# **Original Article**

# Harmonizing soft tissue subnasale and chin position in a forehead-based framework: interracial commonalities and differences between Asian and Caucasian females

# Tian Chen<sup>a</sup>; Xianrui Yang<sup>b</sup>; Chaoran Xue<sup>a</sup>; Ding Bai<sup>c</sup>; Hui Xu<sup>d</sup>

# ABSTRACT

**Objectives:** To establish a reference system for assessing the anteroposterior (A-P) position of the subnasal and lower-facial soft tissues for whole facial harmony.

**Materials and Methods:** Forty Asian and 40 Caucasian females with attractive profiles were selected as the "attractive" samples, with "ordinary" samples for comparison. Each profile was analyzed, and comparisons were made to reveal the interracial commonalities and differences. Esthetically essential parameters were established. An averaged attractive profile for each race was created by digital morphing and then modified into 30 variations based on combined variations of the esthetically essential parameters. Assessments were performed to investigate the esthetic ranges.

**Results:** A-P position of the subnasal and lower-facial landmarks harmonized with the forehead for female profile esthetics. In addition to balanced soft tissue subnasale (sSn)- and soft titssue pogonion (Pos)-to-forehead A-P relations, harmonizing lower-facial soft tissues to sSn was indispensable for profile attractiveness. sSn-to-glabella, Pos-to-glabella, and Pos-to-sSn A-P relations were esthetically essential. Perceived by orthodontists, the attractive Asian female profiles had sSn-to-glabella A-P relations ranging from 0.5 mm to 4.5 mm, Pos-to-sSn from -9.0 mm to -5.5 mm, and Pos-to-glabella from -8.5 mm to -1.0 mm. Compared with Asians, the attractive Caucasian female profiles had more anteriorly and widely distributed sSn relative to the forehead, wider ranges of Pos-to-sSn A-P relations, and more prominent chins.

**Conclusions:** A reference system comprising sSn-glabella, Pos-sSn, and Pos-glabella horizontal distances was constructed for facial profile analysis. This system could aid treatment planning for surgical or orthopedic repositioning of the maxilla and chin. (*Angle Orthod*. 2025;95:86–95.)

KEY WORDS: Facial profile; Esthetics; Facial plastic surgery; Orthognathic surgery

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#### INTRODUCTION

One of the ultimate goals of orthognathic and facial plastic surgery is to pursue the beauty of facial soft tissue.<sup>1–5</sup> Current treatment designs for repositioning the maxilla and/or mandible mainly focus on hard tissue analysis. However, adhering solely to cephalometric standards may sometimes fall short of delivering an esthetically desirable outcome.<sup>6</sup> Facial harmony can be achieved within a wide range of cephalometric values, making it imperative to integrate both hard and soft tissue analyses.<sup>7,8</sup>

Among the essential elements of mid- and lowerfacial profile esthetics are the soft tissue subnasale (sSn), lips, and chin, the positions of which may be affected by orthodontic and orthognathic treatment. Authors of previous studies have proposed soft tissue analyses assessing the anteroposterior (A-P) positions of the lips and chin based on measurements limited to the mid and lower face.<sup>9–18</sup> Evidence is lacking on how the sSn and chin should be evaluated in relation to the upper face.

Among the parameters geometrically characterizing the A-P orientation and shape of the forehead, glabella,<sup>5,19</sup> the forehead facial axial (FFA) point and forehead inclination<sup>19</sup> have been shown to be strongly associated with facial harmony. However, it remains unclear which of these upper face-related parameters should be included in assessment of the mid- and lower-facial soft tissue. Additionally, it is important to determine how the assessment system should be adjusted for different racial groups.

In the current study, we aimed to address these questions by constructing a reference system for assessing the sSn and chin positions to achieve overall facial harmony. We focused on Asian and Caucasian females to investigate the interracial commonalities and differences in the spatial relationships of the upper-, mid-, and lower-facial soft tissue in well-balanced profiles.

#### MATERIALS AND METHODS

This study comprised two parts. First, real facial profile photos from "attractive" and "ordinary" samples were analyzed to identify esthetically essential parameters and reveal interracial commonalities and differences. Second, averaged attractive faces for Asian and Caucasian females were created by digital morphing and averaging, eliminating confounding factors from other facial traits. The composite image was modified into 30 variations based on combined variations of the essential parameters. Assessments were conducted to investigate the esthetic ranges. The workflow of the study is presented in Figure 1. The study was approved by the Ethics Committee of West China Hospital of Stomatology, Sichuan University.

#### **Sample Selection**

To establish the ordinary samples, 40 Asian females (25.2  $\pm$  3.1 years old) and 40 Caucasian females (25.7  $\pm$ 2.8 years old) were recruited from the general population. The exclusion criteria included any syndrome causing craniofacial dysmorphology, a history of facial filling, surgery, or trauma. Pleasing appearance was not a criterion. For the attractive samples, 40 Asian females (23.9  $\pm$  2.5 years old) with attractive profile appearances were selected, having no history of facial surgery or filling and no history of facial trauma. For both the ordinary samples and the attractive Asian subjects, full-facial profile photos were taken in a natural head position with a ruled scale on the side, using a digital camera. To compare the attractive Asian females with Caucasian counterparts, 40 photos of attractive Caucasian female profiles were collected from online resources. The attractiveness of these 160 photos was rated in a survey by 90 laypersons (45 females and 45 males, aged 26.3  $\pm$  2.8 years) using a 0-10 visual analog scale (VAS), where 0 indicated the least attractive and 10 indicated the most attractive.

#### Measurements

For each photo, facial landmarks were located, and reference lines were constructed as illustrated in Figure 2. Horizontal distances were measured from the mid- and lower-facial landmarks to the FFA vertical (Line 1) or the glabella vertical (Line 2) and from the lower-facial landmarks to the sSn vertical (Line 3). The contour of the forehead (flat, rounded, or angular) was recorded,<sup>19</sup> and inclination of the forehead was measured. After calculating the averaged midfacial depth (the horizontal distance from the tragus to the most anterior aspect of the eyeball) of the ordinary Caucasian sample, the actual sizes of the attractive Caucasian profiles were estimated by scaling the photos up and down to fit the averaged midfacial depth. All the photos were analyzed by one investigator using Adobe Photoshop software (CC2018, Adobe Systems Inc., San Jose, Calif).

# Digital Processing; Image Construction and Photographic Modification

Within the attractive samples of Asian or Caucasian females, the photos were arranged in descending order of attractiveness according to the VAS scores. The top 10 photos were selected as most attractive and were then merged using FantaMorph software



Figure 1. Workflow of the study.

(5.6.2 Deluxe, Abrosoft Co., Beijing, China) to create two averaged attractive profiles (AAPs), one for each race, as framed in red in Figure 3A, B.

For each AAP, the horizontal distances from sSn and Pos points to Line 2 were measured and recorded. Modifications were made in the mid- and lower-facial regions based on combinations of the sSn-Line 2 and Pos-Line 2 distances. These modifications resulted in variations in lip- and chin-to-sSn A-P relations. The U1-sSn, L1-sSn, and Pos-sSn horizontal distances were measured for each image. Those modifications of the images plus the AAPs were arranged randomly in Series 1 (Figure 3A, 30 Asian profiles) and Series 2 (Figure 3B, 30 Caucasian profiles) for further esthetic assessment.

#### **Esthetic Assessment**

Assessments were performed via an online survey by 90 orthodontists (57 Asians, 33 Caucasians) and 90 laypersons (48 Asians, 42 Caucasians), with an even distribution of males and females. Each rater assessed the images in Series 1 and 2 using a 0–10 VAS, without comparison between the two series. To determine intraobserver reliability, the assessments were performed twice with a 2-week interval, and the mean scores were used for statistics.

#### Statistics

Data analysis was conducted using SPSS (version 25.0; SPSS Inc., Chicago, IL) and GraphPad Prism



#### Forehead landmarks:

- Tr: soft tissue trichion.
- Su: Superion, the most superior aspect of the forehead with rounded or angular contour.
- FFA: the midpoint between trichion and glabella for foreheads with flat contour, or the midpoint between superion and glabella for foreheads
- with rounded or angular contour.
- GI: soft tissue glabella.

#### Mid- and lower-facial landmarks:

- sSn: soft tissue subnasal point.
- UI: the most anterior aspect of the upper lip.
- LI: the most anterior aspect of the lower lip.
- Pos: soft tissue pogonion.

#### **Reference lines:**

#### Line1-3 were all vertical lines perpendicular to the true horizontal.

- Line 1: the vertical line through the FFA point.
- Line 2: the vertical line through the GI point.
- Line 3: the vertical line through the sSn point.
- Line 4: the line connecting glabella to the uppermost point of the clinical forehead (superion point for foreheads with rounded or angular contour, trichion point for foreheads with flat contour). Forehead inclination was defined as the angle between Line 1 and Line 4.

Figure 2. Facial landmarks and reference lines.

(GraphPad Software Inc., San Diego, Calif). Independent *t*-test was used to detect the differences in measurements between samples. The Pearson correlation coefficient was applied to assess the correlations between measurements. Intraobserver reliability was determined by the intraclass correlation coefficient (ICC). Differences in esthetic ratings between samples were detected by one-way analysis of variance (ANOVA). The effects of



**Figure 3.** Variable assignments and photographic modifications for the (A) Asian (Series 1) and (B) Caucasian (Series 2) female profiles. Digital photographic modifications of the AAP (framed in red) of (A) Asian and (B) Caucasian females were performed by moving the midand/or lower-facial structures forward or backward according to the values of the two variables (a: sSn-Line 2 distance; b: Pos-Line 2 distance; a positive value is assigned when the point was anterior to the reference line). For each series, a total of 30 images were created, numbered, and arranged in the panel according to their variable assignments.

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Table 1. Forehea	d Contours and Forehead Inclinations
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	As	ian	Cauc	asian
	Attractive Sample	Ordinary Sample	Attractive Sample	Ordinary Sample
Type of forehead contour, %				
Rounded	62.5	55.0	12.5	12.5
Flat	2.50	2.50	15.0	35.0
Angular	35.0	42.5	72.5	52.5
Forehead inclination, °				
$\text{Mean} \pm \text{SD}$	$12.35\pm2.90$	$12.35\pm3.71$	$11.06\pm3.26$	$12.04\pm4.23$

rater gender or group on esthetic ratings were evaluated by two-way ANOVA. Differences in esthetic ratings between images within each series were detected by Sidak's multiple comparisons. The level of significance was set at 0.05. For each series of images rated by each group, the 30 images were divided into two, three, or four grades according to Sidak's multiple comparisons. These grades were termed attractive (a), neutral (n) or split further into n and subneutral (s), and unattractive (u), in descending order of attractiveness.

## RESULTS

#### Forehead Inclination Did Not Significantly Correlate With sSn-to-Forehead or Pos-to-Forehead A-P Relations in Attractive Profiles

The percentages of the three types of forehead contour differed interracially, with no significant difference (P > .05, Table 1) in the forehead inclination between the ordinary and attractive samples intraracially. For the attractive samples, the forehead inclination did not significantly (P > .05,  $r \le 0.28$ ) correlate with the horizontal distances from sSn or Pos to the foreheadrelated reference lines (Lines 1 and 2), suggesting little impact of forehead inclination on the upper- and midfacial harmonization.

# sSn and Pos Positions Harmonized With the Forehead Anteroposteriorly for Profile Esthetics. sSn-Glabella, Pos-Glabella, and Pos-sSn Horizontal Distances Were Identified as Esthetically Essential Parameters

The esthetic superiority of facial profiles of the attractive samples over the ordinary samples was validated by significantly higher scores (P < .05) given by the laypersons. When measured relative to the forehead landmarks, the mid- and lower-facial landmarks of the attractive profiles distributed in narrower ranges with smaller SDs than the ordinary profiles (Table 2, Figure 4), suggesting that the A-P spatial coordination of the upper-, mid-, and lower-facial

**Table 2.** Descriptive Statistics for the Anteroposterior Spatial Relations of the Upper-, Mid, and Lower-Facial Landmarks in the Asian and Caucasian Female Profiles<sup>a</sup>

	As	ian	Cauc	asian	
	Attractive Sample	Ordinary Sample	Attractive Sample	Ordinary Sample	
To Line 1					
Glabella-Line 1	$\textbf{2.49} \pm \textbf{0.82}$	$2.50\pm0.79$	2.73 ± 1.01	$2.92 \pm 1.31$	
sSn-Line 1	4.07 ± 2.15	$3.57 \pm 2.52$	4.97 ± 2.29	$5.45\pm2.80$	
UI-Line 1	$5.93\pm2.00$	$6.70\pm2.59$	$6.60 \pm 2.67$	7.11 ± 3.03	
LI-Line 1	$3.14 \pm 2.26$	$3.68\pm2.97$	$4.15 \pm 2.41$	$4.64\pm2.97$	
Pos-Line 1	$-1.70 \pm 2.47$	$-2.92\pm3.49$	$-0.77 \pm 2.34$	$-1.21 \pm 3.39$	
To Line 2					
sSn-Line 2	$2.00 \pm 1.61$	$1.08 \pm 2.30$	$2.26 \pm 1.86$	$2.53\pm2.23$	
UI-Line 2	$3.51 \pm 1.90$	$\textbf{4.19} \pm \textbf{2.43}$	$3.86 \pm 2.27$	$4.19\pm2.48$	
LI-Line 2	$0.72\pm2.06$	$1.18 \pm 2.88$	$1.41 \pm 2.09$	$1.72 \pm 2.54$	
Pos-Line 2	$-4.07 \pm 2.20$	$-5.42\pm3.40$	$-3.50 \pm 1.95$	$-4.12 \pm 3.07$	
To Line 3					
UI-Line 3	$1.86\pm0.76$	$3.12 \pm 1.56$	$1.63\pm1.05$	$1.66 \pm 1.50$	
LI-Line 3	$-0.93 \pm 1.21$	0.11 ± 2.29	$-0.82 \pm 1.36$	$-0.82\pm2.07$	
Pos-Line 3	$-5.77 \pm 1.67$	$-6.50 \pm 3.45$	$-5.74 \pm 1.58$	$-6.66 \pm 3.10$	
Between lips					
UI-LI	$-2.79 \pm 0.94$	$-3.01 \pm 1.40$	$-2.45 \pm 0.97$	$-2.47\pm1.27$	

<sup>a</sup> Data are presented as distances in millimeter. A positive value was assigned when the point was anterior to the reference line, or when the LI point was anterior to the UI point.



**Figure 4.** The anteroposterior (A-P) spatial relations of the upper-, mid-, and lower-facial landmarks in the profile photos of the (A) Asian and (B) Caucasian females. The horizontal distances from the facial landmarks to the reference lines in the profile photos of the attractive and ordinary samples of (A) Asian and (B) Caucasian females are presented as individual scatter points. To show the A-P interrelations between the landmarks of one individual, the points representing measurements of one individual are connected by lines. The upper-lip-to-lower-lip A-P relations are presented as horizontal distances from L1 to U1 points. A positive value is assigned when the point was anterior to the reference line or when the L1 point was anterior to the U1 point.



#### Asian profiles (Series 1)



**Figure 5.** Esthetic grading for the Asian and Caucasian profile images. For each series of images rated by each group of raters, a table was constructed to show the variable assignments and esthetic assessments. The mean scores for the images are shown in a heat-map manner. In each table, 30 colored dots, representing the 30 images, are arranged according to their variable assignments (sSn-L2: sSn-Line 2 distance, Pos-L2: Pos-Line 2 distance). The color of the dot reflects the level of the mean score given to the image. On each dot, a figure represents the serial number of the image, and a letter represents the esthetic grade; a: attractive; n: neutral; s: subneutral; and u: unattractive.

landmarks were facial traits that distinguished the attractive from the ordinary profiles.

The A-P positions of the mid- and lower-facial landmarks in the attractive samples showed greater interracial similarity, narrower ranges, and smaller SDs intraracially when assessed relative to Line 2 than to Line 1 (Table 2, Figure 4), suggesting greater interracial consistency and esthetic sensitivity of the upper-, mid-, and lower-facial relations assessed in the reference frame of glabella rather than in that of FFA point.

#### In Addition to Harmonizing sSn and Pos Positions to Glabella, Relations of Lower-Facial Landmarks to sSn Were Esthetically Sensitive and Indispensable for Profile Esthetics

The A-P positions of the lips and chin (UI, LI, and Pos points) were distributed within even narrower ranges when measured relative to sSn vertical (Line 3) than the forehead-related reference lines in the attractive sample (Table 2, Figure 4), indicating great

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interracial consistency and esthetic sensitivity. The lower-facial soft tissues should be spatially coordinated with sSn on the premise of a balanced sSn-to-glabella A-P relation.

#### Interracial Differences in Assessing sSn-Glabella, Pos-Glabella, and Pos-sSn A-P Relations

To investigate reference ranges for the esthetically essential parameters, average-featured and digitally modified photos were used to eliminate confounding factors. No significant differences (P >.05) were found between rater genders, and data were pooled for analysis. In contrast, remarkable differences (P < .05) were found between orthodontists and laypersons and between Asian and Caucasian raters. The ratings by the four groups of raters were analyzed separately (Figure 5 and 6).

The attractive Asian female profiles had less prominent sSn and chins had narrower ranges of Pos-tosSn A-P relations than the attractive Caucasian most attractive: images with the highest score;

attractive: images with scores not significantly lower (P > 0.05) than the highest score;

neutral and sub-neutral: images with scores neither significantly higher than all the images in the "unattractive" grade nor significantly lower than all the images n the "attractive" grade fell into the "neutral" grade, or were subdevided into "neutral" and "sub-neutral" when significant differences were found within grade;

unattractive: images with scores not significantly higher (P > 0.05) than the lowest score

#### Asian profiles (Series 1) Asian laypersons **Caucasian orthodontics**

sSn-L2 (mm) (mm) Pos-L2	-3.5	-1.5	0.5	2.5	4.5	6.5
-11.0	-7.5	-9.5	-11.5	-13.5		
-8.5	-5	-7	-9	-11	-13	
-6.0	-2.5	-4.5	-6.5	-8.5	-10.5	-12.5
-3.5	0	-2	-4	-6	-8	-10
-1.0		0.5	-1.5	-3.5	-5.5	-7.5
1.5			1	-1	-3	-5

Asian orthodontics

-6.5 -8.5 -10.5 -12.5

5.5 -7.5 -9.5 -11.

-0.5 -2.5 -4.5 -6.5

-5 -7 -9

0 -2

2

-25 -0.5 1.5 3.5 5.5 75

1

-1 -3

1.5

-9.0

-6.5 -4 -6 -8 -10 -12

-4.0 -1.5 -3.5

-1.5

1.0

3.5

Asian orthodontics



sSn-L2 (mm) (mm) Pos-L2	-3.5	-1.5	0.5	2.5	4.5	6.5
-11.0	-7.5	-9.5	-11.5	-13.5		
-8.5	-5	-7	-9	-11	-13	
-6.0	-2.5	-4.5	-6.5	-8.5	-10.5	-12.5
-3.5	0	-2	-4	-6	-8	-10
-1.0		0.5	-1.5	-3.5	-5.5	-7.5
1.5			1	-1	-3	-5

Caucasian laypersons

sSn-L2 (mm) (mm) Pos-L2	-3.5	-1.5	0.5	2.5	4.5	6.5
-11.0	-7.5	-9.5	-11.5	-13.5		
-8.5	-5	-7	-9	-11	-13	
-6.0	-2.5	-4.5	-6.5	-8.5	-10.5	-12.5
-3.5	0	-2	-4	-6	-8	-10
-1.0		0.5	-1.5	-3.5	-5.5	-7.5
1.5			1	-1	-3	-5

#### **Caucasian profiles (Series 2)**

	A	Asian laypersons				)	Cauc	asia	n ort	hodo	ntics	
sSn-L2 (mm) (mm) Pos-L2	-2.5	-0.5	1.5	3.5	5.5	7.5	sSn-L2 (mm) (mm) Pos-L2	-2.5	-0.5	1.5	3.5	5.5
-9.0	-6.5	-8.5	-10.5	-12.5			-9.0	-6.5	-8.5	-10.5	-12.5	
-6.5	-4	-6	-8	-10	-12		-6.5	-4	-6	-8	-10	-12
-4.0	-1.5	-3.5	-5.5	-7.5	-9.5	-11.5	-4.0	-1.5	-3.5	-5.5	-7.5	-9.5
-1.5	1	-1	-3	-5	-7	-9	-1.5	1	-1	-3	-5	-7
1.0		1.5	-0.5	-2.5	-4.5	-6.5	1.0		1.5	-0.5	-2.5	-4.5
3.5			2	0	-2	-4	3.5			2	0	-2

#### 1.5 3.5 5.5 7.5 -2.5 -0.5 -6.5 -8.5 -10.5-12.5 -4 -6 -8 -10 -12 -1.5 -3.5 -5.5 -7.5 -9.5 -11. 1 -1 -3 -7 .0 1.5 -0.5 -2.5 -4.5 -6. 2 0 -2

Caucasian	laypersons
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sSn-L2 (mm) (mm) Pos-L2	-2.5	-0.5	1.5	3.5	5.5	7.5
-9.0	-6.5	-8.5	-10.5	-12.5		
-6.5	-4	-6	-8	-10	-12	
-4.0	-1.5	-3.5	-5.5	-7.5	-9.5	-11.5
-1.5	1	-1	-3	-5	-7	-9
1.0		1.5	-0.5	-2.5	-4.5	-6.5
3.5			2	0	-2	-4

Figure 6. Pos-to-sSn relations for images of different esthetic grades rated by different groups of raters. For each series of images rated by each group of raters, a table is constructed to show the variable assignments, esthetic grading, and Pos-to-sSn horizontal distances. In each table, 30 colored little squares, representing the 30 images, are arranged according to their variable assignments (sSn-L2: sSn-Line 2 distance, Pos-L2: Pos-Line 2 distance). The color of the little squares reflects the esthetic grades of the images they represent. The highestscored ones are regarded as the most attractive. On each little square, the Pos-to-sSn horizontal distance (mm) is shown as a figure in blue. A positive value is assigned when Pos was anterior to sSn.

female profiles. Perceived by the orthodontists, the attractive Asian profiles had sSn-Line 2 distances that ranged from 0.5 mm to 4.5 mm, Pos-to-sSn A-P relations from -9.0 mm to -5.5 mm, and Pos-Line 2 distances from -8.5 mm to -1.0 mm. The attractive Caucasian profiles had sSn-Line 2 distances that ranged from -0.5 mm to 5.5 mm, Pos-to-sSn A-P relations from -8.0 mm to -1.0 mm, and Pos-Line 2 distances from -6.5 mm to 1.0 mm (Figures 5 and 6). Note that the esthetic ranges derived from the digitally modified images were like that obtained from the attractive profiles of the natural persons (Figure 4).

Caucasian orthodontists showed similar preferences but were more critical to profile assessments than Asian orthodontists. The Caucasian and Asian orthodontists showed consistency in assessing sSn positions for well-balanced profiles. However, the Caucasian orthodontists had less tolerance for maxillary-mandibular discrepancies and mandibular retrusion (Figure 5 and 6). Laypersons perceived facial profiles of their own race in a similar but less critical manner than orthodontists, while showing poor discernment for alien facial profiles (Figure 5 and 6).

#### DISCUSSION

The study demonstrated interracial consistency and esthetic sensitivity of A-P relations of the lower-facial soft tissue with sSn. It was previously reported that the U1 point was at 2.10  $\pm$  1.25 mm anterior, the L1 point was at 0.42  $\pm$  1.64 mm anterior, and the Pos point was at 2.90  $\pm$  1.85 mm posterior to the sSn vertical in attractive Caucasian female profiles.<sup>15</sup> In the current study, we show similar results, but the average positions of the lips and chin were slightly more posterior to the sSn vertical (Figure 4B, Table 2, Supplemental Figure 1). This mild discrepancy might have resulted from different criteria for sample selection or changes in esthetic perception over time.

Importantly, maintaining the lips and chin at positions in harmony with sSn was necessary but not sufficient for achieving an esthetic profile. Based on this study, incorporating the glabella vertical into the reference system was essential to planning the esthetically pleasing positions of the mid and lower face. With the glabella vertical (Line 2) and sSn vertical (Line 3) as the reference frames, the sSn-Line 2, Pos-Line 2, and Pos-Line 3 horizontal distances were identified to be the esthetically essential parameters for assessing subnasal and chin positions for overall facial harmony. The esthetic ranges for these parameters varied between races. The attractive Asian profiles had less prominence of the maxilla and chin than Caucasian counterparts.

The sSn, U1, L1, and Pos points are subject to orthodontic treatment, orthognathic, and facial contouring surgery. An esthetics-oriented diagnosis focused on soft tissue goals<sup>1,2</sup> might result in treatment planning different from that obtained through cephalometric analvsis.1,6,10-12,15 Soft tissue analysis should be considered yet not relied upon entirely. This study could provide a reference for surgical repositioning of the jaws. It is recommended that the sSn-glabella relation be optimized first, then the lower-facial soft tissue relative to sSn positioned. It is helpful to bear in mind the interracial differences showing that attractive Asian female profiles had sSn positions less anterior to the forehead, sSn-to-glabella distance within narrower ranges, and lip and chin-to-sSn A-P relations in narrower ranges than attractive Caucasians (Table 2, Figure 4-6, Supplemental Figure 1).

It is worth noting that the reference ranges of sSn-Line 2 and Pos-Line 2 distances obtained through testing on digitally modified images were similar but not totally the same as those observed in the attractive sample. These differences suggested individual variability and the flexibility of a reference range when applied to individuals. It would be inappropriate to place everyone into the same esthetic framework. Mathematical quantification of beauty should be viewed as a guideline to optimize the treatment outcome rather than as a strict value that is required to be strictly followed.

# CONCLUSIONS

 In this study, we proposed a reference system that helps in assessing and planning the maxillary and mandibular positions for female profile esthetics. This system comprised (1) two reference lines: the glabella vertical and the sSn vertical; and (2) three parameters: sSn-to-glabella, Pos-to-sSn, and Pos-to-glabella horizontal distances.

- Balanced sSn- and Pos-to-glabella and lower-facialto-sSn A-P relations were essential to profile esthetics.
- The quantified relations yielded clinical recommendations which stressed interracial commonalities and differences between Asian and Caucasian females.

### SUPPLEMENTAL DATA

Supplemental Figure 1 is available online.

**Supplemental Figure 1.** Lip and chin positions relative to sSn for the digitally modified profiles of the three esthetic grades rated by different groups of raters. To show the differences of the lips- and chin-tosSn A-P relations among different esthetic grades, the UI-Line 3, LI-Line 3, and Pos-Line 3 horizontal distances were measured in each image. The images are grouped into three panels corresponding to the esthetic grades rated by the four groups of raters. A positive value is assigned when the landmark was anterior to the reference line. The landmarks of one individual are connected by lines.

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#### DISCLOSURE

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