Original Article

Comparison of White and Chinese perception of esthetic Chinese lip position

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ABSTRACT

Objective: To compare the esthetic preference of White and Chinese judges with regard to Chinese lip position.

Materials and Methods: The profile images of a dental and skeletal Class I Chinese adult male and female were digitally adjusted to Chinese mean values. The lip profile was adjusted with the upper and lower lip at the mean distance from the Ricketts' E-line. These images were used as baseline images and were further digitally manipulated to generate six additional images with the upper and lower lip such that they lay 0.5, 1.0, and 2.0 standard deviations (SDs) in front of or behind the E-line. An additional image was modified based on a White mean value. The images were viewed and ranked by 251 White and Chinese judges (dentists and laypersons) in Australia and China.

Results: Significantly more Chinese judges ranked the retrusive profiles higher than the White judges. The White judges also ranked the profile image adjusted to −0.5 SD as the most esthetic for both the female and male, while the Chinese judges ranked the −1.0 SD profile as the most esthetic.

Conclusions: The ethnicity of the judges is a significant factor influencing the perception of esthetic lip position. The Chinese judges prefer a more retrusive profile and are more likely to rate a protrusive profile as unacceptable, compared with the White judges. (*Angle Orthod.* 2014;84:246–253.)

KEY WORDS: Esthetic perception; Esthetic line; Lip position; Caucasian; Chinese; Ethnicity

INTRODUCTION

Improving facial esthetics is an integral part of orthodontic treatment.[1] One important component of orthodontic diagnosis and treatment planning is the evaluation of patient's soft tissue profile.[2] Lip position has an important influence on facial profile esthetics, requiring orthodontists to align the teeth based on the patient's soft tissue preference.[3]

The dentofacial norms of the Chinese population are well established.[4–8] Past investigations on dentofacial esthetics in Chinese were focused mainly on hard tissue profile,[9–12] while studies on soft tissue profile and differences in perception of facial esthetics between different ethnic groups are limited.[13,14]

The purpose of this study was to determine whether the ethnicity of the judges was a significant factor in esthetic preference. The study then assessed and compared the perception of White and Chinese judges on the esthetic lip position of Chinese adults.

MATERIALS AND METHODS

The study was approved by the Human Research Ethics Committee of the University of Sydney (Protocol No. 07-2011/13675) and the University of Hong Kong (IRB Reference No. UW11-349). All participants were also provided with a Participant Information Statement.

The profile images and lateral cephalograms of Chinese male and female adults with Class I skeletal and dental profiles were selected. The original profile images were digitally manipulated with Dolphin software, Version 11.0 (Dolphin Imaging and Management,

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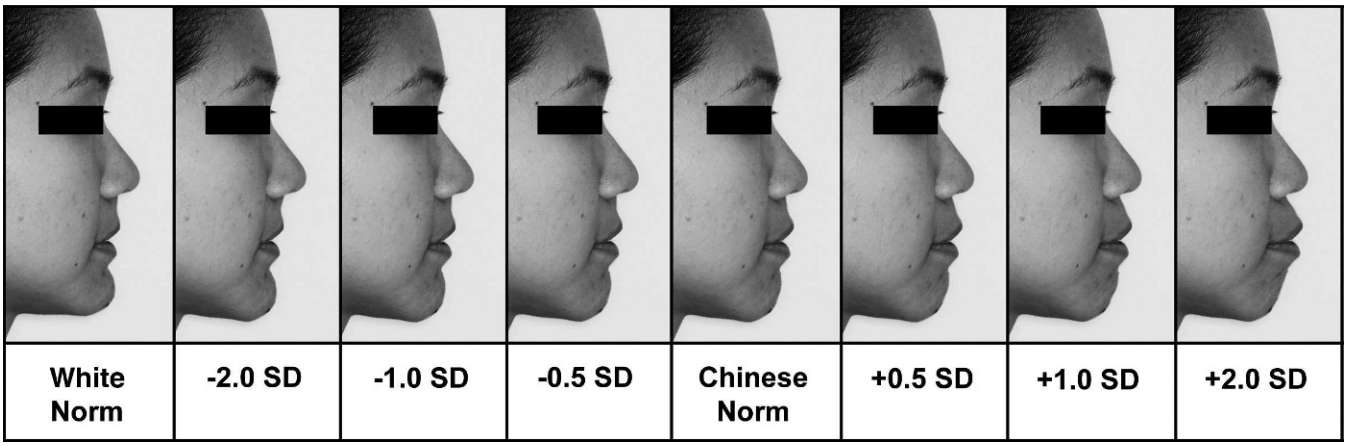

Figure 1. Female profile images.

Chatsworth, Calif) to obtain the mean antero-posterior and vertical values of a Chinese adult profile. The Chinese adult profile was based on the cephalometric norms established by the Gu et al. study in 2011.[4] This was done by adjusting Point A to Nasion perpendicular and Pogonion to Nasion perpendicular distances (Pt A-N perpendicular and Pg-N perpendicular, respectively) and lower anterior facial height (LAFH) to Chinese mean values.[4] The lip profile was also adjusted with the upper and lower lip at the mean distance (in millimeters) from the Ricketts' E-line[15] (UL-E line, LL-E line).

These images were used as baseline images and they were then further digitally manipulated to generate six additional images (Figures 1 and 2) such that the upper and lower lip lay 0.5, 1.0, and 2.0 standard deviations (SDs) in front of or behind the E-line. An additional image was modified based on White mean values. This was again done by adjusting Pt A-N perpendicular, Pg-N perpendicular, LAFH, UL-E line, and LL-E line to White mean values from the same study.[4]

Of the various soft tissue parameters, we used the E-line as the baseline study because it is widely used in studies on esthetic preference and provides interpretation and comparison with previous studies.[16] Computer-generated profile photos and silhouettes are commonly used in orthodontic research to evaluate patient profile esthetics. The study by Hockley et al.[17] in 2012 concluded that when evaluating soft tissue esthetic profile preferences, rater preferences obtained using photographs were closer to the established esthetic norms than were those obtained using silhouettes.

The survey was conducted in two locations, Australia (Sydney) and China (Hong Kong). The images were viewed by White and Chinese judges, which comprised dentists as well as laypersons. The laypersons were university students from non–dental-related faculties. The eight profile images for each gender were randomly ordered on a single slide and shown to the judges in the form of a Microsoft Office PowerPoint presentation. Prior to viewing the images the judges entered their age, gender, and dental experience on the data-collection form.

The survey consisted of three components. First, the judges were asked to rank the eight profiles from the

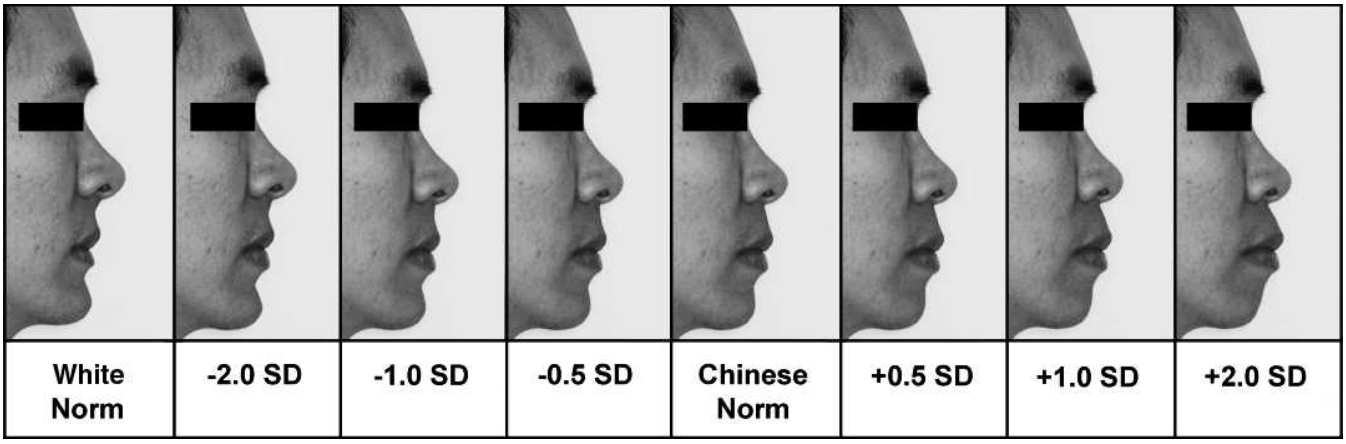

Figure 2. Male profile images.

Table 1. Characteristics of the Study Sample

	Ethnicity	
	White (n = 129)	Chinese (n = 122)
Location		
Hong Kong	2	93
Sydney	127	29
Dental experience		
Professional	40	45
Layperson	89	77
Dental professionals		
Orthodontist	9	18
General dentist	24	23
Other specialist	7	4
Sex		
Male	48	34
Female	81	88
Age		
<18 y	1	2
18–30 y	83	81
30–55 y	26	36
> 55 y	19	3

most attractive to the least attractive without repeating a rank. As the judges were required to give a unique rank for each profile image, this was useful to determining the order of preference. In the second part of the survey, the judges were asked to mark their preference on a Visual Analogue Scale (VAS).[18] As the judges were allowed to mark the same score for different profile images, this helped to determine whether their preference over another profile was significant. In this study, we used the norm profile as the control image for comparison. In the last part of the survey, the judges had to classify the profiles as either ''acceptable'' or ''unacceptable.'' This binary answer helped to establish the level of tolerance. For example, a profile ranked last may still be classified as acceptable.

Statistical Analysis

Generalized Estimating Equations (GEE) models for ordinal data were constructed to analyze the ranks of the male and female profiles separately. GEE models for binary data were constructed to analyze the acceptability of male and female profiles separately. GEE models for Gaussian data were used to analyze the VAS scores of male and female profiles.

In each of the models above, an interaction term between the profile number and ethnicity was used to determine whether the outcome (rank, acceptability, or VAS score) differed for each profile between Whites and Chinese. Covariates considered were judges' dental experience, age, sex, and ethnicity and each of their interaction variables with profile. Each of the models was clustered by the judge.

Table 2. Analysis of Rank—Chinese vs White for Each Female Profile[ab]

Female Profile	Odds Ratio	Lower 95% CI	Upper 95% CI
White norm	0.93	0.6	1.43
−2.0 SD*	1.64	1.01	2.67
−1.0 SD**	2.05	1.29	3.25
−0.5 SD	0.96	0.65	1.43
Chinese norm	0.85	0.56	1.31
+0.5 SD	0.86	0.55	1.34
+1.0 SD*	0.58	0.39	0.88
+2.0 SD***	0.25	0.12	0.52

[a] Adjusted by dental experience; *** $P < .001$; ** $P < .01$; * $P < .05$.
[b] CI indicates confidence interval; SD, standard deviation.

The data analysis for this article was generated using SAS Enterprise Guide software, version 4.3 (SAS System for Windows, SAS Institute Inc, Cary, NC).

RESULTS

The images were viewed and ranked by 251 judges in Australia and China. There were 129 White judges and 122 Chinese judges. The assessing panel in Australia comprised 156 people, of whom 51 were dentists and 105 were laypersons. Hong Kong had 95 judges, of whom 34 were dentists and 61 were laypersons. Overall, there were 166 laypersons and 85 dentists. The 85 dentists comprised 47 general dentists, 27 orthodontists, and 11 dental specialists. Table 1 describes the characteristics of the total sample in detail.

Ethnicity of the judges was found to be a significant factor ($P < .01$) in all three measures of the analysis—rank, VAS score, and acceptability. Dental experience was found to be a significant factor only in the rank measures ($P < .05$). Dental experience refers to the level of professional experience, that is, general dentist, orthodontist, dental specialist, and ''never trained in the area of dentistry.'' No significant difference was found in age or gender of the judges.

Analysis of Rank

Table 2 shows that for −1.0 and −2.0 SD female profiles, the Chinese judges found these profiles significantly more attractive compared with White judges. On the other hand, the Chinese judges found the +1.0 and +2.0 SD female profiles significantly less attractive compared with the White judges. Table 3 shows the comparison for male profiles. Compared with the White judges, the Chinese judges found −1.0 SD, −2.0 SD, and White norm profiles significantly more attractive and the +0.5, +1.0, and +2.0 SD profiles significantly less attractive.

Table 3. Analysis of Rank—Chinese vs White for Each Male Profile[ab]

Male Profile	Odds Ratio	Lower 95% CI	Upper 95% CI
White norm**	2.43	1.46	4.05
−2.0 SD**	1.89	1.2	2.98
−1.0 SD**	1.83	1.21	2.79
−0.5 SD	0.77	0.49	1.23
Chinese norm	0.83	0.56	1.22
+0.5 SD*	0.62	0.4	0.97
+1.0 SD**	0.53	0.35	0.79
+2.0 SD**	0.26	0.13	0.52

[a] Adjusted by dental experience; *** $P < .001$; ** $P < .01$; * $P < .05$.
[b] CI indicates confidence interval; SD, standard deviation.

White judges ranked the −0.5 SD profile as the most attractive and the −1.0 SD profile as the second most attractive for both female and male. On the other hand, Chinese judges ranked the −1.0 SD profile as the most attractive and the −0.5 SD profile as the second most attractive. The ranking order in Tables 4 and 5 was based on the odds ratio of each profile image relative to the Chinese norm, adjusted by dental experience.

For the female profile, both White and Chinese judges ranked the Chinese norm profile the third highest and perceived the +2.0, +1.0, and +0.5 SD images as the least attractive. For male profiles, the order of ranks was largely different between White and Chinese from ranks 1 to 6. Both White and Chinese judges ranked the images adjusted to +2.0 SD and +1.0 SD as the least attractive.

Analysis of VAS Score

The VAS score measured the significance of the difference in preference of each profile vs the Chinese norm profile, with the respective *P*-value indicated with an asterisk. A positive coefficient indicates that the profile was scored more favorably compared with the Chinese norm profile, while a negative coefficient indicates that it was scored less favorably than the norm profile.

Table 4. Analysis of Rank—Ranking Order for Female Profiles[a]

Female Profile	White Judges	Chinese Judges
Most attractive		
1	−0.5 SD	−1.0 SD
2	−1.0 SD	−0.5 SD
3	Chinese norm	Chinese norm
4	White norm	−2.0 SD
5	−2.0 SD	White norm
6	+0.5 SD	+0.5 SD
7	+1.0 SD	+1.0 SD
8	+2.0 SD	+2.0 SD
Least attractive		

[a] Results are adjusted by dental experience. SD indicates standard deviation.

Table 5. Analysis of Rank—Ranking Order for Male Profiles[a]

Male Profile	White Judges	Chinese Judges
Most attractive		
1	−0.5 SD	−1.0 SD
2	−1.0 SD	−0.5 SD
3	Chinese norm	Chinese norm
4	+0.5 SD	−2.0 SD
5	−2.0 SD	White norm
6	White norm	+0.5 SD
7	+1.0 SD	+1.0 SD
8	+2.0 SD	+2.0 SD
Least attractive		

[a] Results are adjusted by dental experience. SD indicates standard deviation.

The analysis of the VAS scores for female is shown in Table 6. The White judges significantly prefer −0.5 SD profile compared with the Chinese norm, while the Chinese judges significantly prefer −1.0 and −0.5 SD profiles. The White judges found the White norm, −2.0, +0.5, +1.0, and + 2.0 SD profiles significantly less attractive than the Chinese norm, while the Chinese judges only found the protrusive profiles significantly less attractive.

For the male profiles in Table 7, the Chinese judges significantly prefer −1.0 SD compared to the Chinese norm, while the White judges do not significantly prefer any profile images over the Chinese norm. The White judges found the White norm, +1.0, and +2.0 SD profiles significantly less attractive compared to the Chinese norm, while the Chinese judges found the White norm, +0.5, +1.0, and +2.0 SD profiles significantly less attractive.

Analysis of Acceptability

Figures 3 and 4 show the percentage of judges who found the profiles acceptable. It was observed that as the profile images become more protrusive from the Chinese norm, a greater percentage of Chinese judges rated them as unacceptable. For female profiles (Table 8), significantly more Chinese judges found the +2.0, +1.0, and +0.5 SD profiles unacceptable, compared with White judges. For male profiles (Table 9), significant differences were found in +1.0 and +2.0 SD images. The results also showed that the retrusive profiles were better tolerated compared to the protrusive profiles.

DISCUSSION

In the modern society it is increasingly important for orthodontic treatment outcome to be esthetically pleasing to the patient as well as to their peers and

Table 6. Analysis of Visual Analogue Scale (VAS) Score for Female Profiles[a]

	White Judges			Chinese Judges		
Female Profile	Coefficient	Lower 95% CI	Upper 95% CI	Coefficient	Lower 95% CI	Upper 95% CI
White norm vs Chinese norm	−0.55*	−1.02	−0.09	−0.12	−0.59	0.36
−2.0 SD vs Chinese norm	−0.79**	−1.24	−0.33	−0.14	−0.65	0.37
−1.0 SD vs Chinese norm	0.37	−0.04	0.77	0.99***	0.57	1.42
−0.5 SD vs Chinese norm	0.63**	0.30	0.95	0.67***	0.34	1.00
+0.5 SD vs Chinese norm	−0.97***	−1.33	−0.61	−1.08***	−1.49	−0.68
+1.0 SD vs Chinese norm	−1.48***	−1.87	−1.08	−2.29***	−2.69	−1.89
+2.0 SD vs Chinese norm	−3.00***	−3.47	−2.53	−3.53***	−4.03	−3.03

[a] CI indicates confidence interval; SD, standard deviation.
*** $P < .001$; ** $P < .01$; * $P < .05$.

community. The perception of beauty is not only an individual preference, it also has a cultural bias.[19] The upper and lower lips and chin were found to be the most important facial features influencing the perception of facial esthetics.[9]

It is well established that there are marked ethnic differences in soft tissue characteristics between Chinese and White profiles. In general, the Chinese soft tissue profile shows a less prominent nose, with a less obtuse nasolabial angle, more protrusive upper and lower lips, and a more convex facial profile.[4–6]

Given that the Chinese population norm tends to exhibit more protrusive lips, we might have expected that the Chinese judges would find the protrusive profiles more acceptable. The results of this study indicated that the contrary was true. This study suggested that Chinese were less likely to find the protrusive profiles acceptable, preferred more retruded lip positions compared with White judges, and that the differences in preference were significant.

The results of this study were consistent with those of previous research on hard tissue esthetics in Chinese. Maganzini et al.[11] and Soh et al.[12] found that normal and bimaxillary retrusive profiles were perceived to be the most attractive, while protrusive mandibles were perceived to be the least attractive.

There was no comparable study evaluating the esthetic lip position in the Chinese population. However, there were studies investigating the esthetic soft tissue profile in other Asian communities, which share similar characteristics of more convex facial features, as in the case of the Chinese. Shimomura et al.[20] found that Japanese orthodontic patients preferred a slightly more retruded lip position than was present in the average facial profile for both male and female. The study by Ioi et al.[21] showed similar preferences in Korean and Japanese dental students. These findings were consistent with our results, in which Chinese significantly preferred more retrusive profiles over their population norm. Table 10 shows a summary of perception studies on facial profile esthetics in Asians.

The perception of facial esthetics is complex and is influenced by many cultural mechanisms and reinforcements operating in our society.[22] Our results strongly supported the proposition that ethnicity of the judges was a significant factor influencing the perception of esthetic facial profile.

Interestingly, the White judges, on the other hand, were more likely to find the protrusive profiles acceptable and preferred less retruded lip positions compared with the Chinese judges. A consideration in the design of this study was to generate a Chinese profile image based on White norm values. It was found that the White norm image was consistently ranked below the Chinese norm image by both White and Chinese judges.

The study by Matoula and Pancherz[23] showed that the attractive White females and males bear a more

Table 7. Analysis of Visual Analogue Scale (VAS) Score for Male Profiles[a]

	White Judges			Chinese Judges		
Male Profile	Coefficient	Lower 95% CI	Upper 95% CI	Coefficient	Lower 95% CI	Upper 95% CI
White norm vs Chinese norm	−1.08***	−1.48	−0.67	−0.69	−1.26	−0.12
−2.0 SD vs Chinese norm	−0.49	−0.89	−0.10	−0.07	−0.60	0.46
−1.0 SD vs Chinese norm	0.27	−0.03	0.56	0.82***	−0.43	1.20
−0.5 SD vs Chinese norm	−0.08	−0.44	0.28	0.17	−0.26	0.60
+0.5 SD vs Chinese norm	−0.26	−0.57	0.05	−0.87***	−1.23	−0.51
+1.0 SD vs Chinese norm	−1.20***	−1.59	−0.80	−1.90***	−2.34	−1.47
+2.0 SD vs Chinese norm	−2.64***	−3.04	−2.24	−3.64***	−4.12	−3.16

[a] CI indicates confidence interval; SD, standard deviation.
*** $P < .001$.

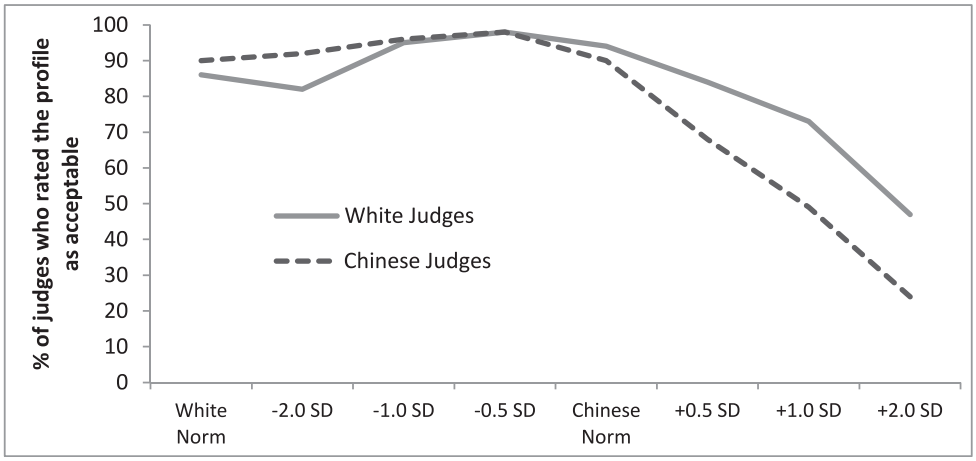

Figure 3. Comparison of acceptability for female profiles.

convex soft tissue profile and smaller distances from the upper and lower lips to the E-line. These studies indicate the esthetic preferences of Whites when judging their own ethnic group. It appeared that the White also used a similar esthetic standard by which to judge facial esthetics in Chinese.

The studies discussed earlier were based on judges from one ethnic group. There were limited studies that compared the differences in esthetic preference between two or more ethnic groups. The results from this study were consistent with those of the studies by Mejia-Maidl et al.[13] and Farrow et al.,[14] in which the ethnicity of the judges was a significant factor in the evaluation of esthetic preference. Mejia-Maidle et al.[13] presented facial images of Mexican men and women to Mexican and White judges. Mexican judges preferred more retruded lips than did the White judges, particularly for the female profiles. Farrow et al.[14] found that African Americans preferred a profile that was straighter than the norm for their race but more protrusive than White standards.

When we compared the Chinese judges in Australia and China, our results showed no significant difference in esthetic preferences between them. It appeared that geographic separation did not have a significant influence.

The results of this study have clinical inference with regard to the justification of orthodontic extraction therapy in skeletal Class I Chinese patients with a protrusive lip profile. In the study by Xu et al.[24] comparing extraction vs nonextraction treatment outcomes for borderline Chinese patients, Chinese clinicians significantly preferred the facial profile of the extraction patients but had no significant preference for tooth alignment, overbite, overjet, midline symmetry, or posterior occlusion. An explanation suggested for this preference is that extraction treatment reduces protrusion of the lower lip compared with nonextraction. Orthodontic mini-implants allow a maximum amount of anterior tooth retraction without anchorage loss in the posterior teeth.[25] The increasing popularity of temporary anchorage devices in Asia also

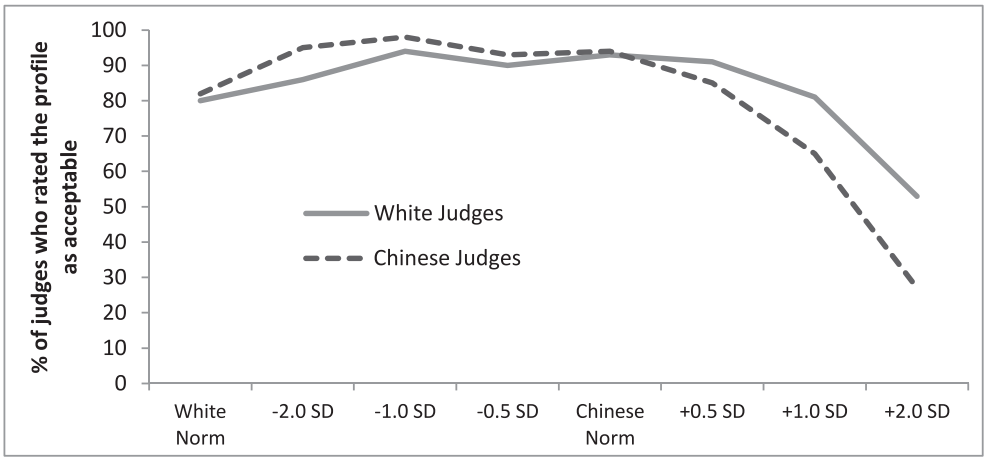

Figure 4. Comparison of acceptability for male profiles.

Table 8. Analysis of Acceptability for Female Profiles[a]

Female Profile	White Norm, %	−2.0 SD*, %	−1.0 SD, %	−0.5 SD, %	Chinese Norm, %	+0.5 SD**, %	+1.0 SD***, %	+2.0 SD***, %
White judges	86	82	95	98	94	84	73	47
Chinese judges	90	92	96	98	90	68	49	24

[a] SD indicates standard deviation.
*** $P < .001$; ** $P < .01$; * $P < .05$.

Table 9. Analysis of Acceptability for Male Profiles[a]

Male Profile	White Norm, %	−2.0 SD, %	−1.0 SD, %	−0.5 SD, %	Chinese Norm, %	+0.5 SD, %	+1.0 SD*, %	+2.0 SD***, %
White judges	80	86	94	90	93	91	81	53
Chinese judges	82	95	98	93	94	85	65	27

[a] SD indicates standard deviation.
*** $P < .001$; * $P < .05$.

Table 10. Summary of Previous Perception Studies on Facial Profile Esthetics in Asians

Study	Ethnicity of Profile Image	Assessors	Findings
Maganzini et al. (2000)[11]	Chinese	85 native Chinese from Beijing	Normal and maxillary-deficient profile were most acceptable for female. Normal and bidental retrusive were most acceptable for male.
Soh et al. (2005)[12]	Asian-Chinese	31 Asian dentists 92 Asian dental students 152 Asian laypersons	Normal and bimaxillary retrusion male and female profiles were perceived to be highly attractive. Protrusive mandible was perceived to be the least attractive.
Chan et al. (2008)[9]	Asian-Chinese	31 White orthodontists 31 White dental students 80 White laypersons	All White examiners preferred the normal Class I or bimaxillary retrusive profiles in both sexes.
Ioi et al. (2008)[21]	Japanese	52 Japanese dental students 46 Korean dental students	Japanese and Korean dental students preferred a slightly more retruded lip position compared to average for both male and female. Most favored lip position relative to E-line were as follows: For female: −4.5 to −2.5 mm for upper lip (UL); −1.5 to 0.5 mm for lower lip (LL) For male: −5.5 to −3.55 mm for UL; −2.0 to 0 mm for LL
Shimomura et al. (2011)[20]	Japanese	150 Japanese orthodontic patients	Orthodontic patients preferred a retruded lip position compared to average.

appears to be consistent with the esthetic preference of Chinese patients in our study.

There were some limitations in this study that should be recognized. The study did not distinguish between native Chinese living in Australia and new immigrant Chinese recently residing in Australia. The influence of geographic location and ethnic factors on perception of esthetic lip position would require further investigation in order to come to any conclusions. Although the study had digitally generated a Chinese adult profile based on the cephalometric norms from established researchers, it should be taken into consideration that China has a population of 1.3 billion people and contains subpopulations with variations in their norms. In this study, the laypersons were mainly university students ranging in age between 18 and 30 years and may not be representative of the entire population.

CONCLUSIONS

- The ethnicity of the judges is a significant factor influencing the perception of esthetic lip position.
- The Chinese professional and nonprofessional judges prefer a more retrusive profile and are more likely to rate a protrusive profile as unacceptable, compared with the White judges.

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