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Influence of Upper Incisor Inclination on Smiling Profile Aesthetics in Skeletal Class III

Wipawee Punyaardhansakun, Tanapat Jearanai, Bancha Samruajbenjakun, Pannapat Chanmanee*

Faculty of Dentistry, Prince of Songkla University, Songkhla 90112, Thailand

*Corresponding author: pannapat.c@psu.ac.th

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ABSTRACT

This study aimed to assess the influence of upper incisor inclinations on smiling profile aesthetics in skeletal Class III patients, considering the effects of skeletal simulations, the assessor's expertise, and the assessor's gender. A smiling profile photograph of a Thai female with normal skeletal, dental, and soft tissue features was digitally adjusted to represent 16 images with 4 skeletal simulations and 4 upper incisor inclinations. The number of assessors was 180, which included orthodontists, general dentists, and laypersons. They were asked to evaluate the smiling profile aesthetics of each image using a numerical rating scale. The aesthetic scores were analysed using a mixed between-within-subjects ANOVA ($p < 0.05$). The results showed that the interaction effect between orthodontic expertise and upper incisor inclinations was not observed in the skeletal Class III groups. Normal upper incisor inclination had the highest aesthetic score. Proclination of the upper incisors by 3° significantly decreases the aesthetic score, except in the skeletal Class III with prognathic mandible group. The assessor's gender did not affect the aesthetics score of the smiling profile. In conclusion, upper incisor inclinations and skeletal simulations significantly influenced smiling profile aesthetics in the skeletal Class III simulations. The assessor's expertise and gender did not affect the evaluations.

Keywords: *Aesthetic; incisor inclination; orthodontics; profile; skeletal Class III*

INTRODUCTION

Achieving an attractive smile is one of the primary objectives of patients seeking orthodontic treatment (Wedrychowska-Szulc & Syryńska, 2010; Pabari *et al.*, 2011). Sarver & Ackerman (2003b) proposed assessing smiles across four dimensions that included frontal, oblique, sagittal, and time. The sagittal dimension provides the best visualisation of overjet and incisor inclinations. Consequently, patients with skeletal Class II or III may exhibit an aesthetically pleasing smile from the front but reveal skeletal discrepancies and dental compensations when assessed sagittally.

The prevalence of skeletal Class III is notably higher in Asian populations, which is 10% to 15% of the demographics, whereas in other ethnic groups it was less than 5% (Hardy *et al.*, 2012). A study of skeletal Class III Thai patients found that most of them had a prognathic mandible (82.51%), and the maxilla was equally split between an orthognathic (49.78%) and a retrognathic (49.33%) position (Triviroj *et al.*, 2013). For many adult patients with skeletal Class III, the optimal treatment typically involves orthodontic treatment combined with orthognathic surgery. However, some patients refuse this option due to its cost and invasiveness. In such cases, orthodontic camouflage becomes an alternative for mild to moderate skeletal discrepancies. Nevertheless, this approach may cause proclination of the upper incisors (Park *et al.*, 2019; Araujo & Squeff, 2021), which potentially affects overall aesthetics, particularly in the profile view (Sarver & Ackerman, 2003b).

Lateral cephalometric analysis is commonly used in orthodontic diagnosis and treatment planning. Macias *et al.* (Gago *et al.*, 2012) discovered that attractive faces often align with cephalometric norms. However, these norms may not reveal an aesthetic sense because of various factors such as gender, age, ethnicity, expertise, and facial features (Soh *et al.*, 2005; Ghaleb *et al.*, 2011; Tole *et al.*, 2014; Bronfman *et al.*, 2015; Najafi *et al.*, 2015; Chirivella *et al.*, 2017). Moreover, most normative values usually derive from studies involving patients with normal skeletal relationships (Suchato & Chaiwat, 1984; Sorathesn, 1988; Dechkunakorn *et al.*, 1994), which limit their applicability to those with skeletal discrepancies in orthodontic camouflage treatment.

In recent years, orthodontics has started to prioritise aesthetics based on patient preferences (Sarver & Ackerman, 2003a). Previous studies on aesthetic perceptions of smiling profiles in patients with different maxillary incisor inclinations primarily focused on those with skeletal Class I (Cao *et al.*, 2011; Ghaleb *et al.*, 2011; Chirivella *et al.*, 2017). Consequently, the generalisability of findings to patients with different skeletal relationships may be limited. Najafi *et al.* (2015) explored the aesthetic perception of incisor inclinations in smiling profiles while considering mandibular position. The findings indicated that normal upper incisor inclination was the most attractive in patients with prognathic mandibles for all assessor's groups. However, the authors have not found a study that investigated the impact of upper incisor proclination on smiling profile aesthetics in skeletal Class III patients, particularly when considering both maxillary and mandibular positions.

Hence, this research primarily aimed to assess how upper incisor inclinations influence smiling profile aesthetics in skeletal Class III patients. The impact of skeletal simulations, the assessor's expertise, and the assessor's gender on the influence of upper incisor inclinations on smiling profile aesthetics was considered a secondary objective.

MATERIAL AND METHODS

This research was approved by the institutional review board committee (Ref. No.: Protocol EC6603-015) of the Faculty of Dentistry, Prince of Songkla University, Thailand.

Subject Selection

An adult female participant was chosen based on the specific clinical and lateral cephalometric criteria: (1) skeletal Class I normodivergent pattern with orthognathic maxilla and mandible (ANB = 3 ± 2°, SN-MP = 33 ± 5°, SNA = 85 ± 4°, SNB = 82 ± 3°) (Sorathesn, 1988); (2) normally inclined and positioned upper incisor (UI-NA = 22 ± 6°, 5 ± 2 mm) (Suchato & Chaiwat, 1984); (3) normal soft tissue cephalometric analysis (FCA = 9 ± 5°, NLA = 91 ± 8°, UFH = 48 ± 3 mm, LFH = 69 ± 4 mm, TL = 58 ± 7 mm, LCTA = 115 ± 7°) (Sorathesn, 1988); (4) normally positioned upper and lower lips (U. lip-E line = −1 ± 2 mm, L. lip-E line = 2 ± 2 mm) (Dechkunakorn *et al.*, 1994); (5) all permanent teeth with or without the third molars; (6) Class I canine and molar relationships with normal overjet and overbite; and (7) harmonious face and smile in both frontal and profile views. The subject was informed of the intent of the study and signed a consent form. A right smiling profile photograph of the subject seated in a natural head position with a posed smile was taken using a digital SLR camera with a 50-mm lens (ILCE-6100; Sony Corporation, Tokyo, Japan) at 2 m distance under standard conditions. A 0.5-mm precision ruler was placed near the face to standardise the image ratio.

Image Adjustment for Assessment

The subject's original image (Fig. 1A) underwent a two-step modification. In the first step, the image was adjusted using Dolphin Imaging Software (Version 11.95; Dolphin Imaging System, Canoga Park, CA) to simulate patients who exhibit three simulations of skeletal Class III completely treated with orthodontic camouflage. In the first simulation (retrognathic maxilla), the maxilla was moved backward by 10 mm (Fig. 1B). The second simulation (retrognathic maxilla and prognathic mandible) involved a 5 mm backward movement of the maxilla and a 5 mm forward movement of the mandible (Fig. 1C). In the third simulation (prognathic mandible), the mandible was moved forward by 10 mm (Fig. 1D). The upper incisor position was moved forward 5 mm, while the lower incisor position was moved backward 4 mm to obtain a normal overjet in skeletal Class III simulations. A total of four images with different skeletal simulations were obtained.

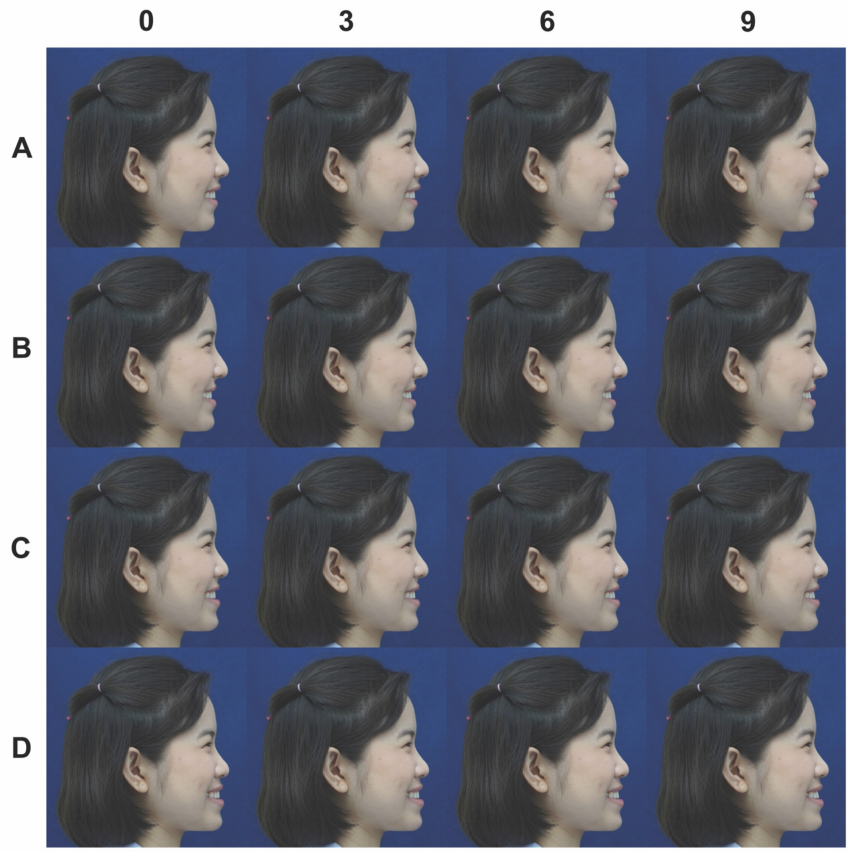

Fig. 1 Modified images with different skeletal simulations and incisor inclinations. (A) Skeletal Class I with orthognathic maxilla and mandible; (B) Skeletal Class III with retrognathic maxilla and orthognathic mandible; (C) Skeletal Class III with retrognathic maxilla and prognathic mandible; (D) Skeletal Class III with orthognathic maxilla and prognathic mandible; (0) Normally inclined upper incisor; (3) 3° proclination; (6) 6° proclination; and (9) 9° proclination.

In the second step, the original image and three modified images (Figs. 1B, 1C, and 1D) were imported into Adobe Photoshop Software (Version 24.1; Adobe Systems, San Jose, CA, USA). Initially, the central and lateral incisors of the original image were individually cut, and the rotation centre was set at the incisal edge of the central incisor and the midpoint of the incisal edge of the lateral incisor (Ghaleb *et al*., 2011). Each simulation involved adjusting in 3° increments, presenting four levels of incisor inclinations: the original inclination (A0), +3° (A3), +6° (A6), and +9° (A9). Afterward, only the dental part of the A3, A6, and A9 images was cut and transferred to the other images (Figs. 1B, 1C, and 1D), using the incisal edge of the central incisor as a reference. This process resulted in a total of 16 images, forming 4 sets with different skeletal simulations. Each set included four images with different maxillary incisor inclinations. Artistic editing was done as needed to preserve a natural appearance.

Assessment Form

Google Forms (Google LLC, Mountain View, CA, USA) was utilised to generate an assessment form consisting of six sections. The first section provided instructions on conducting an assessment. In the second section, demographic data that included age and gender (male or female) and the degree of orthodontic expertise (orthodontists, general dentists, and laypersons) were collected. The other four sections were dedicated to the aesthetic assessment form for each skeletal simulation that featured four images with varying maxillary incisor inclinations. A numerical rating scale (NRS), anchored by the descriptors “least attractive” and “most attractive,” was placed below each image. The order of the images was automatically randomised for each assessor. To assess its validity before incorporating it into the data collection process, three experts were asked to review the assessment form using the index of item-objective congruence (IOC) which indicated that the assessment form had high validity (IOC = 1) (Rovinelli & Hambleton, 1977).

Assessors

The sample size was determined based on a previous study (Najafi *et al*., 2015) using G*Power software (Version 3.1.9.6; Heinrich-Heine-Universitat Dusseldorf, Dusseldorf, Germany) with a power of 0.8 and a level of significance (alpha) set at 0.05, which indicated 180 subjects were needed. Sixty subjects in each expertise group (orthodontists, general dentists, and laypersons) equally distributed by gender were invited to participate in this study by quota sampling, a non-probability method that ensures a specified number of participants from each subgroup. Data were collected from the first available subjects who met the criteria until the quotas were filled. Orthodontists were individuals who had completed an accredited orthodontic training programme and provided orthodontic treatment. General dentists were individuals who graduated with a Doctor of Dental Surgery degree and provided general practice. Laypersons were non-dental healthcare individuals. Subjects who had facial deformities or prior facial surgical treatment, experienced loss of their anterior teeth, or had mental health issues were excluded.

Rating of Photographs

The assessment form was distributed directly to the three groups of assessors: orthodontists, general dentists, and laypersons. The assessors were given the following instructions: (1) utilise a computer, laptop, or tablet with a minimum screen size of 10 inches to complete the assessment; (2) rate the smiling profile aesthetics of each image on a scale from 0 (least attractive) to 10 (most attractive); and (3) evaluate each image sequentially, dedicating approximately 30 seconds per image, without returning to any previously assessed images. To ensure intra-examiner reliability, 30 randomly selected assessors were asked to re-evaluate the assessment two weeks after their initial assessment.

Data Analysis

The data we obtained from each assessor included age, expertise, gender, and the attractive score (NRS) for each photograph. The mean and standard deviation (SD) values of the attractive score for each photograph were calculated based on the expertise and gender of the assessors (Table 1). Statistical analyses were performed using SPSS (Version 29; SPSS, IBM Corp., Chicago, IL, USA), with a significance level set at $p < 0.05$ for all tests. The reproducibility between the initial assessment and the reassessment two weeks later by 30 randomly selected assessors was evaluated using the intraclass correlation coefficient (ICC). Across all expertise and gender groups, the ICC values were greater than 0.91, indicating excellent reliability (Koo & Li, 2016).

A mixed between-within subjects 4-way ANOVA was used to analyse the interaction effect of four independent variables: the within-subject variable (skeletal simulations and upper incisor inclinations) and the between-subject variable (orthodontic expertise and gender) (Tabachnick & Fidell, 2019). Additionally, the analysis explored both the simple interaction effects and the simple effects of upper incisor inclinations on smiling profile aesthetics, applying a Bonferroni correction to control for multiple comparisons.

RESULTS

The cephalometric analysis of the participant chosen for image adjustment demonstrated normal values of skeletal, dental, and soft tissue variables. The angular measurements of incisor inclination from the original profile photograph showed that the angle between Tg (tangent to the labial surface of the maxillary central incisor) and Hr (horizontal line) was 85°, and the angle between Tg and Sn–Pg′ was 10°.

One hundred and eighty assessors with a mean age of 28.96 ± 7.4 years old (range 24–53) participated in this study. The mean and SD of the attractive score for each image classified by expertise and gender of the assessors are shown in Table 1. The results indicated that the mean score for normal upper incisor inclination was highest across all skeletal simulations, expertise, and gender groups, followed by 3°, 6°, and 9° proclination (Table 1).

Table 1 Mean and SD of attractive scores categorised by the expertise and gender of the assessors

Image	Expertise						Gender			
	Orthodontist		General dentist		Layperson		Male		Female	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
A0	8.25	1.49	7.57	1.73	7.68	1.77	7.73	1.72	7.93	1.65
A3	7.37	1.84	7.15	1.53	7.25	1.60	7.20	1.67	7.31	1.65
A6	6.48	2.11	6.40	1.73	6.93	1.61	6.41	1.88	6.80	1.78
A9	5.75	2.22	5.95	2.06	6.32	1.89	5.92	2.14	6.09	1.99
B0	5.18	2.24	4.40	1.97	5.75	2.14	5.06	2.28	5.17	2.08
B3	4.85	2.37	4.15	1.94	5.42	2.36	4.73	2.39	4.88	2.18
B6	4.37	2.07	3.82	1.78	5.12	2.27	4.22	2.24	4.64	1.95
B9	3.72	2.12	3.53	1.78	4.77	2.01	3.94	2.17	4.07	1.91
C0	5.50	2.21	4.63	1.92	6.82	1.89	5.49	2.25	5.81	2.14
C3	5.25	2.19	4.30	1.97	6.45	2.19	5.21	2.44	5.46	2.13
C6	4.78	2.02	4.27	1.79	5.97	2.00	4.99	2.16	5.02	1.96
C9	4.43	2.09	3.97	1.89	5.72	1.98	4.68	2.23	4.73	1.99

(*continued on next page*)

Table 1 (*continued*)

Image	Expertise						Gender			
	Orthodontist		General dentist		Layperson		Male		Female	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
D0	4.78	2.31	3.53	2.05	5.50	2.69	4.66	2.55	4.56	2.43
D3	4.60	2.31	3.27	1.96	5.35	2.49	4.41	2.46	4.40	2.38
D6	4.43	2.11	3.22	1.83	5.18	2.20	4.31	2.21	4.24	2.19
D9	4.17	2.11	3.18	1.85	4.97	2.36	4.11	2.23	4.10	2.24

Notes: A = skeletal Class I with orthognathic maxilla and mandible; B = skeletal Class III with retrognathic maxilla and orthognathic mandible; C = skeletal Class III with retrognathic maxilla and prognathic mandible; D = skeletal Class III with orthognathic maxilla and prognathic mandible; 0 = normally inclined upper incisor; 3 = 3° proclination; 6 = 6° proclination; 9 = 9° proclination.

Table 2 Mixed between-within subjects ANOVA and simple effects of each independent variable

Parameters	df	Sum of squares	Mean square	F value	*p*-value
Inclination	1.735	480.460	276.855	88.614	< 0.001**
Error (Inclination)	301.963	943.413	3.124		
Skeletal	2.377	2,923.707	1,229.886	203.428	< 0.001**
Error (Skeletal)	413.636	2,500.763	6.046		
Expertise	2.000	895.459	447.730	11.031	< 0.001**
Gender	1.000	12.800	12.800	0.315	0.575
Error	174.000	7,062.654	40.590		
Skeletal*Inclination*Expertise	15.182	22.195	1.462	1.760	0.035*
Skeletal*Inclination*Expertise*Gender	15.182	18.497	1.218	1.467	0.109
Error (Skeletal*Inclination)	1,320.805	1,097.038	0.831		

Notes: * $p < 0.05$; ** $p < 0.001$

A mixed between-within-subjects ANOVA incorporating between-subject variables (gender and expertise) and within-subject variables (skeletal simulations and incisor inclinations) was conducted (Table 2). The results indicated that there was no difference in the scores by gender. However, a significant three-way interaction effect was observed between upper incisor inclinations, skeletal simulations, and orthodontic expertise ($p = 0.035$). This indicates that the relationship between any two of these factors is influenced by the third factor. Therefore, simpler two-way interactions were analysed within each level of the third factor. This included examining the interaction between skeletal simulations and upper incisor inclinations within each expertise group (Table 3) and the interaction between assessor expertise and upper incisor inclinations within each skeletal group (Table 4).

In the analysis of the simple interaction effect within each expertise group (Table 3), significant differences were observed in the orthodontist and general dentist groups ($p < 0.001$). However, no significant difference was found in the layperson group. This suggested that the effect of upper incisor inclinations on smiling profile aesthetics depends on the skeletal simulations for orthodontists and general dentist's groups, but not for laypeople group.

In the analysis of the simple interaction effect within each skeletal simulation (Table 4), significant differences were observed only in the skeletal Class I group (Fig. 1A) ($p = 0.006$). However, no significant differences were found in the skeletal Class III groups (Figs. 1B, 1C, and 1D). This indicated that the effect of upper incisor inclinations on smiling profile aesthetics depends on the assessor's expertise only in the skeletal Class I group, but not in the skeletal Class III groups. The pairwise comparisons of attractive scores between normal and proclined upper incisors revealed that proclination of the upper incisors by 3° significantly decreases the aesthetic score, except in the skeletal Class I group (Fig. 1A) for general dentists and in the skeletal Class III with prognathic mandible group (Fig. 1D) (Table 5).

Table 3 Simple interaction effects and simple effects within each expertise group

Parameters	df	Sum of squares	Mean square	F value	*p*-value
Orthodontist					
Inclination*Skeletal	6.434	67.576	10.502	13.447	< 0.001**
Error (Inclination*Skeletal)	379.634	296.486	0.781		
General dentist					
Inclination*Skeletal	7.038	36.900	5.243	5.055	< 0.001**
Error (Inclination*Skeletal)	415.270	430.725	1.037		
Layperson					
Inclination	1.890	131.120	69.362	29.647	< 0.001**
Error (Inclination)	111.532	260.943	2.340		
Inclination*Skeletal	6.017	13.084	2.175	1.954	0.071
Error (Inclination*Skeletal)	355.002	395.103	1.113		

Notes: * Statistically significant at $p < 0.017$ (Bonferroni correction); ** $p < 0.001$

Table 4 Simple interaction effects and simple effects within each skeletal simulation

Parameters	df	Sum of squares	Mean square	F value	*p*-value
A					
Inclination*Expertise	4.483	27.375	6.107	3.481	0.006*
Error (Inclination)	396.703	695.908	1.754		
B					
Inclination	2.430	123.144	50.687	44.225	< 0.001**
Inclination*Expertise	4.859	7.497	1.543	1.346	0.245
Error (Inclination)	430.023	492.858	1.146		
C					
Inclination	2.298	89.960	39.151	35.070	< 0.001**
Inclination*Expertise	4.596	7.753	1.687	1.511	0.190
Error (Inclination)	406.705	454.037	1.116		
D					
Inclination	2.182	24.004	11.000	9.747	< 0.001**
Inclination*Expertise	4.364	2.342	0.537	0.475	0.770
Error (Inclination)	386.244	435.904	1.129		

Notes: A = skeletal Class I with orthognathic maxilla and mandible; B = skeletal Class III with retrognathic maxilla and orthognathic mandible; C = skeletal Class III with retrognathic maxilla and prognathic mandible; D = skeletal Class III with orthognathic maxilla and prognathic mandible; *Statistically significant at $p < 0.013$ (Bonferroni correction); ** $p < 0.001$.

Table 5 Pairwise comparisons of normal inclination and minimum proclination of upper incisor showing significant differences, categorised by skeletal simulations and accessor's expertise

Expertise	Skeletal simulations	Inclination[a] (degree)	Mean difference[b]	Std error	*p*-value	95% Confidence interval for difference	
						Lower bound	Upper bound
All	All	3	0.350	0.052	< 0.001**	0.211	0.489
Layperson	All	3	0.321	0.084	< 0.001**	0.152	0.489
Orthodontist	A	3	0.883	0.217	< 0.001**	0.450	1.317
General practice	A	6	1.167	0.217	< 0.001**	0.733	1.600
All	B	3	0.306	0.088	0.004*	0.070	0.542
All	C	3	0.317	0.082	0.001*	0.098	0.536
All	D	6	0.328	0.087	0.001*	0.095	0.561

Notes: A = skeletal Class I with orthognathic maxilla and mandible; B = skeletal Class III with retrognathic maxilla and orthognathic mandible; C = skeletal Class III with retrognathic maxilla and prognathic mandible; D = skeletal Class III with orthognathic maxilla and prognathic mandible; [a] Minimum proclination of upper incisor showing significant differences; [b] Normal inclination (0) - inclination[a]; * $p <$ significant level from Bonferroni correction; ** $p < 0.001$.

DISCUSSION

Orthodontic camouflage in skeletal Class III patients usually involves proclination of the upper incisors (Park *et al.*, 2019; Araujo & Squeff, 2021). This study found that proclination of the upper incisors led to a decreased aesthetic score across all assessor groups related to skeletal simulations and the assessor's expertise with no influence from the assessor's gender.

This study utilised full-face colour profile photographs for their realistic details that surpassed drawings and silhouettes. While other facial components may influence aesthetic perception, using modified images from a single participant proved effective in eliminating interference from other facial features. This approach is a valuable method for studying and comparing the impact of dental appearance (Schlosser *et al.*, 2005; Cao *et al.*, 2011; Ghaleb *et al.*, 2011; Najafi *et al.*, 2015). The NRS was chosen for its simplicity, ease of comprehension, and superior repeatability compared to a visual analogue scale. Furthermore, word bias inherent in a Likert scale was avoided (Hasson & Arnetz, 2005; Voutilainen *et al.*, 2016; Rosas *et al.*, 2017).

When considering each skeletal simulation, it was observed that within the skeletal Class I group, orthodontic expertise had an impact on the aesthetic perception of each incisor inclination. However, expertise showed no significant effect in skeletal Class III. This finding aligned with the results from Najafi *et al.* (2015) where different expertise groups selected different incisor inclinations as most favourable for the normal mandibular position. However, all expert groups concurred that a normal incisor inclination was the optimal choice for the protruded mandibular position.

This study revealed that normal upper incisor inclination was the most preferable among all skeletal simulations in all assessor groups. A 3° proclination of the upper incisor significantly diminished the aesthetic score, except in a skeletal Class I group for general dentists and in skeletal Class III with a prognathic mandible. These findings were consistent with a previous study (Cao *et al.*, 2011), which found that a normal or slightly retroclined upper incisor was the most preferable. Increased proclination of the upper incisor led to a reduced aesthetic score across all assessor groups. However, the study by Najafi *et al*. (2015) noted that the layperson group preferred the normal incisor inclination, while orthodontists preferred a 5° proclination. Ghaleb *et al*. (2011) found that laypersons preferred both normal inclination and a 5° proclination, while orthodontists and general dentists preferred a 5° proclination.

In a skeletal Class III prognathic mandible group, Najafi *et al*. (2015) found that normal incisor inclination was the most preferable among all evaluators. However, our study could accept an additional 3° proclination without a significant loss of esthetics. In any case, laypersons did not take the skeletal simulations into consideration and only accepted normal incisor inclination, which indicated the need for caution when treating patients.

To date, the author did not find a study that investigated the aesthetic perception of each incisor inclination in patients with a retruded maxilla. However, studies examining the impact of retruded upper incisors on aesthetics indicated a significant reduction in scores (Schlosser *et al*., 2005; Cao *et al*., 2011). This reduction may be associated with the loss of lip support, widening of the nasolabial angle, and increased prominence of the nose and chin that contributed to an older appearance (Schlosser *et al*., 2005; Proffit *et al*., 2019). This effect may be relevant to the retruded maxilla group in our study, which exhibited lower aesthetic scores than the orthognathic maxilla group. This study found that the assessor's gender had no impact on the aesthetic perception of smiling profiles. These findings were consistent with earlier research by Ghaleb *et al*. (2011) and Najafi *et al*. (2015). While normal incisor inclination was preferred, prioritising anatomical limitations in treatment planning is essential. Aesthetic perception is subjective and influenced by various factors (Soh *et al*., 2005; Ghaleb *et al*., 2011; Tole *et al*., 2014; Bronfman *et al*., 2015; Najafi *et al*., 2015; Chirivella *et al*., 2017), which emphasises the importance of effective communication between dentists and patients. The limitations of this study included its reliance on 2D images from only one female participant and uncontrolled environmental factors in the online assessment. Further studies should address these limitations.

CONCLUSION

Upper incisor inclinations influence the smiling profile aesthetics of skeletal Class III patients. In this group, the aesthetic perception of each upper incisor inclination depends on the skeletal simulations but not on the assessor's expertise. A normal upper incisor inclination was the most preferred across all skeletal simulations and the assessor's expertise. However, assessors were more accepting of a 3° proclination in cases of skeletal Class III with a prognathic mandible. Among laypersons, skeletal simulations did not affect the aesthetic perception of upper incisor inclinations. The assessor's gender had no impact on smiling profile aesthetics.

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