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Original Article

Impact of orthodontic education on the perception of attractiveness and acceptance of facial profiles in adult Taiwanese and Caucasian women

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KEYWORDS
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Abstract *Background/purpose:* The labiomental angle is a critical indicator of lower facial harmony and esthetics. This study investigated the impact of labiomental angle variations on facial attractiveness and examined how orthodontic education influenced aesthetic perception among dental students. Specifically, it evaluated the perceived attractiveness and acceptance of varying labiomental angles in Taiwanese and Caucasian women, aiming to explore potential cultural and educational effects on esthetic preferences.
Materials and methods: Three-dimensional facial scans of one Taiwanese and one Caucasian adult female were digitally modified to generate eight labiomental angle variations (117°–152°, at 5° intervals). Each variation included five images and one video, resulting in 16 sets. Eighty-eight dental students assessed these images before and after attending orthodontic lectures. Attractiveness was evaluated using a Visual Analog Scale (VAS), while acceptance was rated on a 3-point Likert scale. The null hypothesis proposed no significant difference in students' perception of attractiveness and acceptance between the two ethnic profiles.
Results: Before the lectures, the most attractive labiomental angle for the Taiwanese female

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was 137°, shifting to 147° after the lectures. For the Caucasian female, 117° remained the most attractive before and after the lectures. In terms of acceptance, the most preferred angles were 137° for the Taiwanese and 117° for the Caucasian profile. These differences were statistically significant, leading to rejection of the null hypothesis.
Conclusion: Cultural background, ethnicity, and orthodontic education significantly influenced students' perceptions of labiomental esthetics, emphasizing the value of education in shaping aesthetic standards.

Introduction

Aesthetic concerns in orthodontics primarily focus on the following aspects: (1) Creation of a harmonious smile:[1,2] Orthodontists must design smiles that align with aesthetic principles, taking into account a patient's facial features, dental alignment, and gingival condition. Achieving this requires a deep understanding of facial structure and the ability to apply aesthetic principles effectively in clinical practice. (2) Harmony between dental alignment, jaw structure, and facial appearance:[3,4] Dental alignment influences not only masticatory function but also overall facial aesthetics. Proper alignment ensures optimal occlusal contact while contributing to a visually balanced appearance. Additionally, the relationship between the maxilla and mandible plays a pivotal role in facial harmony. Orthodontists must carefully evaluate the interaction between dental alignment and jaw structure to achieve the best aesthetic results.

Facial esthetics play a significant role in orthodontic diagnosis and treatment planning. Among various soft tissue parameters, the labiomental angle—formed between the lower lip and the chin—serves as a critical indicator of lower facial harmony and attractiveness. As modern aesthetic standards continue to evolve, the evaluation of facial features has become increasingly refined and comprehensive. The labiomental fold influences not only overall facial structure but also facial expressions and visual focus. Therefore, in orthodontic treatment, its aesthetics must be carefully considered. Whether in smile design, dental alignment, jaw relationships, or soft tissue aesthetics, orthodontists must tailor treatment plans to each patient's unique characteristics and needs. Proper attention to and adjustment of the labiomental fold during orthodontic treatment are essential for achieving optimal aesthetic outcomes.

As patients become increasingly focused on achieving specific facial aesthetic outcomes, three-dimensional (3D) facial scanning and reconstruction technology has become an essential tool in orthodontics. Facial scanners have wide-ranging applications in diagnosis, treatment planning, outcome evaluation, research, and education. Technological advancements have not only improved the precision and effectiveness of orthodontic treatment but have also enhanced patient satisfaction. The growing use of facial scanners in dentistry and orthodontics allows for more accurate design and modification of the labiomental fold while facilitating clearer communication between clinicians and patients regarding treatment expectations and goals. Furthermore, research on labiomental angle attractiveness across different ethnic groups holds significant implications for both orthodontics and aesthetic medicine. This study investigates how dental students in Taiwan perceive the aesthetic attractiveness of the labiomental angle, comparing their evaluations of Taiwanese and Caucasian female profiles. Additionally, we examined whether orthodontic lectures influenced dental students' perceptions of labiomental angle. Our goal was to deepen the understanding of aesthetic differences between ethnic groups and to support the development of more personalized treatment plans that enhance orthodontic aesthetic outcomes. Ultimately, these insights contribute to advancements in orthodontics and related fields.

This study focused on the labiomental angle because it was a modifiable feature in orthodontic and surgical treatment and one that frequently drew attention in esthetic evaluations. Understanding how orthodontic education affects students' perception of this specific facial feature can offer insights into the development of professional aesthetic judgment and may inform future educational approaches.

Materials and methods

Fourth-year dental students were invited to complete a questionnaire before and after attending orthodontic lectures. This study design aimed to assess potential changes in their aesthetic perceptions and evaluation criteria following relevant education. To obtain 3D facial data, the Accu3D face scanner (Digident Image Technology Co., Taichung, Taiwan) was used to scan the faces of one adult Taiwanese woman (Fig. 1) and one adult Caucasian woman (Fig. 2), both of whom had no history of facial trauma, plastic surgery, or orthognathic surgery. The 3D scan data were analyzed using Accu3Dx Pro software (Digident Image Technology Co., Taichung, Taiwan), which was also employed for facial measurements.

The labiomental angle of both models was systematically adjusted in 5° increments, ranging from 117° to 152°, generating eight variations of each face. These modifications preserved Rickett's aesthetic line[5] and maintained the

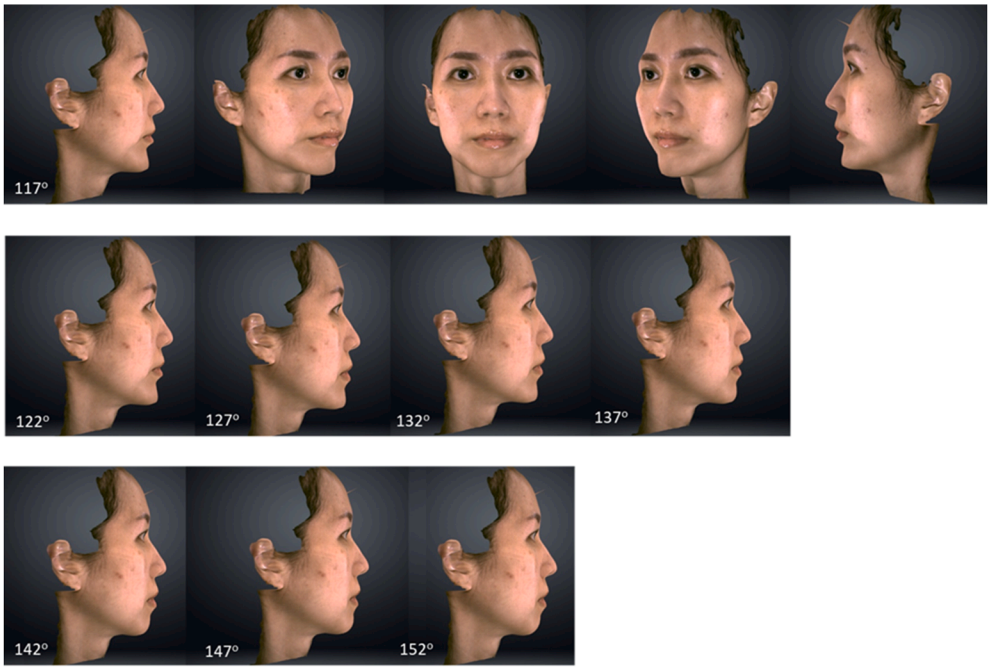

Figure 1 Taiwanese woman: 5 images (117°), from right to left 90-degree profiles. Labiomental fold angle: 122°, 127°, 132°, 137°, 142°, 147°, and 152°.

upper-to-lower lip relationship. The software's built-in functions allowed for controlled adjustments: reducing the labiomental angle by repositioning the entire mandible posteriorly while advancing the chin and increasing it by moving the mandible forward while repositioning the chin posteriorly.

For each model, five images were generated using screen captures, including a frontal view, left and right 90° lateral views, and left and right 45° oblique views. Additionally, following the methodology outlined in Tan et al.,[6] we created 10-s video clips for each 3D model. These videos smoothly transitioned from the right 90° lateral view to the frontal view and then to the left 90° lateral view. Both the images and video clips were presented to participants as visual references while they completed the questionnaire assessing their aesthetic attractiveness and acceptances.

A self-developed questionnaire was used for data collection. Students were invited to complete the survey before and after attending orthodontics lectures to evaluate changes in their aesthetic judgments. To ensure thoughtful evaluation, the questionnaire was administered with a 30-min time limit. Participants were not informed about the specific facial modifications in each 3D model before or after completing the questionnaire.

The questionnaire consisted of three sections: demographic information, preference in profile, and acceptance in abnormality.

1. Demographic information: This section collected background data on participants, including sex, age, and history of orthodontic treatment.
2. Visual analogue scale (VAS): Participants viewed 3D images and video clips of facial models with varying labiomental angles and rated the attractiveness of each model using a VAS ranging from 0 to 100. They were allowed to assign the same score to multiple reconstructed facial models. Question 1: On a scale from 0 to 100, how would you rate the attractiveness of this 3D image?
3. Perceptions of abnormality and acceptability: Participants assessed the degree of abnormality in the labiomental angle in each image and indicated their level of acceptance. Question 2: What is your impression of this 3D image? Responses were recorded using a 3-point Likert scale: (1) No noticeable abnormalities (2) Noticeable abnormalities but acceptable (3) Noticeable abnormalities and unacceptable. Lower scores reflected greater acceptability. They were allowed to assign the same score to multiple reconstructed facial models.

Statistical analyses were performed using SPSS 20.0 software (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to calculate the mean age of participants, as well as the mean VAS and Likert scale scores with their corresponding standard deviations. To evaluate intramodel and intermodel differences in participants' ratings of attractiveness and acceptance of Taiwanese and Caucasian female models before and after the orthodontic lectures, a paired t-test was conducted. Since the same group of students participated at both time points, the paired t-test was appropriate for analyzing the pre-test and post-test data. A 95 % confidence interval was calculated, and statistical significance was set at $P < 0.05$. The null hypothesis stated that there was no significant difference in participants' attractiveness for a specific labiomental angle before versus after attending the lectures for both the Taiwanese and Caucasian female models. All study procedures were approved by the Institutional Review Board of Kaohsiung Medical University Chung-Ho Memorial Hospital (KMUHIRB-SV(II)-20220053).

Results

Eighty-eight students participated in the study, including 55 males (mean age: 21.8 years) and 33 females (mean age: 22.2 years). The VAS scores, representing attractiveness recorded before (Table 1) and after the lecture (Table 2), indicated that the Taiwanese female model exhibited scores ranging from 49.81 (117°) to 71.00 (137°) pre-lecture, and from 47.39 (117°) to 73.32 (147°) post-lecture (Fig. 3). Significant changes in VAS scores were observed for the Taiwanese female model at labiomental angles of 117°, 127°, and 147°. In contrast, for the Caucasian female model, scores ranged from 37.10 (152°) to 62.51 (117°) before the lecture and from 40.84 (152°) to 65.85 (117°) after the lecture, with significant changes observed across all angles.

Regarding the Likert scale, which measured acceptance before (Table 3) and after the lecture (Table 4), the Taiwanese female model's scores ranged from 1.53 (137°) to 2.66 (117°) pre-lecture and from 1.51 (137°) to 2.72 (117°) post-lecture (Fig. 4). Significant changes in Likert scale scores were observed at angles of 127° and 132°. Conversely, for the Caucasian female model, scores ranged from 1.99 (117°) to 2.83 (152°) before the lecture and from 1.90 (117°) to 2.84 (152°) afterward, with no significant changes observed across any angles.

A comparison of aesthetic attractiveness for specific labiomental angles in both models is presented in Table 5. Before the lectures, the VAS score for the model with a labiomental angle of 117° was significantly higher for the Caucasian female model than for the Taiwanese female model. However, for models with labiomental angles ranging from 127° to 152°, the VAS scores were significantly higher for the Taiwanese female models compared to the Caucasian female model. The Likert scale scores for the Taiwanese female models with a labiomental angle of 117° were significantly higher than those for the Caucasian female models. Conversely, for angles ranging from 127° to 152°, the Likert scale scores were significantly higher for the Caucasian female models than for the Taiwanese female models. After the lectures, the VAS scores for models with labiomental angles of 117° and 122° were significantly higher for the Caucasian female model than for the Taiwanese female model. Conversely, for angles ranging from 137° to 152°, the VAS scores were significantly higher for the Taiwanese female models than for the Caucasian female models. Similarly, the Likert scale scores for the Taiwanese female models with angles of 117° and 122° were significantly higher than those for the Caucasian female models. However, for angles from 127° to 152°, the Likert scale scores were significantly higher for the Caucasian female models than for the Taiwanese female models. Given the significant differences observed in both VAS and Likert scale scores between the Taiwanese and Caucasian female models, the null hypothesis was rejected.

Table 1 Changes in labiomental angle attractiveness among students before and after orthodontic education using a visual analogue scale (VAS) for the Taiwanese women.

Labiomental	Before lecture		After lecture		*P* value
Angle (°)	Mean	SD	Mean	SD	
117	49.81	20.86	47.39	22.26	0.023*
122	53.93	17.99	52.50	15.72	0.200
127	68.32	17.14	64.30	18.54	<0.001*
132	64.55	16.56	62.55	15.41	0.088
137	71.00	14.70	71.86	13.61	0.397
142	65.94	19.11	67.68	18.29	0.120
147	68.99	14.73	73.32	17.28	<0.001*
152	59.98	18.79	62.01	21.24	0.052

*: Significant, $P < 0.05$.

Table 2 Changes in labiomental angle attractiveness among students before and after orthodontic education using a visual analogue scale (VAS) for the Caucasian female model.

Labiomental	Before lecture		After lecture		*P* value
Angle (°)	Mean	SD	Mean	SD	
117	62.51	17.59	65.85	18.50	0.002*
122	51.69	20.62	62.44	22.00	<0.001*
127	57.69	21.72	62.16	20.40	<0.001*
132	53.33	18.50	60.23	20.59	<0.001*
137	49.96	19.28	53.47	21.27	0.001*
142	49.34	17.86	53.75	21.87	<0.001*
147	38.88	19.10	45.85	21.07	<0.001*
152	37.10	19.27	40.84	19.29	<0.001*

*: Significant, $P < 0.05$.

Discussion

The labiomental fold is a soft tissue fold that lies between the lower lip and the chin. Its shape and depth vary significantly among individuals.[7] When observed from the front, it appears as an indentation that separates the lower lip from the chin. Clinically, the labiomental fold's characteristics are described by its depth and angle. In modern aesthetics, these two features are crucial markers of facial attractiveness. A moderate depth and an appropriate angle of the labiomental fold can enhance facial contours, contributing to a more appealing and balanced appearance. On the other hand, an excessively deep or shallow labiomental fold can disrupt the proportions of the face, affecting overall aesthetic harmony. As youthful facial features continue to be sought after, age-related changes can make the labiomental fold more pronounced. This is often due to bone resorption, which can lead to a less defined lower face and an increased mandibular angle.[3] Furthermore, aging is frequently associated with a deep nasolabial angle, a pronounced labiomental fold, and submental fullness, all of which can contribute to a more aged appearance.[7–9]

To measure the depth of the labiomental fold,[7] the deepest point of the fold (soft tissue point B) must first be identified. This point is the most concave midline location between the contour of the lower lip (from the labrale inferius to the soft tissue menton). A tangent line is then drawn between the lower lip margin and the most

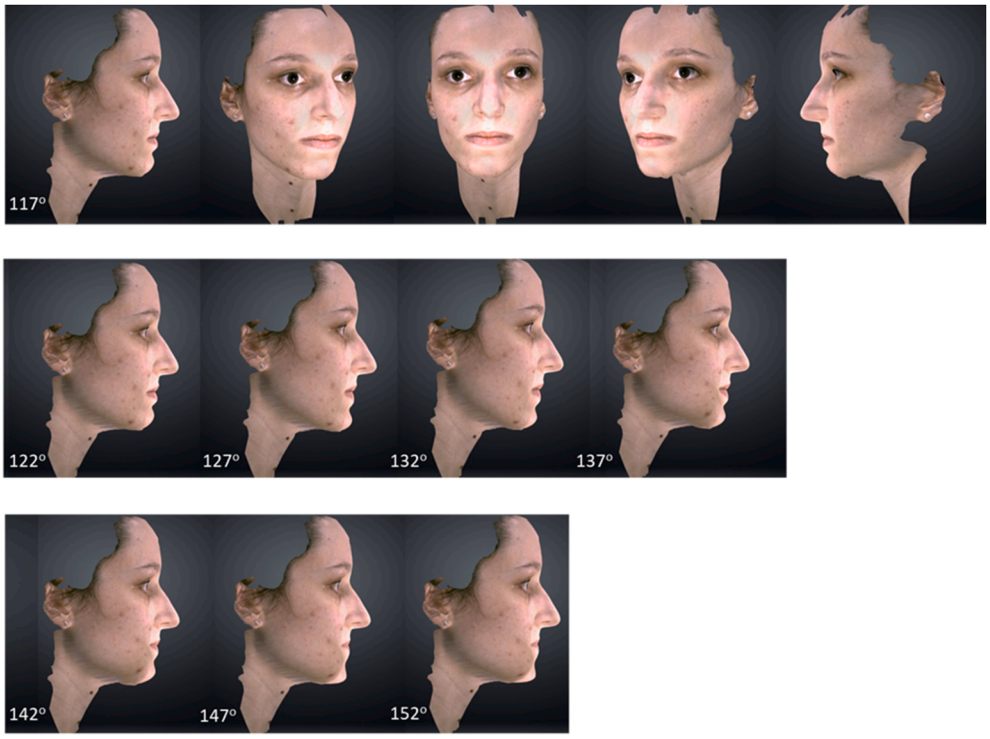

Figure 2 Caucasian woman: 5 images (117°), from right to left 90-degree profiles. Labiomental fold angle: 122°, 127°, 132°, 137°, 142°, 147°, and 152°.

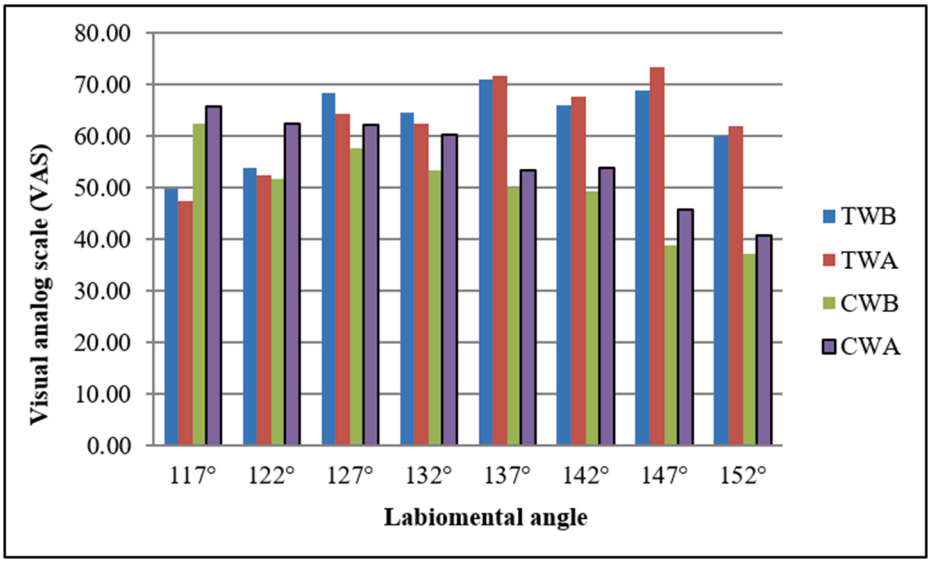

Figure 3 Changes in attractiveness ratings across labiomental angles before and after an orthodontic lecture, measured using a visual analogue scale (VAS).
TWB: Taiwanese woman model before education.
TWA: Taiwanese woman model after education.
CWB: Caucasian woman model before education.
CWA: Caucasian woman model after education.

prominent point of the chin's soft tissue (soft tissue pogonion). The depth of the labiomental fold is determined by measuring the perpendicular distance from this tangent line to the deepest point of the fold. In Western populations, the average labiomental fold depth is approximately 4 ± 2 mm. Women generally have a slightly greater labiomental fold depth than men (6 mm vs. 4 mm), likely due to differences in chin prominence.

Table 3 Changes in labiomental fold angle (LFA) acceptances among students before and after orthodontic education using a Likert scale for the Taiwanese female model.

Labiomental	Before lecture		After lecture		*P* value
Angle (°)	Mean	SD	Mean	SD	
117	2.66	0.80	2.72	0.55	0.550
122	2.41	0.66	2.49	0.66	0.348
127	1.73	0.60	1.93	0.72	0.012*
132	1.77	0.69	1.99	0.67	0.005*
137	1.53	0.62	1.51	0.63	0.779
142	1.73	0.81	1.76	0.76	0.703
147	1.60	0.72	1.55	0.68	0.511
152	1.94	0.78	2.10	0.74	0.075

*: Significant, $P < 0.05$.

Table 4 Changes in labiomental fold angle (LFA) acceptances among students before and after orthodontic education using a Likert scale for the Caucasian female model.

Labiomental	Before lecture		After lecture		*P* value
Angle (°)	Mean	SD	Mean	SD	
117	1.99	0.74	1.90	0.73	0.328
122	2.43	0.71	2.27	0.74	0.052
127	2.15	0.77	2.22	0.75	0.470
132	2.17	0.75	2.17	0.72	1
137	2.56	0.58	2.51	0.59	0.540
142	2.52	0.64	2.48	0.69	0.620
147	2.78	0.51	2.75	0.53	0.550
152	2.83	0.46	2.84	0.43	0.854

*: Significant, $P < 0.05$.

The labiomental angle is measured using a similar approach.[7] First, soft tissue point B is located. From this point, a tangent is drawn along the lower lip, while another tangent is drawn from the most prominent point on the upper part of the chin's soft tissue pad. The angle formed at the intersection of these two lines represents the labiomental angle. Accurate assessment of labiomental fold depth and angle is crucial in orthodontics, orthognathic surgery, and aesthetic medicine. Excessive or insufficient depth can affect facial harmony and treatment outcomes. Advancements in imaging technology, such as CBCT and 3D facial scanning, have improved the accuracy of these measurements, aiding in treatment planning for orthodontic and aesthetic procedures. Understanding these parameters is crucial for achieving balanced facial proportions and optimal aesthetic outcomes.

In this study, students completed a questionnaire before and after attending orthodontics lectures. The lectures covered key topics, including malocclusion classification, cephalometric analysis, diagnosis and treatment planning, craniofacial growth and development, and orthodontic appliances. The course aimed to provide fourth-year dental students with a comprehensive understanding of craniofacial growth, malocclusions, and diagnostic principles while introducing them to various orthodontic treatment methods.

The curriculum comprised 16 lectures covering a range of orthodontic topics, including the classification and nomenclature of malocclusions, cephalometric analysis, craniofacial growth and development, dental and occlusal abnormalities, etiologies of malocclusion, occlusal guidance, removable and functional orthodontic appliances, fixed orthodontic appliances, orthodontic biomechanics and tissue response, orthodontic diagnosis and treatment planning, adult orthodontics, orthodontics and temporomandibular joint disorders, clear aligners, and orthognathic surgery with comprehensive orthodontic treatment. Three specific lectures—cephalometric analysis, orthodontic diagnosis and treatment planning, and orthognathic surgery with comprehensive orthodontic treatment-emphasized standard facial profiles, contemporary aesthetic norms, and treatment planning strategies for achieving an ideal facial profile in patients with malocclusions. Consequently, the students' perceptions of facial aesthetics were likely influenced by the orthodontics lectures.

Various rating methods are employed to assess participants' evaluations of facial appearance, aesthetics, and attractiveness. Two commonly used tools are the VAS and the Likert scale.[10–13] When evaluating aesthetic attractiveness, the VAS provides an objective scoring system, allowing individual aesthetic judgments to be structured and quantifiable. The VAS is commonly used for assessing image quality through subjective visual evaluation, where images are rated based on specific criteria. This method can be extended to facial aesthetics to measure individuals' attractiveness for various facial features essentially, their ideal appearance using a scale from 1 to 100. In this study, a Likert scale was used to assess the acceptability of different facial features. Participants indicated their level of agreement with a given statement, ranging from "completely unacceptable" to "completely acceptable." By using the Likert scale, participants could clearly express their acceptance of different facial characteristics, reducing the influence of overly subjective or emotionally driven choices. Notably, after attending the lectures, individuals with initially low acceptance of certain features may have reconsidered whether their perceptions were influenced by bias, potentially fostering a more inclusive perspective. It is important to distinguish between preference and acceptability. While preference reflects an individual's ideal appearance based on VAS ratings, acceptability refers to whether a person finds a particular feature tolerable even if it does not fully align with their aesthetic ideal.

One effective method for ensuring participant attentiveness and response consistency is to make the scoring directions of these two scales opposite to each other a technique known as a consistency check or reverse scoring strategy.[14,15] If a participant assigns a high score on the VAS (indicating strong preference) but also selects a high score on the Likert scale (where a high score indicates rejection), their responses may be inconsistent, suggesting inattentiveness or misunderstanding of the questions. For example, if a participant rates a feature as 70 on the VAS (indicating "highly favorable") but selects a 3 on the Likert scale (indicating "extremely abnormal/completely unacceptable"), their

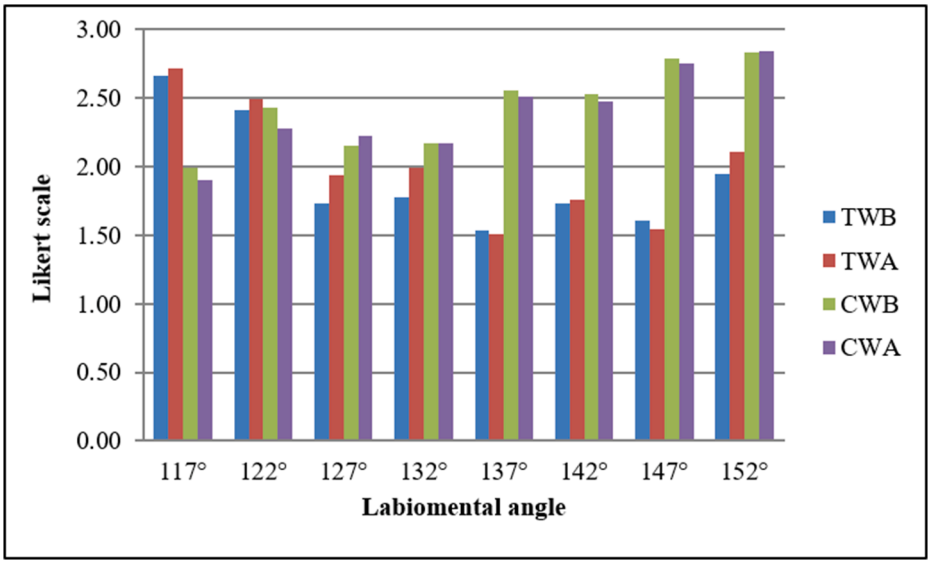

Figure 4 Changes in attractiveness ratings across labiomental angles before and after an orthodontic lecture, measured using a Likert scale.
TWB: Taiwanese woman model before education.
TWA: Taiwanese woman model after education.
CWB: Caucasian woman model before education.
CWA: Caucasian woman model after education.

Table 5 Comparison of labiomental fold angle (LFA) attractiveness and acceptances between Taiwanese and Caucasian female models among students before and after orthodontic education.

Labiomental Angle (°)	VAS				Likert			
	Before lecture		After lecture		Before lecture		After lecture	
	P value		*P* value		*P* value		*P* value	
117	<0.001*	C > T	<0.001*	C > T	<0.001*	T > C	<0.001*	T > C
122	0.323	—	<0.001*	C > T	0.807	—	0.039*	T > C
127	<0.001*	T > C	0.371	—	<0.001*	C > T	0.006*	C > T
132	<0.001*	T > C	0.398	—	<0.001*	C > T	0.038*	C > T
137	<0.001*	T > C	<0.001*	T > C	<0.001*	C > T	<0.001*	C > T
142	<0.001*	T > C	<0.001*	T > C	<0.001*	C > T	<0.001*	C > T
147	<0.001*	T > C	<0.001*	T > C	<0.001*	C > T	<0.001*	C > T
152	<0.001*	T > C	<0.001*	T > C	<0.001*	C > T	<0.001*	C > T

*: Significant, $P < 0.05$; —: Not Significant.
Taiwanese female model: T, Caucasian female model: C.
Preference: Visual analogue scale (VAS).
Acceptance: Likert scale.

responses contradict each other, raising concerns about response reliability. Additionally, participants who fail to notice the direction of the Likert scale where 1 represents "extremely normal/completely acceptable" and 3 represents "extremely abnormal/completely unacceptable" may inadvertently select incorrect responses out of habit. By implementing reverse scoring, researchers can identify inconsistent responses and improve the overall validity of the study's findings. This study designed the scoring directions of the VAS and Likert scale to be opposites in order to ensure that participants were attentive and provided consistent responses. This approach helped confirm that they truly understood the questions and remained focused while answering. By encouraging participants to think more critically, this strategy also minimized the risk of social desirability bias, reducing the likelihood of participants selecting answers out of habit.

In a study of Naini et al.,[16] using portrait analysis and Adobe Photoshop CS2 software, found that the most attractive labiomental angles for Caucasian women were between 107° and 118°, with angles up to 140° considered acceptable. The angles outside this range were perceived as unattractive, with those below 98° or above 162° regarded as highly unappealing. Specifically, deep labiomental folds with angles as low as 84° and nearly flat folds with angles around 162° were rated as the least attractive. A systematic review by Wen et al.[17] compiled a database of labiomental angles

measured with facial scanners across Asian, African, and Caucasian populations. The study revealed that the average labiomental angle in Asian women was 133.4° (95 % confidence interval: 128.3°—138.5°), in African women was 129° (95 % confidence interval: 120.1°—136.3°), and in Caucasian women was 132° (95 % confidence interval: 127.9°—136.2°). Jayaratne et al.,[18] using a 3D anthropometric analysis of the orolabial region in Chinese young adults, found no significant difference in the labiomental angle between males (138.94°) and females (141.27°). Kim et al.[19] evaluated the facial dimensions of young adult women with aesthetically preferred facial features and found that the Miss Korea group had significantly smaller labiomental angles. The mean labiomental angle in the Miss Korea group was 113.82°, which was significantly lower than that of young adult women in the general population, whose average angle was 131.01°. Yi et al.[20] compared the facial proportions of attractive young women from Eastern and Western populations and found that Miss Korea had a significantly wider labiomental angle than Miss Paraguay.

In the present study, prior to attending the orthodontics lectures, students assigned the highest VAS scores to the 137° model for the Taiwanese woman and the 117° model for the Caucasian woman. This suggests a preference for a more prominent chin in Caucasian women, which may have been influenced by media portrayals or personal impressions of foreign women. However, after the lectures, the highest VAS score for the Taiwanese woman shifted to the 147° model, while the preference for the Caucasian woman remained at the 117° model. This change indicates a strong impact of the lecture on the students' aesthetic evaluations of Taiwanese women. Statistical analysis further revealed a significant decrease in VAS scores for the 117° model of the Taiwanese woman, while the VAS score for the same angle of the Caucasian woman significantly increased. These findings suggest a notable shift in the participants' perceptions of chin prominence, with a preference for a less prominent chin in Taiwanese women and a more pronounced chin in Caucasian women. Furthermore, after the course, the VAS scores for all angles of the Caucasian female model were significantly higher.

Regarding facial acceptance, before the orthodontics lectures, all participants gave the lowest Likert scale scores to the 137° model of the Taiwanese woman and the 117° model of the Caucasian woman. This suggests that a flatter chin in Caucasian women was considered a normal and acceptable appearance. These attractiveness remained unchanged after the lectures. Interestingly, while the preference (VAS) and acceptance (Likert scale) for the Caucasian models were aligned, for the Taiwanese models, the highest VAS score was assigned to a model with an angle 10° greater than the one receiving the highest Likert score. This suggests a slight discrepancy between preference and acceptance, which may be attributed to the limited 3-point scale of the Likert measure.

When comparing the VAS and Likert scale scores for the Taiwanese and Caucasian models with the same angle before and after the lectures, a significant difference in preference was found for the Caucasian female model at 117°. Students continued to show a strong preference for this model. However, for angles ranging from 127° to 152°, the VAS scores for the Taiwanese female models were significantly higher than those for the Caucasian female models, indicating a stronger preference for the Taiwanese models. This could be attributed to the more prominent facial features of the Caucasian models used in the study, such as a pronounced nose, chin, and deeper labiomental fold, which may have contributed to a more harmonious overall appearance. The Likert scale scores showed alignment between preference and acceptance, confirming the consistency of participants' evaluations.

After the lectures, for the models with angles of 147° and 152°, no significant preference was expressed for the Caucasian female models, as the scores for both Taiwanese and Caucasian models were non significantly different. Regarding acceptability (Likert scale), the appearance of the Taiwanese female models with angles of 117° and 152° was rated significantly lower than that of the Caucasian female models. Overall, the results showed that for models with angles of 122°, 132°, and 137°, both the preference for and acceptance of the Taiwanese female model's appearance were significantly higher than those for the Caucasian female models. In contrast, for the model with an angle of 117°, both the preference for and acceptance of the Caucasian female model's appearance were significantly higher than those for the Taiwanese female model's appearance. Although significant changes in scores were observed, the overall trends remained consistent before and after the lectures: Caucasian women with a more prominent chin were preferred, while a less prominent chin was preferred for Taiwanese women.

The VAS can be used to measure an individual's preference for various facial features, providing a concrete way to establish aesthetic standards. By using the VAS, individuals can identify their most preferred facial types, offering insight into their aesthetic inclinations. On the other hand, the Likert scale offers a structured approach to evaluating the acceptability of facial appearances, enabling a more rational assessment of aesthetic tolerance. Unlike the VAS, which assesses preference, the Likert scale focuses on whether a particular appearance is deemed acceptable, even if it does not align with the individual's preference. Increasing a person's acceptance of various features does not necessarily mean abandoning their personal attractiveness; instead, it expands their range of choices and helps reduce limitations caused by aesthetic biases.

The orthodontic curriculum for senior dental students included several lecture topics directly related to the development of aesthetic perception, particularly regarding the labiomental angle. These topics included cephalometric analysis, which introduced students to soft tissue landmarks such as the labiomental fold and its angular measurements. Orthodontic diagnosis and treatment planning emphasized profile evaluation and the impact of skeletal discrepancies on facial harmony. Orthognathic surgery focused on the esthetic outcomes of surgical interventions such as genioplasty and mandibular setback or advancement. These lectures collectively contributed to students' ability to assess the labiomental angle not only from an esthetic standpoint but also from a diagnostic and therapeutic perspective.

The present study is subject to several limitations. A key limitation of this study is the use of only two female models—one Taiwanese and one Caucasian—to represent

entire ethnic groups. This narrow representation significantly limits the generalizability of the findings, as it does not account for the wide range of facial diversity that exists within each ethnic group. Facial morphology can vary considerably due to individual genetic, regional, and environmental factors, and relying on a single exemplar per group restricts the ability to draw broader conclusions about aesthetic preferences. Future research should incorporate a more diverse set of models within each ethnic category to enhance both statistical power and the representativeness of the findings.

After studying orthodontics, the most preferred labiomental angle for the Taiwanese woman, as measured by the VAS, shifted from 137° to 147°. In contrast, the preferred angle for the Caucasian woman remained at 117° both before and after the lectures. The least-preferred labiomental angle remained unchanged 117° for the Taiwanese woman and 152° for the Caucasian woman. Regarding acceptance, as measured by the Likert scale, the trends mirrored those observed in the VAS scores. In conclusion, when evaluating facial aesthetics, it is essential to consider the influence of cultural differences. Orthodontists and medical professionals should tailor treatment plans based on patients' cultural backgrounds and aesthetic attractiveness to ensure optimal treatment outcomes.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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