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TABLE OF CONTENTS

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Perception of Facial Esthetics by Native Chinese Participants by Using Manipulated Digital Imagery Techniques

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ABSTRACT

This investigation utilized a manipulated digital video imaging model to elicit profile facial esthetics preferences in a lay population of native Chinese participants from Beijing. A series of 4 distinct digitized distortions were constructed from an initial lateral cephalogram. These images represented skeletal or dental changes that differed by 2 standard deviations from the normative values for Chinese adults. Video morphing then created soft-tissue profiles. A series of nonparametric tests validated the digitized distortion model. The native Chinese participants in this sample found that the profile distortions most acceptable were the “flatter,” or bimaxillary retrusive distortion, in the male stimulus face and the “anterior divergent,” or maxillary deficiency, in the female stimulus face.

KEY WORDS: Native Chinese, Facial esthetics, Digital imagery, Video morphing.

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INTRODUCTION Return to TOC

In today's society, a high value is placed on physical attractiveness. Overall physical appearance, and more specifically facial balance and symmetry, have been recognized as an indication of how people are perceived by others in society as well as how they perceive themselves.[1,2]

The negative psychosocial consequences of facial unattractiveness caused by skeletal malocclusions have been extensively documented. Many orthognathic surgical procedures involve dramatic changes in facial skeletal structures as well as changes in the physiologic functions of speech, mastication, and respiration. It is not surprising that a large majority of prospective orthognathic surgery patients cite facial esthetics as a strong motivator for seeking treatment.[3–8]

Current concepts in diagnosis and treatment planning focus on the balance and harmony of various facial features. It is now common to hear that our treatment goals should be geared toward the achievement of an overall skeletal, dental, and soft-tissue balance.[9–14] Increased skeletal treatment and surgical intervention make it extremely important to study examples of esthetically balanced faces and the scope of acceptable compromises between different facial elements. However, a thorough facial examination must include not only the clinician's knowledge of perceived normality, but also the patient's perception of attractiveness. The relative positions and the spatial

relations of the nose, lips, and chin are significant soft-tissue contributors to achieving a balanced facial profile.[15–19]

The perception of beauty is not only an individual preference that may be influenced by training, but it also may have cultural and ethnic biases.[20–23] There are no exact rules governing why a face is beautiful. Artists and professionals have attempted to define and recreate an ideal. Although they recognize beauty, objective standards are difficult to define.

Perceptions of facial esthetics among dental professionals have been extensively investigated. Previous authors have attempted to rank or classify faces on the basis of their attractiveness. Researchers have attempted to determine whether the treating clinician, the patient, and the lay public groups agree in their perception of acceptable facial esthetics. Some studies seem to indicate that professionals and lay groups are in agreement, whereas other studies suggest various degrees of disagreement between the trained and untrained observer.[24,25] To further complicate the issue, different testing methods that allow the rater to evaluate various facial forms have been suggested. The testing tools suggested have varied from full face, to lower face only, to color profile and silhouettes. The methods of testing have ranged from simple comparisons to more complex pairing, and the methods of analysis have been both quantitative and qualitative.[26,27]

As orthodontic and orthognathic treatment is prescribed, it is not sufficient to quantify normative values for skeletal and dental relationships among all races without investigating facial preferences and biases. The orthodontic literature is replete with cephalometric standards and profile preferences of Caucasian and African American patients, yet similar data are missing for the Chinese patient pool. It is clear that esthetic proportions of the native Chinese population differ from the neoclassical facial canons.[28] Thus, the major purpose of this study was to investigate the profile preferences of the Chinese population by a dynamic testing method.

MATERIALS AND METHODS Return to TOC

Sample population

The Chinese rater group consisted of 85 native Chinese participants from Beijing. Of these raters, 38 were women, and 47 were men (45% women and 55% men). Their mean age was 26.3 ± 5.3 years.

Manipulated digital imagery technique

An adult native Chinese male and female stimulus face (A) was selected for digital distortion (Figures 1 and 2 ). Both subjects were 24 years old and were chosen because they exhibited Class I occlusions with average dental proclination and balanced lower facial skeletal proportions previously established as norms for this population. They were meant to be representative of the average facial profile for this ethnic group. Because the Chinese have a shorter than average anterior cranial base and a dental proclination greater than Caucasian norms, their “normal” profile would be classified, by Caucasian standards, as bimaxillary protrusive.[29,30] This profile was selected as representative of the “normal” Chinese participant.

Each subject had a lateral cephalometric radiograph taken in natural head position. The cephalometric radiograph was placed on the Kaiser prolite 5000 view box (Kaiser Corporation, Dusseldorf, Germany) with the profile facing to the right. A Sony CCD color video camera SSCS20 (Sony Corporation of America, New York, NY, USA) was held in place over the view box by Kaiser RT1 and RB300 attachments at a constant lens at an object distance of 51 cm. The camera aperture was set at an f-stop of 22. This distance was previously calibrated to provide as close as possible to an actual 1-to-1 object ratio. The center of the camera lens was directly above the cephalogram to allow for alignment with the Frankfort horizontal. Once the cephalometric image was properly oriented, it was captured and stored in the computer by using Quick Ceph Image software (Quick Ceph™ Systems, Sarasota, FL 34238, USA). Using the same equipment and methodology, the subject's soft-tissue facial profile was video recorded and captured.

The Quick Ceph Image program also allowed for minor adjustments to justify any magnification discrepancies between the cephalometric and profile images.[31] This was accomplished by allowing for the superimposition of the photographic profile over the lateral soft-tissue cephalometric profile. This orientation permitted corrections to be made on the hard-tissue skeleton by radiographic manipulation. These skeletal corrections were computer transferred to the patient's profile portrait.

Construction of profile distortions

Normative ratios and values in the anteroposterior proportional skeletal relationships were based on a combination of analyses.[32–34] The Quick Ceph Image software allowed these skeletal manipulations to be translated into soft-tissue movements of the nasal tip and lower third of the face using programmed ratios previously established from Caucasian patients and modified for the Chinese population.[7,8,35] Four disproportional facial profiles (B, C, D, and E) were constructed from the initial normal digitized stimulus image (A), providing a total of 5 profiles to be compared. These disproportional images differed by 2 standard deviations from the average anteroposterior skeletal and dental values for Chinese adults.[29,30]

Descriptions of these profile distortions are as follows:

1. Face A represented the normal facial type with balanced skeletal and dental values corresponding to the Chinese cephalometric values. It was defined by normal antero-posterior and vertical relationship of both jaws and normal antero-posterior and vertical relationship of the dentition.

2. Face B was digitally constructed to provide a “flatter,” or orthognathic, facial profile that most closely resembled the dental norms of the Caucasian population. This profile distortion would be retrusive to the Chinese dental norms. It was defined by normal antero-posterior and vertical relationship of both jaws and maxillary and mandibular dental retrusion.

   Faces C and D were digitally constructed to represent variations of Class III malocclusions that were known to be prevalent in the Chinese population.

3. Face C was defined by a maxillary antero-posterior deficiency with normal antero-posterior and vertical relationship of the mandible and normal antero-posterior and vertical relationship of the dentition.

4. Face D was defined by a mandibular prognathism with normal antero-posterior and vertical relationship of the maxilla and normal antero-posterior and vertical relationship of the dentition.

5. Face E was digitally constructed to assess whether a convex profile could be found to be attractive. It was defined by mandibular antero-posterior deficiency with normal antero-posterior and vertical relationships of the maxilla and normal antero-posterior and vertical relationships of the dentition. (Figures 3 and 4).

Data analysis

Two series of digitally manipulated profiles were first presented to a single rater at 5 different times in order to test intrarater reliability. The entire Chinese rater group was then asked to evaluate and rank the profiles. The stimulus face and profile distortions were presented to the raters by means of a standard comparison method in which each rater was presented all 5 profiles at once. The raters were given a period of 90 seconds to rank the profiles in an attractiveness order from 1 through 5. They were not permitted to assign the same ranking to more than 1of the profiles and were instructed to rank 1 as the most attractive and 5 the least acceptable.

RESULTS Return to TOC

Table 1 measured the intrarater reliability when the examiner, on 5 separate occasions, ranked male and female profiles by the standard comparison method. The Kendall coefficient of concordance *W* indicated that these measures were reliable and reproducible at a level of significance of $P < .01$. The high value of *W* (ranges between 0 and +1) was interpreted as meaning that the rater consistently applied the same standard when ranking either the male or female profiles and, as such, demonstrated the validity of manipulated digital images as a testing tool.[36]

This was followed by a determination of interrater reliability when the Chinese rater group ranked the male and female profiles distortions. For the standard method, a Kendall coefficient of concordance *W* was utilized (Table 2). A high or significant value of *W* was interpreted as meaning that the raters as a whole were applying the same standard in ranking these profiles.[36] This tested the validity of manipulated digital images as a testing tool within our Chinese rater group.

A *t*-test was done for the standard comparison method in order to determine the means and the standard deviations of the rankings given to each of the digitally manipulated profiles. A Tukey's multiple comparison test was done for a determination of the facial profile preferences and attractiveness, as determined by these Chinese laypersons when using the standard comparison method (Tables 3 and 4). Profiles with the same designation (*, **, or ***) were considered equally attractive by the rater groups and are not significantly different from each other at the $P \leq .05$ significance level.

DISCUSSION Return to TOC

Skeletal changes can be transformed into soft-tissue profile changes by using manipulated digital imagery techniques, and these manipulations can accurately mimic cephalometric changes achieved by orthognathic surgery. Correlations also have been made between cephalometric measurements and anthropometric facial measurements. These ratios allow skeletal changes to be transformed into soft-tissue movements.[37,38] As such, the initial objective of this study was to determine whether a group of digitally manipulated profile images could be constructed that allowed consistent comparisons to be made.

Tables 1 and 2 illustrate the agreement or concordance between rankings when our rater group tested the standard comparison method. They indicated that the Chinese rater group could consistently rank the male or female stimulus face with its profile distortions and demonstrated the validity of manipulated digital images as a testing tool for profile preferences. Once the validity of the testing tool was demonstrated, we then chose to investigate the profile preferences of a native Chinese rater group by this dynamic testing method. We felt

that soliciting facial preferences from a population of Chinese laypersons would give the treating orthodontist, surgeon, or other health care professional a glimpse of culturally derived attractiveness scales.

When evaluating the stimulus face and the 4 profile distortions, the native Chinese raters ranked the male and female profiles in a consistent preference order. The type of facial preference, however, was different in the male and female profile distortions provided.

An examination of Table 3 shows that the most acceptable digital distortion for the male stimulus face was the bidental retrusive profile (B). It was statistically as acceptable and not significantly different from the preference for the undistorted stimulus face (A; Figure 5). The Class II mandibular deficient distortion (E) and both Class III skeletal malocclusions, the maxillary deficient (C), and mandibular prognathism (D) were equally unattractive.

Since the Chinese have a shorter than average anterior cranial base and a greater dental proclination than Caucasian norms, their " normal" stimulus profile would be classified, by those standards, as bimaxillary protrusive. The preference, then, for the bidental retrusive profile (B) was initially a surprising occurrence. Cultural bias and psychosocial instinct notwithstanding, this preference is consistent with other reports that both professional and lay rater groups prefer straighter profiles to dentally protrusive ones.[23] The Chinese laypersons in our study found dental retrusion in a otherwise balanced male skeletal pattern to be as attractive as the stimulus face and more acceptable than either Class II or Class III skeletal dysplasias.

An examination of Table 4 shows that the most acceptable digital distortion for the female stimulus face was the maxillary deficient profile (C). It was statistically as acceptable and not significantly different from the preference for the undistorted stimulus face (A; Figure 6). The Class II mandibular deficient distortion (E) was perceived to be least attractive.

The Chinese rater group showed a clear preference for the anterior divergent female profile. That is a profile where the upper lip is at least not protrusive to the lower lip and in some cases is slightly retrusive to it. This would be culturally consistent in that previous cephalometric studies have shown that relative maxillary deficiency is a normal occurrence in several Asian populations.[35]

It seems evident from the data that the native Chinese subjects show a total aversion for the Class II skeletal convex profile (E) and overt mandibular prognathism (D) in either the male or the female digitized distortions. They perceive that a more orthognathic profile with dental retrusion (B) is an acceptable relationship in the otherwise balanced male profile and that a maxillary deficiency (C) is an acceptable compromise in an otherwise balanced female profile.

Clinical implications might include the orthodontic reduction of maxillary and mandibular dental proclination and skeletal treatment of maxillary deficiency, mandibular deficiency, and mandibular prognathism in native Chinese men. The esthetic treatment of native Chinese women could include orthodontic camouflage of some skeletal maxillary retrusion by the retraction of mandibular anteriors with increased proclination of the maxillary anteriors. Surgical options in this group might be limited to overt mandibular deficiency and prognathism.

Orthodontic treatment planning should be an interactive process. Previous reports have elucidated the benefits of video imaging in patient understanding, expectation, and communication.[39,40] In this process in which the patient and practitioner serve as co–decision makers, each approaches the perceived problem list from a different prospective. Cultural biases and attractiveness ratings all play a role in their eventual decision.

The conclusions of this study should be an aid in designing treatment plans that are consistent with perceptions of beauty, attractiveness, and facial balance for our patients of native Chinese heritage.

CONCLUSIONS Return to TOC

It is clear from the results of this study that manipulated digital imagery techniques and the resulting digitized distortions can be a useful model for assessing facial preferences. The following conclusions can be drawn or inferred:

1. The Chinese layperson in our study found dental retrusion in a otherwise balanced male skeletal pattern to be as attractive as the bimaxillary protrusive stimulus face.

2. The Chinese layperson in our study found the maxillary deficient profile in an otherwise balanced female skeletal pattern to be as attractive as the undistorted stimulus face.

3. The native Chinese show a total aversion for the Class II skeletal convex profile and overt mandibular prognathism in either the male or the female digitized distortions.

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TABLES Return to TOC

TABLE 1. Intra-rater Reliability for Male and Female Profiles Using the Standard Comparison Method

Profile	*W* Value	*P* Value
Male	0.824	≤.01
Female	0.904	≤.01

TABLE 2. Intra-rater Reliability for Chinese Laypersons Evaluating Digitally Manipulated Male and Female Profiles by the Standard Comparison Method

Profile	*W* Value	Chi-square Value	n − 1	*P* Value
Male	0.571	198.81	84	≤.01
Female	0.393	136.96	84	≤.01

TABLE 3. Preferences of Chinese Laypersons Evaluating the Digitally Manipulated Male Profile by the Standard Comparison Method[a]

Profile	n	Mean	Standard Deviation
Normal (A)*	85	1.70	0.73
Bidental retrusion (B)*	85	1.75	0.85
Maxillary deficiency (C)**	85	3.85	0.99
Mandibular prognathism (D)**	5	4.25	1.10
Mandibular deficiency (E)**	85	3.45	1.10

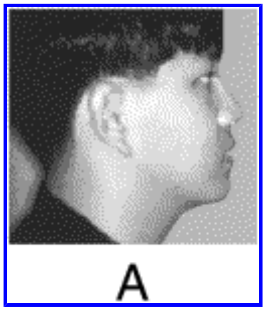
[a] Profiles with the same designation (* or **) were considered equally attractive by the rater groups and are not significantly different from each other at the $P \leq .05$ significance level.

TABLE 4. Preferences of Chinese Laypersons Evaluating the Digitally Manipulated Female Profile by the Standard Comparison Method[a]

Profile	n	Mean	Standard Deviation
Normal (A)*	85	2.30	0.99
Bidental retrusion (B)**	85	2.70	1.38
Maxillary deficiency (C)*	85	1.90	0.91
Mandibular prognathism (D)**	5	3.60	0.50
Mandibular deficiency (E)***	85	4.90	0.44

[a] Profiles with the same designation (*, **, or ***) were considered equally attractive by the rater groups and are not significantly different from each other at the $P \leq .05$ significance level.

FIGURES Return to TOC



Click on thumbnail for full-sized image.

FIGURE 1. The “normal” Chinese male stimulus face (A) with a balance of dental and skeletal proportions

Click on thumbnail for full-sized image.

FIGURE 2. The “normal” Chinese female stimulus face (A) with a balance of dental and skeletal proportions

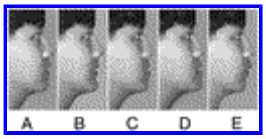


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FIGURE 3. The “normal” Chinese male stimulus face with digitized distortions to produce (B) bidental retrusion, (C) maxillary deficiency, (D) mandibular prognathism, and (E) mandibular deficiency

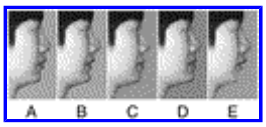

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FIGURE 4. The “normal” Chinese female stimulus face with digitized distortions to produce (B) bidental retrusion, (C) maxillary deficiency, (D) mandibular prognathism, and (E) mandibular deficiency

Click on thumbnail for full-sized image.

FIGURE 5. The most acceptable profile distortion of the “normal” Chinese male stimulus face (A) was the bidental retrusive profile (B)

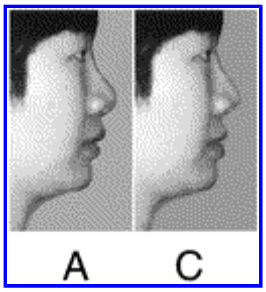

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FIGURE 6. The most acceptable profile distortion of the “normal” Chinese female stimulus face (A) was the maxillary deficient profile (C)

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