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A preliminary study on the key factors contributing to the attractive lips of Chinese children

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ABSTRACT

Objective: To explore the aesthetic characteristics of the Chinese children lips. **Methods:** Frontal and profile photographs of 653 healthy children were categorized as the attractive and the unattractive by three laypersons and objectively measured for comparison. **Results:** The attractive group tended to be smaller in the upper paramedian red lip height, the lower paramedian red lip height, the midline upper red lip height, the central bow angle, and the lip angle, while greater in the Cupid's bow width. **Conclusions:** Thinner lips seemed to be more attractive than full ones among Chinese children.

1. Introduction

Lips are one of the most frequently involved organs in maxillofacial surgery. Lip reconstruction is required for patients with cleft, trauma, or tumor. In China, the annual number of cleft lip repair alone surpasses around 20 000. Besides the functional benefits of speech articulation^[1,2] and breathing^[3], natural aesthetics is still the major surgical goal of lip reconstruction.

In previous study, various descriptions on the characteristics of aesthetic lips have been developed. Some reports emphasize the fullness and appearance of the diamond-shaped unit of the upper lip^[4–6], while others identified the perioral rhytids and decreased lip projection as signs of unattractiveness^[7]. Also, whether there are

measurable objective discrepancies behind our subjective judgment of aesthetic lips has yet to be answered. Moreover, most previous anthropometric measurements were performed among Caucasian lips^[8,9], which might not be suitably applied to Asian patients. In this study, subjective grading and objective photogrammetry were combined to explore the discrepancy between attractive and unattractive lips among Chinese children.

2. Materials and methods

2.1. Subjects

A total of 653 healthy children (303 female and 350 male) from two elementary schools in Chengdu, China were included. All included subjects aged between six to nine, and had experienced no oral or maxillofacial diseases including congenital or acquired deformities, oral and maxillofacial trauma, tumor, infection, and orthodontic treatment. Informed consent was obtained from all of their

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custodians, and the research has been approved by the ethical board of West China Stomatology College.

2.2. Image collection

Frontal and profile photographs were taken according to the standards of European Association for Cranio-Maxillo-Facial Surgery with Nikon D300s camera by a same experienced photographer^[10,11].

A calibration globule was held on the forehead of each subject as a scale. All subjects were instructed to display a relaxed facial expression with lips close and at rest (Figure 1A, 1B).

Once taken, the photographs were modified with the Photoshop CS3 software from Adobe Company. Planes were cut away to isolate the lips in a rectangle. All sets of lips are isolated from their corresponding faces in the same manner in preparation for classification (Figure 1C).

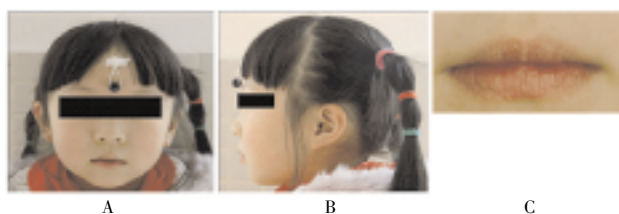


Figure 1. Frontal and profile photograph.

A) Frontal view with a relaxed facial expression. A calibration globule was held anterior to the forehead; B) Profile with a calibration globule on the forehead; C) Isolated lips.

2.3. Subjective classification

Three lay volunteers from different provinces of China (two female and one male) were asked to independently judge the cropped photographs (Figure 1C) as attractive or unattractive at first sight according to their subjective preference. Lips considered as neutral were excluded. Lips considered attractive by all three volunteers were categorized as the attractive group, and those considered unattractive by all three volunteers were categorized as the unattractive group.

2.4. Photogrammetry

Lips included in the attractive and unattractive groups were measured in software Image. J which is a public domain, Java-based image processing program developed at the National Institutes of Health. Soft tissue landmarks were located as illustrated in Figure 2 and photographic measurements included were listed in Table 1.

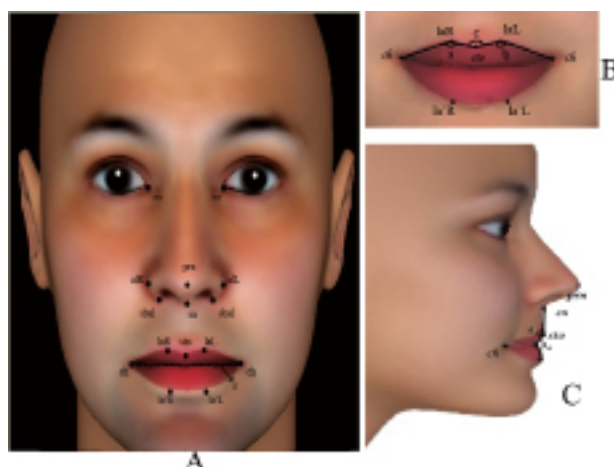


Figure 2. Abbreviation: en, endocanthion; alR, right alare; alL, left alare; sbal, subalare; sn, subnasale; laR, right labiale superioris; laL, left labiale superioris; ch, cheilion; lf, labial fissures; sto, stomion; la'R, right labiale inferioris; laL, left labiale inferioris; prn, pronasale; a, right cupid's bow angle; b, left cupid's bow angle; c, central bow angle; d, upper lip convexity; e, lips angle.

Table 1

Soft tissue landmarks used for measurement and evaluation.

Measurements	Descriptions
sbalL–chL	left distance from subalare to cheilion
sbalR–chR	right distance from subalare to cheilion
sbalL–laL	left distance from subalare to labiale superioris
sbalR–laR	right distance from subalare to labiale superioris
laL–lf	left upper paramedian red lip height
laR–lf	right upper paramedian red lip height
la'L–lf	left lower paramedian red lip height
la'R–lf	right lower paramedian red lip height
sto–lf	midline upper red lip height
laL–laR	cupid's bow width
chL–chR	total mouth width
a	right cupid's bow angle
b	left cupid's bow angle
c	central bow angle
d	upper lip convexity
e	lips angle

All measurements were listed in Table 1. Asymmetry ratio for each measurement was calculated according to the formula $Q=(G-K)/G \times 100\%$ (Q refers to the asymmetry ratio, G refers to the larger measurement value and K refers to the smaller measurement value). All pictures were independently measured twice by each of the two measurers with an interval of three weeks, and the mean values were calculated for analysis.

2.5. Statistical analysis

The test-retest reliability of each measurer and the scorer reliability between the two measurers were examined with the intraclass correlation coefficient^[12]. The Student's *t*-test was employed to compare the measurement results and the asymmetry ratios between the attractive group and

the unattractive group, and the P value was set at 0.05 as significant.

3. Results

Volunteer 1 picked 196 lips as attractive and 457 as unattractive, volunteer 2 picked 243 as attractive and 412 as unattractive, and volunteer 3 picked 210 as attractive and 443 as unattractive. In the end, the attractive group included 93 subjects, and the unattractive group included 145 subjects (Figure 3).



Figure 3. A) 93 sets of lips were selected as attractive by all 3 volunteers; B) 145 sets of lips were selected as unattractive by all 3 volunteers.

The ICC values ranged between 0.809 and 0.921 ($P < 0.05$), suggesting dependable reliability and reproducibility of the photogrammetry.

The mean value of each measurement for the attractive group and the unattractive group was shown in Table 2.

Table 2

Comparison of anthropometric facial measurements in 93 attractive and 145 unattractive lips.

Parameters	Attractive	Unattractive	P -value
laR-lf (mm)	73.000±12.000	77.000±16.000	0.026 *
laL-lf (mm)	72.000±11.000	78.000±17.000	0.007 **
laR'-lf (mm)	84.000±12.000	95.000±17.000	0.000 **
laL'-lf (mm)	84.000±12.000	96.000±18.000	0.000 **
Right cupid's bow angle (°)	132.020±7.350	131.160±10.470	0.521
Left cupid's bow angle (°)	129.070±7.590	127.670±8.540	0.236
Central bow angle (°)	138.740±7.190	142.010±8.700	0.006 **
Upper lip convexity (°)	105.780±9.130	105.100±7.700	0.588
Lips Angle (°)	87.860±15.830	77.990±14.360	0.000 **
sbalL-laL (mm)	134.000±18.000	131.000±21.000	0.387
sbalL-chL (mm)	220.000±20.000	226.000±22.000	0.043 *
sbalR-laR (mm)	122.000±18.000	121.000±21.000	0.771
sbalR-chR (mm)	222.000±21.000	227.000±22.000	0.062
laL-laR (mm)	104.000±13.000	98.000±15.000	0.004 **
chL-chR (mm)	415.000±35.000	410.000±44.000	0.339
sto-lf (mm)	58.000±9.000	65.000±15.000	0.000 **
Asymmetry ratio of distance from subal to la	0.103±0.072	0.100±0.067	0.745
Asymmetry ratio of distance from subal to ch	0.038±0.029	0.029±0.022	0.021*
Asymmetry ratio of la-lf	0.048±0.040	0.060±0.041	0.042*
Asymmetry ratio of la'-lf	0.037±0.032	0.053±0.046	0.006**
Asymmetry ratio of cupid's bow angle	0.042±0.030	0.046±0.035	0.391

* $P < 0.05$, ** $P < 0.01$.

Abbreviation: sbalR, right subalare; sbalL, left subalare; la, labiale superioris; laR, right labiale superioris; laL, left labiale superioris; chR, right cheilion; chL, left cheilion; lf, labial fissures; la', labiale inferioris; la'R, right labiale inferioris; la'L, left labiale inferioris; sto, stomion.

Significant differences were observed in seven length measurements ($P < 0.05$) (Figure 4). The attractive lips tended to be smaller in the midline upper red lip height, the upper paramedian red lip height, and the lower paramedian red lip height.

Two angle measurements demonstrated significant differences. The attractive group tended to be smaller in the central bow angle (c) while smaller in the lips angle (e) (Figure 5).

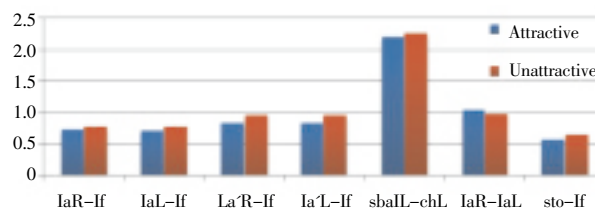


Figure 4. The mean value of length.

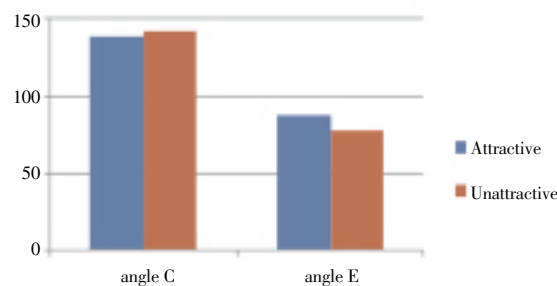


Figure 5. The mean value of angle.

The asymmetry ratios of both groups were within physiological norms (<10%)^[13]. The asymmetry ratios of three measurements demonstrated statistically significant difference. The asymmetry ratio of the distance from subalare to cheilion was smaller in the unattractive group, while those of the upper paramedian red lip height and the lower paramedian red lip height were smaller in the attractive group (Figure 6).

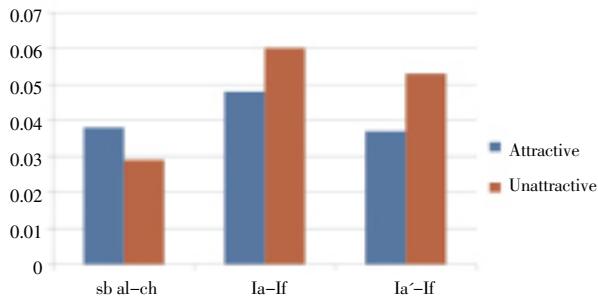


Figure 6. The asymmetry ratio of paired data.

4. Discussion

Optimal plastic and reconstructive surgical outcomes depend on profound understanding of the anatomic and aesthetic features specific to the ethnics of the patients. An explicit description of the objective anatomic features that make lips attractive would guide the surgeons to clarify the surgical goal, perfect their techniques, and achieve better outcomes.

Ayako Mori *et al*^[14] analyzed 109 Japanese children's lip and nose shapes using 3-dimensional digitizer to create standard facial models of normal Japanese children and created standard facial models of normal Japanese children. Anthropometric study of the upper lip of 1 500 healthy children in Chengdu, Western China by Zhu *et al*^[15] identified the morphological data about the upper lips of normal Chinese children were significantly different among the groups divided by age. Previous studies involving the comparison of attractive and unattractive lips mainly focus on the adults. Wong *et al*^[16] proposed that the lips of Asian adults that were deemed most attractive exhibited features consistent with a thinner upper lip. While Baudouin and Tiberghien^[17] believed that full lips make adult female faces attractive. Bisson *et al*^[18], by measuring the lip heights and angles from the frontal view photographs, confirmed that models assumed to have esthetically beautiful lips had fuller lips than non-model controls. Sforza *et al*^[19] who studied Northern Italian children aged 4–9 observed that attractive children have more voluminous lips and higher mouth, again by measuring from the frontal view. Our study, for the first time, explored the aesthetic characteristics of the lips of Chinese children.

Significant discrepancy did exist between the attractive

lips and the unattractive lips in our study. Most significant differences were observed in the right lower paramedian red lip height, the left lower paramedian red lip height, the upper lip surface midline height, and the lips angle. The attractive group tended to have thinner lower lips and larger lip angle. Also, the results suggested that the attractive lips were greater in the distance between two peaks of the Cupid's bow and smaller in the central bow angle. Therefore, we presume that flatter upper lips tend to be regarded more attractive by Chinese than plump ones, which is incoherent with the previous thoughts that pouty, sensual-appearing lips are more popular. Chinese prefer thinner and more streamlined lips (Figure 7A).



Figure 7. The ideal attractive lips vs unattractive lips in Asian eyes. A) attractive lips ; B) unattractive lips.

Most of the parameters showing significant difference located in the middle part of lips, suggesting the vermilion tubercle area of the lips be crucial to lip aesthetics and deserve more attention during lip reconstruction. Take the rotation-advancement surgery in unilateral cleft lip repair for example: better vermilion tubercle projection might be achieved by rotating downwardly the non-cleft side orbicularis oris rather than just suturing it up with the contralateral. According to our statistical analysis of the asymmetrical ratio, three paired parameters showed significant discrepancy, including the upper paramedian red lip height, the lower paramedian red lip height, and the distance from subalare to cheilion. Although the attractive lips seemed to be more symmetrical in most of the measurements, they are still not absolute symmetrical. Many studies have shown that slight facial asymmetry is a native phenomena and absolute symmetry is uncommon^[20].

Photographs proved to be reliably in reflecting nasal labial soft tissue landmarks and had been widely applied in previous researches^[21]. European Association for Cranio-Maxillo-Facial Surgery standardized photographic techniques were employed to minimize the distortion error. With only lip area demonstrated to volunteers, the measurement bias was further reduced. The ICC values also suggested high reliability of the measurements implemented. The sample amount of our study was comparatively large, involving more than 650 healthy children, where many preliminary conclusions and regular patterns could be obtained. Subjective classification of the attractive and

the unattractive lips were done by laypersons instead of surgeons, as it is the former who make the final judgment of the surgical outcome in society.

The results of this study have to be interpreted with caution, as aesthetics could never be simplified into merely linear or angular measurements. Individuality should always be kept in mind during the surgical designing of lip reconstruction, with multiple factors, like gender, facial contour, and cultural influences, taken into consideration.

Conflict of interest statement

We declare that we have no conflict of interest.

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