Esthetic evaluation of incisor inclination in smiling profiles with respect to mandibular position

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Introduction: The smile is a key facial expression, and a careful assessment of the facial profile in smiling is an essential part of a complete orthodontic diagnosis. The aim of this study was to determine the preferred maxillary incisor inclination in the smile profile with regard to different mandibular positions. **Methods:** A smiling profile photograph of a man with normal facial profile features was altered digitally to obtain 3 different mandibular sagittal positions in 4-mm decrements or increments from −4 to +4 mm. In each mandibular position, the inclination of the maxillary incisors was changed from −10° to +10° in 5° increments. A total of 234 raters (72 senior dental students, 24 orthodontists, 21 maxillofacial surgeons, 25 prosthodontists, and 92 laypeople) were asked to score each photograph using a Likert-type rating scale. Mann-Whitney, Kruskal-Wallis, and intraclass correlation coefficient tests were used to analyze the data. **Results:** In retruded and protruded mandibles, normal incisor inclination and the most retroclined incisors were selected as the most and the least attractive images, respectively, by almost all groups. With an orthognathic mandible, the image with the most retroclined incisors was selected as the least attractive, but the raters were not unanimous regarding the most attractive image. The intraclass correlation coefficient was 0.82 (high level of agreement). Also, the sex of the raters had no effect on the rating of the photographs. **Conclusions:** It is crucial to establish a normal incisor inclination, especially in patients with a mandibular deficiency or excess. An excessive maxillary incisor lingual inclination should be avoided regardless of the mandibular position. (Am J Orthod Dentofacial Orthop 2015;148:387-95)

Improving facial esthetics has gained more popularity with the advent of the soft tissue paradigm and is a main goal in the treatment of orthodontic patients.[1] The mouth is an important feature in facial attractiveness,[2-5] and a facial smiling profile assessment is an integral part of a complete orthodontic diagnosis.[6] Kerns et al[7] reported that from an esthetic viewpoint, the profile and frontal views of the same smile were not rated similarly; the former was rated higher than the latter. Buccolingual inclination of the maxillary incisors also plays a major role in profile smile attractiveness.[6,8]

To improve the prediction of the most proper position of the maxillary incisors, several profilometric studies have been conducted.[6,9,10] Schlosser et al[9] compared the preferences of orthodontists and laypeople with regard to the buccolingual position of the maxillary incisors in smiling profiles. This study showed a higher level of acceptance with maxillary incisor protrusion than with retrusion in both panels and therefore suggested either not to retract a normally protrusive maxillary dentition or to advance rather than retract the maxillary anterior teeth. In another study by Ghaleb et al,[10] 3 groups including dentists, orthodontists, and laypeople scored the attractiveness of smiling profiles based on maxillary incisor inclinations. The results showed that a 5° protrusion of the maxillary incisors from the normal inclination had the highest rate of appeal among the raters. A statistically significant difference was found among different groups regardless of the sex of the raters of the preferred profile photographs.

Cao et al[6] reported that the smiling profile with a 5° lingual incisor inclination was the most favorable among their panels (orthodontists and undergraduate students), whereas the profiles with 15° of labial inclination received the lowest scores.

Although previous studies of profile esthetics have mainly focused on the position or the inclination of the maxillary incisors in profile views with normal mandibular position, to our knowledge, no studies have yet evaluated the esthetic effects of maxillary incisor inclination with regard to different mandibular positions in smiling profiles.[6,9,10] Moreover, the mandibular position is a characteristic of the patient's inherent underlying skeletal pattern and is difficult to alter during orthodontic treatment. Therefore, it may be important for clinicians to take into account the balance between the incisor inclination and the mandibular sagittal position. This information might assist orthodontists in considering mandibular position in treatment planning for choosing the appropriate inclination for the maxillary incisors.

The objectives of this study were to determine the preferred maxillary incisor inclination in the smile profile of a male subject with regard to different mandibular positions and to elucidate whether the raters' profession and sex played a role in the assessment of the preferred maxillary incisor inclination.

MATERIAL AND METHODS

A finished orthodontic patient (age, 23 years) was chosen from the patients treated at the orthodontics clinic of Shiraz University of Medical Sciences. Informed consent was obtained from the patient for participating in this study. He was chosen based on the following clinical and lateral cephalometric criteria: (1) Class 1 canine and molar relationships with adequate overjet and overbite, (2) well-positioned maxillary incisors according to cephalometric standards, (3) normal facial convexity angle and vertical height ratio as described by Legan and Burstone,[11] (4) normal soft tissue cephalometric analysis (Ricketts' E-line[12] and Merrifield's z-angle[13]), and (5) facial angle and H-angle as described by Holdaway[14] and nasolabial angle and maxillary lip angle as described by Arnett and Bergman[15] within the normal range.

A right lateral profile photograph with the patient in natural head position with a blue background at a distance of 1.5 m from the camera and a speed of 1/125 was taken with a digital camera (c-2000; Olympus America, Melville, NY) under standard conditions. To standardize the photograph, the subject was asked to sit down. By using the ear positioners of the cephalostat, both the Frankfort plane and the pupillary plane were parallel to the ground.

The first image was taken with a neutral facial expression. The second image was taken with the subject in a posed smile, and a small 100-mm ruler was fixed above his head on the facial sagittal plane.

This 100-mm fixed ruler was used as a guide for computer-aided alterations to quantify hard and soft tissue alterations. The ruler and ear positioners of the cephalostat were later removed digitally to give the subject a normal appearance. The use of image alterations of 1 subject has been shown to be successful in studying variations in dental appearance.[10,16]

The smiling photograph was altered using a commercially available image editing software program (Adobe Photoshop CS, version 8.0; Adobe Systems, San Jose, Calif). During the first alteration step, only 1 parameter was changed: the anteroposterior position of the mandible. The mandibular prominence of the subject's facial profile was altered in 4-mm decrements and increments from −4 to +4 mm in to represent retrusion and protrusion of the mandible, respectively. By changing the position of the mandible in the horizontal plane relative to the true vertical line that crosses the glabella (defined as the most prominent anterior point in the midsagittal plane of the forehead[17]), 3 profiles were created (retruded, normal, and protruded). To focus on the sagittal aspect of the facial profile, the vertical height of the constructed face was kept constant.

In the next step, each profile group was further divided into 5 subgroups. The maxillary incisor inclination of each image was changed from −10° to +10° relative to the norm values of the subject in 5° decrements and increments to represent retroclined and proclined incisors. To simulate the changes of incisor inclination, the crowns of the central and lateral incisors were separately cut in the Adobe Photoshop program.[10] Each tooth was considered as an individual object with the center of rotation at the incisal edge. The central incisor was superimposed from the tracing of the lateral cephalograms, and the center of rotation was placed at the incisal edge of the tooth. To maintain the symmetry, the center of rotation of the lateral incisor was set at the midpoint of the mesiodistal width. To maintain the vertical positions of the maxillary incisors, horizontal lines were drawn tangent to the incisal edges of the teeth, and vertical tangents were drawn medial to the maxillary canines as the distal limit for sagittal repositioning of the lateral incisor.[10]

Each simulation was made in 5° decrements and increments, and 2 modifications were produced to represent retroclined incisors and 2 to represent proclined incisors. Artistic editing was used when necessary to

Fig 1. Three sets of altered images with different mandibular positions and incisor inclinations.

maintain a natural appearance. Thus, overall, 3 sets of images were reproduced with different mandibular positions, and each set comprised 5 different maxillary incisor inclinations (from most retroclined to most proclined positions) (Fig 1, Table 1).

Each series of images was printed separately on Digital Royal Paper (Kodak; Rochester, NY) with a Hewlett-Packard Photo Smart printer (Hewlett-Packard, Palo Alto, Calif) in a 15 × 20 cm format and then was placed randomly in a binder. The images were created so that each profile photograph had the same dimensions as a normal human head, based on an average lower anterior facial height. This helped to reduce the potential bias caused by image magnification or size reduction in the observer's perception.[5]

The rating panel comprised 234 raters including 24 orthodontists, 21 maxillofacial surgeons, 25 prosthodontists (all of whom practiced either at the dental clinic of Shiraz University or at their private office in Shiraz), 72 senior dental students, and 92 laypeople who had an appointment at the dental school for dental procedures.

The selection criteria for the laypeople were the following: no previous orthodontic or facial surgical treatment, no facial deformities, no history of facial trauma, and not a health care employee.

Each judge received the profile photographs in 3 sets (different mandibular positions) while seated in the same lighting conditions and was asked to grade each profile based on his or her assessment of the subject's facial attractiveness. At the beginning, the judges were only given specific instructions on the use of the scale, and the images were not shown to them. The same observer instructed all 234 judges. A Likert-type scale was used for rating the photographs because it is largely accepted in the psychology literature as the most useful rating method.[18,19] No specific information was given regarding the images they were about to see, except that the subject was a man. The judges viewed all the photographs first and then began the rating. They were asked not to return to any previously rated photograph as they progressed through the binder. Each judge was asked

Table I. Each profile image with its corresponding mandibular position and labiolingual inclination of the maxillary incisors

Image	Situation
1A	Retruded mandible with $-10°$ of palatal incisor inclination
1B	Retruded mandible with $-5°$ of palatal incisor inclination
1C	Retruded mandible with normal incisor inclination
1D	Retruded mandible with $+5°$ of labial incisor inclination
1E	Retruded mandible with $+10°$ of labial incisor inclination
2A	Normal mandible with $-10°$ of palatal incisor inclination
2B	Normal mandible with $-5°$ of palatal incisor inclination
2C	Normal mandible with normal incisor inclination
2D	Normal mandible with $+5°$ of labial incisor inclination
2E	Normal mandible with $+10°$ of labial incisor inclination
3A	Protruded mandible with $-10°$ of palatal incisor inclination
3B	Protruded mandible with $-5°$ of palatal incisor inclination
3C	Protruded mandible with normal incisor inclination
3D	Protruded mandible with $+5°$ of labial incisor inclination
3E	Protruded mandible with $+10°$ of labial incisor inclination

to rate the attractiveness of each photograph on whatever criteria he or she deemed satisfactory. The smiling profile photographs in each set were randomized before the rating according to a random number table.[6] A questionnaire was prepared for rating the profile images based on the Likert-type scale. All raters were asked to evaluate the profile images of each set at the same session and score them from 1 to 5: 1, very unattractive; 2, unattractive; 3, neither attractive nor unattractive; 4, attractive; and 5, very attractive. They were told to assign each score to only one profile in each set and were instructed to score 1 for the least attractive and 5 for the most attractive profiles. The questionnaire included other questions about the demographic characteristics (age, sex, and profession) of the evaluators. The evaluators were asked to grade the profiles separately for each position of the mandible.

During the rating process, each rater was seated in a quiet area and in the same lighting conditions apart from the other raters and was given 10 minutes to fill out the questionnaires. Each questionnaire was marked only by a numeric code to guarantee anonymity.

Fifty-eight randomly selected raters were also asked to re-rate the images and complete the questionnaires 2 weeks after their initial rating to determine intraexaminer reliability.

Statistical analysis

All statistical analyses were carried out using the Statistical Package for Social Sciences (version 15.0; SPSS, Chicago, Ill). The mean rank score and standard deviation for each photograph were calculated based on the

scores given by each rater. Additionally, the mean rank score and standard deviation of each photograph were calculated independently based on sex and professional group. The Kruskal-Wallis test was used to compare the rankings of the images between the 5 professional groups. The Mann-Whitney test was used to compare the scores of the male and female raters and the pairwise comparisons in the professional groups. Reproducibility among scores between the 2 evaluations was tested using the intraclass correlation coefficient with a 95% confidence interval.

RESULTS

Two hundred thirty-four assessors (132 men, 102 women) with a mean age of 28.9 $\pm$ 7.4 years participated in this study. No significant difference was found between the mean age of the male and female raters in each panel ($P > 0.05$). The statistical analysis showed that the assessors' sex did not affect the rating (Table II).

The mean rank scores of the smiling profile in the different groups are presented in Table III. Pairwise comparisons of the profile images that received significantly different mean scores from the different groups are given in Table IV.

In the profiles with a retruded mandible, image 1C (normal incisor inclination) was reported as the most attractive by all groups; image 1A (the most retroclined incisors) was the least attractive image for all groups except for the laypeople (Fig 2).

In the profiles with an orthognathic mandible, the orthodontists and prosthodontists preferred image 2D ($+5°$ of incisor inclination), the surgeons and laypeople preferred image 2C (normal incisor inclination), and the dental students preferred image 2B ($-5°$ of incisor inclination) as the most attractive. A significant difference was found in the ranking of image 2B among all groups ($P < 0.01$), with the students ranking it lower than all the other groups (mean rank score, 2.2). There was also a significant difference in the ranking of image 2D between groups ($P < 0.01$); the orthodontists rated it lower (mean rank score, 2.0) than did the other groups. Image 2A (most retroclined incisors) was also selected as the least attractive by all groups except for the surgeons, who named image 2E (most proclined incisors) as the least attractive (Fig 3).

In the profiles with protruded mandible, all groups selected image 3C (normal incisor inclination) as the most attractive. A significant difference in the ranking of image 3A (most retroclined incisors) was found between the different groups of raters ($P < 0.01$); the prosthodontists rated it lower (mean rank score, 3.1)

Table II. Mean scores and standard deviations of images with different mandibular positions and incisor inclinations as ranked by male and female raters

Image	Mandibular position	Incisor inclination (°)	Mean ± SD (male)	Mean ± SD (female)	P value
1A	Retruded	−10	3.9 ± 1.2	3.7 ± 1.4	0.539
1B	Retruded	−5	2.7 ± 1.3	2.8 ± 1.1	0.439
1C	Retruded	0	2.3 ± 1.1	2.3 ± 1.3	0.768
1D	Retruded	+5	2.5 ± 1.3	2.6 ± 1.2	0.545
1E	Retruded	+10	3.6 ± 1.5	3.6 ± 1.5	0.838
2A	Normal	−10	3.8 ± 1.3	3.7 ± 1.3	0.396
2B	Normal	−5	2.6 ± 1.1	2.5 ± 1.3	0.553
2C	Normal	0	2.4 ± 1.3	2.5 ± 1.3	0.464
2D	Normal	+5	2.5 ± 1.3	2.5 ± 1.2	0.795
2E	Normal	+10	3.6 ± 1.3	3.4 ± 1.4	0.410
3A	Protruded	−10	3.8 ± 1.3	3.7 ± 1.2	0.515
3B	Protruded	−5	3.1 ± 1.2	3.5 ± 1.2	0.551
3C	Protruded	0	2.1 ± 1.1	2.3 ± 1.2	0.221
3D	Protruded	+5	2.4 ± 1.3	2.3 ± 1.1	0.419
3E	Protruded	+10	3.5 ± 1.5	3.5 ± 1.6	0.832

Table III. Mean scores and standard deviations of images with different mandibular positions and incisor inclinations as ranked by the different groups of raters

Image	Students	Orthodontists	Surgeons	Prosthodontists	Laypeople	P value
1A	3.8 ± 1.2	4.0 ± 1.5	4.3 ± 1.1	4.1 ± 1.1	3.6 ± 1.4	0.147
1B	2.7 ± 1.1	2.6 ± 0.9	2.9 ± 1.1	2.7 ± 1.1	2.7 ± 1.3	0.935
1C	2.3 ± 1.2	1.9 ± 1.1	2.1 ± 1.2	2.2 ± 1.1	2.4 ± 1.1	0.338
1D	2.6 ± 1.3	2.5 ± 1.1	2.3 ± 1.0	2.5 ± 1.3	2.6 ± 1.3	0.879
1E	3.5 ± 1.6	3.9 ± 1.3	3.4 ± 1.4	3.6 ± 1.6	3.7 ± 1.4	0.743
2A	3.9 ± 1.2	4.2 ± 1.4	3.8 ± 1.4	3.7 ± 1.3	3.6 ± 1.4	0.180
2B	2.2 ± 1.1	3.0 ± 0.9	2.5 ± 1.1	2.4 ± 1.2	2.7 ± 1.3	0.015*
2C	2.5 ± 1.3	2.2 ± 1.0	2.3 ± 1.2	2.6 ± 1.3	2.5 ± 1.4	0.780
2D	2.3 ± 1.1	2.0 ± 1.1	2.6 ± 1.2	2.3 ± 1.2	2.8 ± 1.2	0.022*
2E	3.8 ± 1.2	3.5 ± 1.3	3.9 ± 1.4	3.1 ± 1.2	3.4 ± 1.3	0.072
3A	3.7 ± 1.2	4.4 ± 0.9	4.2 ± 1.2	3.1 ± 1.2	3.7 ± 1.3	0.002†
3B	3.1 ± 1.3	3.5 ± 0.8	2.9 ± 1.0	3.8 ± 1.2	2.9 ± 1.2	0.010†
3C	2.2 ± 1.1	1.7 ± 0.7	2.3 ± 1.1	2.2 ± 1.0	2.4 ± 1.3	0.216
3D	2.6 ± 1.2	1.7 ± 0.8	2.3 ± 1.3	2.4 ± 1.4	2.4 ± 1.4	0.094
3E	3.5 ± 1.6	3.6 ± 1.3	3.2 ± 1.6	3.5 ± 1.6	3.6 ± 1.4	0.861

*P <0.05; †P <0.01.

than did all the other groups, and the orthodontists rated it higher (mean rank score, 4.4). Also, there was a significant difference in the ranking of image 3B (−5° of incisor inclination) between the groups (P <0.01); the prosthodontists rated it higher (mean rank score, 3.8) than did the other groups. Image 3A (most retroclined incisors) was also selected as the least attractive in all groups except for the prosthodontists, who believed that image 3B was the least attractive (Fig 4).

Since 25% of the raters scored every photograph twice, the reliability of the ratings was tested using interclass correlation coefficients: 0.82 (lower bound, 0.69; upper bound, 0.95; with 95% confidence) indicated a high level of agreement among the judges when scoring each photograph.

DISCUSSION

Enhancing smile attractiveness is a multifactorial process that can easily be achieved by proper positioning of the maxillary incisors. Both the inclination and the bodily position of these teeth should be favorable to ensure maximum facial harmony.[20]

In this study, we developed a series of facial profile photographs based on the original ideal profile of a male subject to be evaluated by different groups of dental professionals, dental students, and laypeople. By altering the mandibular position and the maxillary incisor inclination in the smiling profiles, we tried to determine the most desirable and the least favorable of the aforementioned combinations as a whole and to elucidate whether the mandibular position and the

Table IV. Pairwise comparisons and *P* values of the profile images that received significantly different mean scores from the different groups of raters

Image	Raters' groups		P value
2B	Orthodontists	Students	0.001
	Orthodontists	Prosthodontists	0.020
	Students	Laypeople	0.016
2D	Orthodontists	Laypeople	0.006
	Students	Laypeople	0.016
3A	Orthodontists	Students	0.010
	Orthodontists	Prosthodontists	0.000
	Orthodontists	Laypeople	0.016
	Prosthodontists	Students	0.031
	Prosthodontists	Surgeons	0.003
	Prosthodontists	Laypeople	0.043
3B	Orthodontists	Surgeons	0.034
	Orthodontists	Laypeople	0.022
	Prosthodontists	Surgeons	0.012
	Prosthodontists	Students	0.016
	Prosthodontists	Laypeople	0.003

2B, Normal mandible with $-5°$ of palatal incisor inclination; *2D,* normal mandible with $+5°$ of labial incisor inclination; *3A,* protruded mandible with $-10°$ of palatal incisor inclination; *3B,* protruded mandible with $-5°$ of palatal incisor inclination.

rater's profession and sex are key factors in ranking the preferred incisor inclination.

Altering the image of 1 subject was done to eliminate the effect of background facial attractiveness. Wagner et al[16] showed this as a useful method in studying variations in dental appearance. In this study, color profile photographs were used, since it has been claimed that color photographs convey facial details more realistically than silhouettes and profile drawings.[21] However, when using photographs, several intrinsic (color and style, nose size, eye color, skin complexion, emotional expression, and age) and extrinsic (hair style, makeup) factors can bias the perception of facial attractiveness.[22,23]

We used the image of an adult to remove any confounding factors such as growth potential and growth-related profile changes.[24] In this study, the profile reproduction method was used; it retains the key features of each photographic model with the help of digital images, and Adobe Photoshop CS only altered the incisor inclination of each facial profile.[25] With this method, the confounding variables were also controlled.

In our study, with the mandible in a normal position, the 5° lingual inclination and 5° labial inclination were rated differently by the different groups. The orthodontists and prosthodontists preferred the 5° labial inclination, and the students preferred the 5° lingual inclination. But the surgeons and laypeople preferred the normal inclination. This showed that in the normal mandibular position, there are preferences among orthodontists and prosthodontists toward a more labial

inclination and a preference toward a more lingual inclination by dental students compared with the other groups. The 10° lingual inclination was also selected as the least attractive image by all raters except for the surgeons, who rated the 10° labial inclination as the least attractive image.

In the study of Ghaleb et al,[10] dentists, orthodontists, and laypeople preferred an increase of 5° in a labial direction in the smiling profile; this agrees with the ratings of the orthodontic and prosthodontic panels in our study. On the other hand, photographs with 10° and 15° of lingual inclination had the lowest scores in all panels in the study of Ghaleb et al; this is comparable to the results of our study panels, except for the surgeons. For the extreme lingual inclinations ($-15°$ and $-10°$), the orthodontists gave significantly lower scores than did the dentists and laypeople. The image with the 15° labial inclination was deemed esthetically acceptable only by the orthodontists. These results agree with our study in which the orthodontist panel gave the lowest scores to the extreme lingual inclination. It can be concluded from our results and those of Ghaleb et al that orthodontists are the greatest critics of extreme lingual inclinations of incisors in smiling when compared with laypeople and other professional groups.

According to Ghaleb et al,[10] the lingual inclination of the maxillary incisors is one factor that can negatively affect the smile and give the face an "old" appearance because of the loss of proper root torque. They found a statistically significant difference between the ratings of photographs between different dental professionals except for profiles with a moderate inclination ($-5°$, normal, and $+5°$). In their study, there was no difference between male and female raters; this is comparable with our findings. In our study, the digital method used to obtain different incisor inclinations was similar to the method used by Ghaleb et al, in which the incisor tip was kept in a constant position. Unlike the study of Ghaleb et al, complete profile photographs were used in our study to obtain a true evaluation of attractiveness.[21] The difference between our result and that of Ghaleb et al may be related to the sex of the subjects, the methods of rating (visual analog scale vs Likert-type rating), and the different populations of the panels.

In the study of the Cao et al,[6] orthodontists who practiced in the orthodontic department at the West China Stomatological Hospital and undergraduates from Sichuan University rated the smiling profile with 5° of lingual inclination as the most attractive. This is different from the results of Ghaleb et al[10] and our study. Cao et al reported the 15° labial inclination as the least attractive, whereas the profiles with 10° of lingual inclination were considered relatively esthetic;
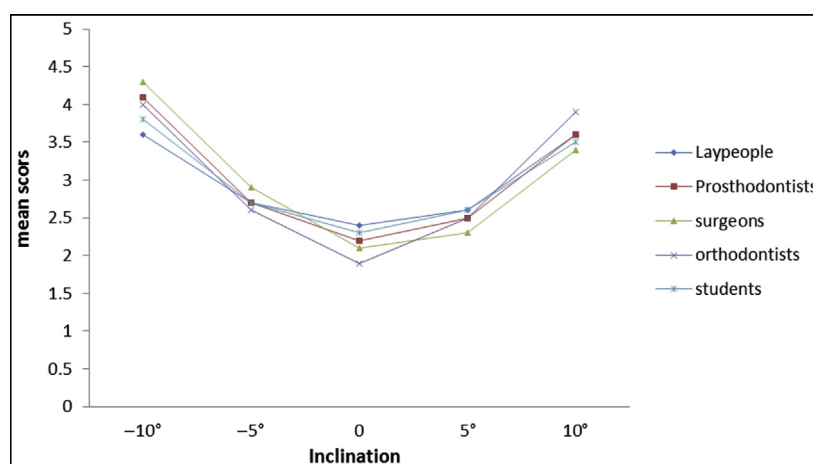
Fig 2. Mean scores of different incisor inclinations for a retruded mandible as ranked by all groups.
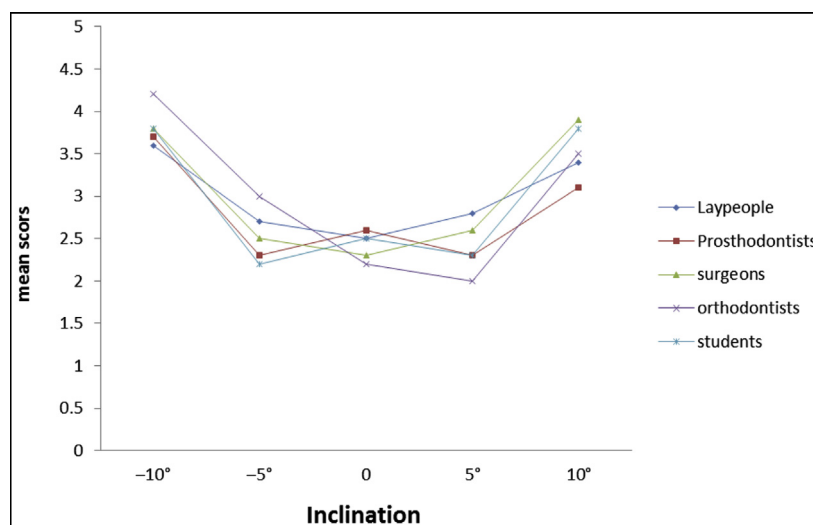

Fig 3. Mean scores of different incisor inclinations for a normal mandible as ranked by all groups.

this is different from the results of our study and that of Ghaleb et al.[10] In the study by Ghaleb, there were no significant differences between the professional and nonprofessional groups in terms of their assessments; this does not agree with our study.

The image alteration method of Cao et al[6] was different from that in our study. Cao et al used goal anterior limit line and maxillary central incisors' facial axial point as reference points for changing the incisor inclination. The maxillary incisor labiolingual inclination was altered, while the facial axial point was kept the same on the goal anterior limit line. So, the forehead was used as a landmark to stabilize the anteroposterior position of the maxillary central incisors in the smiling profiles.

The differences in the results might be attributed to the sex of the model, the methods of rating (visual analog scale vs Likert-type scale), the landmarks used for stabilization of the anteroposterior position of the maxillary incisor, and the different populations from which the judges were chosen.

It has been proven that geographic conditions affect a region's local culture and have a great influence on the public's esthetic concepts.[26,27] Moreover, the perception of esthetics might be affected by the educational and socioeconomic backgrounds of the raters.[28] The perception of esthetics varies from person to person and between different social environments.[29] Simultaneously, rater or profile model variables might affect the raters' opinions regarding facial attractiveness.[28]
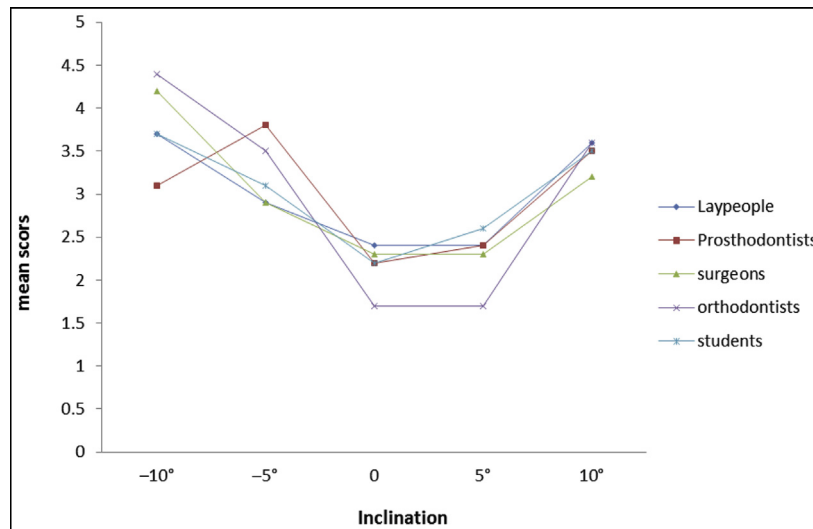
Fig 4. Mean scores of different incisor inclinations for a protruded mandible as ranked by all groups.

In the study by Isıksal et al,[30] although the incisor inclinations were significantly different between the extraction and nonextraction groups, the difference did not affect the smiling esthetics in either group. This contradiction with other studies might be due to the differences in the photographs, since we used lateral facial colored photographs, but Işıksal et al used lower face frontal and three-quarters black and white photographs.

Schlosser et al[9] reported a higher level of acceptance for dental protrusion than for retrusion among orthodontists and laypeople, and concluded that it is preferable to either leave a normally protrusive maxillary dentition where it is or advance it rather than retract it. They reported that orthodontic training did not significantly affect the preference pattern of the raters; this does not agree with the results of our study. Unlike our study, in the study by Schlosser et al, the positions of the incisors were altered, and the incisor inclination was kept constant in the different profiles.

We found no significant differences between the male and female assessors in their ratings of the profile images. This finding is similar to the studies of Ghaleb et al[10] and Arqoub and Al-Khateeb.[31] It can be concluded that the concept of beauty is similar between male and female raters and that a similar standard for facial esthetics exists between the sexes. But Turkkahraman and Gökalp[26] concluded that sex had an effect on the profile preferences in the Turkish population, and significant differences were observed between the sexes.

In our study, in the retruded mandibular position, there were no significant differences in the ratings of

the images between the raters. The normal incisor inclination was unanimously selected as the most attractive facial profile, and a 10° lingual inclination was the least attractive, except for the laypeople, who chose the 10° labial inclination as the least attractive image. In the protruded mandibular position, all groups selected the normal inclination as the most attractive image. The 10° lingual inclination was also selected as the least attractive image in all groups, except for the prosthodontists, who selected the 5° labial inclination as the least attractive image. This study showed that in case of mandibular retrusion and protrusion, less labial or lingual inclination is more desirable in almost all groups; given the same amount of inclination, labial inclination is more preferable than lingual inclination. It may be concluded that in the normal facial convexity angle, the raters were not unanimous in the selection of the best incisor inclination, but when the facial convexity angle deviated from normal, the raters showed more consistency in adherence to the normal incisor inclination as most favorable.

It can be concluded that in a patient with mandibular deficiency where camouflage treatment is indicated, a lingual inclination of the maxillary incisor can compromise esthetics and should be avoided by maintaining appropriate torque during incisor retraction.

Although in this study we assessed the effects of mandibular position on the preferred incisor inclination, the fact that these results were obtained from 1 photograph must be taken into account. Several intrinsic and extrinsic factors can play roles in the perception of facial attractiveness and can hypothetically affect the final outcomes of the study.[22,23] The mere concept of

beauty is at best affected by several characteristic and features.

CONCLUSIONS

This study showed that in case of mandibular protrusion and retrusion, the ratings of the different incisor inclinations were similar among all professional groups, except for the laypeople for the retruded mandible and the prosthodontists for the protruded mandible. All groups believed that a normal incisor inclination is the best choice in both retruded and protruded mandibles, but it was not the case for the normal mandibular position, in which different incisor inclinations were selected as the most favorable by the different professional groups. It might be concluded that for mandibular retrusion and protrusion, less labial or lingual inclination is more preferable in almost all groups; given the same amount of the inclination, labial inclination is more preferable than lingual inclination. Also, the raters' sex had no effect on their ratings of the images.

ACKNOWLEDGMENTS

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