the cultural landscape. Demonstrating status, social acceptance and suitability as a mate, physical aesthetics affect how people view themselves and those around them. Health, fitness and social expectations are consistent in standards of beauty across cultures, although in different cultures people have their own ideas about what makes one beautiful. While time and social conditions can alter these standards, what remains the same is that the notion of beauty is unchanging and powerful.

The results of this study will enhance our understanding of the ways our patients make esthetic judgments.

CONCLUSION

- In the Indian population, the orthognathic profile in both sexes is the most preferred profile.
- In males, the bimaxillary protrusion is considered the least attractive.
- In females, protrusive maxilla is considered the least attractive.
- Mild bimaxillary protrusion cases in females can be treated without extraction, whereas extraction treatment can be used in similar male cases.
- In the Indian population, the position of the mandible is more critical in males than that of the maxilla, whereas the reverse is true for the females.

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