



Original Article

Correlation between facial attractiveness and facial components assessed by laypersons and orthodontists



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KEYWORDS

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Background/purpose: Relationship between facial attractiveness and facial components is not completely clear. The aim was to analyze the correlation between facial attractiveness and facial components assessed by laypersons and orthodontists.

Materials and methods: The attractiveness of 100 adult patients (50 males and 50 females with their frontal, lateral, and frontal smiling photos), before orthodontic treatment, was assessed by 24 laypersons and 24 orthodontists using visual analog scale. Pearson correlation coefficient and stepwise regression were used for statistical analysis.

Results: When laypersons assessed, a significant correlation was found between facial attractiveness and the chin ($r = 0.671$), eyes ($r = 0.669$), lips ($r = 0.585$), hair ($r = 0.527$), teeth ($r = 0.338$), and nose ($r = 0.247$); the chin was responsible for 45.1% of the variation in facial attractiveness, the eyes for 14.3%, and the lips for 0.8%. When orthodontists assessed, a significant correlation was found between facial attractiveness and the lips ($r = 0.789$), eyes ($r = 0.646$), hair ($r = 0.613$), chin ($r = 0.565$), nose ($r = 0.264$), and teeth ($r = 0.221$); the lips were responsible for 62.2% of the variation in facial attractiveness, the eyes for 8.2%, the chin for 1.4%, and the hair for 0.5%.

Conclusion: When laypersons evaluate, the chin contributes the most to facial attractiveness, and when orthodontists evaluate, the lips contribute the most. Whether in the evaluation of laypersons or orthodontists, the contribution of teeth to facial attractiveness is significantly less than that of the lips and chin.

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Introduction

In orthodontic treatment, patients often ask orthodontists if they will look more beautiful and have doubts about the ultimate aesthetic effects. These questions are hard to answer because teeth are only part of the face. It can not be simply concluded that the whole face will become more beautiful once the teeth become neat. So far, the relationship between facial attractiveness and facial components as well as influence factors of it have not been fully understood. In view of this, more research is needed on it which can further indicate effects of the correction and also can be a helpful reference to orthodontists when communicating with patients.

A substantial body of research on the role that physical attractiveness plays in a wide range of outcomes has revealed that physical attractiveness is a beneficial characteristic across multiple domains of life. Westfall et al.¹ showed that both self-rated attractiveness and attractiveness rated by other persons were found to predict the endorsement of belief in a just world. Additionally, both attractiveness measures were found to have a relationship with participant's level of life satisfaction.¹ Physical attractiveness tends to inspire more friendly reactions and more positive evaluations from others, so that the beautiful are more likely to succeed across many kinds of endeavors.² The face is the central contributor to physical attractiveness. An individual with a beautiful face may appear younger, healthier, more attractive and successful.³ Discrimination is relatively frequent among people who are facially unattractive.⁴

Facial components are composed of various parts including the eyes, nose, lips, teeth, and chin. And each of them is closely related to facial attractiveness. It was reported that persons with normal occlusion are rated as attractive, intelligent, agreeable, and extraverted.⁵ Slightly extruded central incisors are aesthetically more attractive than intruded incisors in men,⁶ and the canine vertical position modifications have a statistically significant influence on the smile esthetic evaluations for both laypersons and orthodontists.⁷ Moreover, Przylipek et al.⁸ showed that facial attractiveness increases together with the enlargement of the uncovered eye surface as well as the reduction in nose and lip size. An aesthetically pleasing face should be centered on strength, symmetry, and balance. A defined, well-projected chin and jawline were reported to be crucial to this harmony.^{9,10} Therefore, the overall attractiveness of the face can not be determined by any single component. The understanding of the relationship between the overall attractiveness of the face and each element can help quantify the limitations of orthodontics when soft tissues and teeth are treated.

According to social and personal experience, people have different views on aesthetics. Laypersons are influenced by the aesthetic standards established by actresses and models presented in the entertainment media, and seek to meet these standards. Many studies showed that dental professionals are more critical of dental aesthetic aberrations than non-professionals.^{11,12} For example, in laymen, general clinicians, and orthodontists, there are great differences in their views on dental aesthetics in

relation to gum exposure.^{13–15} Similarly, there are differences in the perception of vertical maxillary excess between dentists and laymen.¹⁶ Classification of aesthetics into unpleasant, acceptable, and pleasant needs to calibrate the perception between dentists and patients. If the perception is not calibrated, there may be some conflicting views on expectations and treatment. The consensus between dentists and patients is essential to standardize treatment plans and methods.

In summary, previous studies have shown the following points: 1. The face is the central contributor to physical attractiveness; 2. Each facial component may be related to facial attractiveness; 3. Laypersons and dental specialists diverge in the perception of facial attractiveness. In a previous study, the facial features that contribute to overall facial attractiveness were assessed by 12 nondental-related raters using three-quarter-view facial photographs.¹⁷ In a recent study, the relationship between facial attractiveness and facial components was assessed by 8 laypersons using frontal smiling photos.¹⁸ However, so far little is known about the difference between laypersons and dental specialists when evaluating attractiveness of facial components. For the first time, this study aimed to compare the differences between laypersons and orthodontists in assessing the correlation between facial attractiveness and facial components including the hair, eyes, eyebrows, nose, lips, teeth, and chin. The null hypothesis to be tested in this study was that there was no significant difference between laypersons and orthodontists in evaluating the correlation between facial attractiveness and facial components.

Materials and methods

Sample collection

This study was approved by the Ethics Committee of Xiangyang Stomatological Hospital (K2019-007). Data were collected from 100 consecutive Chinese adult patients (50 males and 50 females) with an average age of 33.5 years (18–40 years). The patients were selected from the Department of Orthodontics, Xiangyang Stomatological Hospital. Inclusion criteria included no prior orthodontic treatment and normal size and shape of maxillary canines and incisors (maxillary anterior teeth that were not too big, too small, conical, fused, geminated, or curved). The exclusion criteria were fillings or cavities in the maxillary anterior teeth, significant periodontal disease or gingivitis, and craniofacial deformities.

Photo taking

Selected patients were invited to sign the informed consent form, and pictures of the front, lateral, and front smiling faces of the patients were taken in a natural head position. The individual was standing and looking straight ahead and relaxed. When the subject's head was obviously turned up or down, the orthodontist would direct it correctly. There were no glasses, makeup, or jewelry on the face. The orthodontist held the camera at the same height as the

patient's head, a standard distance of 1.5 m. The photographic equipment consisted of a digital SLR camera (Nikon D80, Tokyo, Japan). All the pictures were then set up in PowerPoint presentations, maintaining their relative proportion and size. Finally, 300 photographs of 50 male and 50 female patients and 90 repetitions of 15 male and 15 female patients were divided into two macro-enabled PowerPoint presentations. Each slide contains the frontal, lateral, and frontal smiling photos of a patient (Fig. 1).

Visual analogue scale

The visual analogue scale (VAS) was created with a 100 mm continuous line fixed at 0 on the left (very unattractive) and 10 on the right (very attractive) (Fig. 2). The raters were instructed to write down their assessment of each component in the facial environment at the appropriate point along the scale with a vertical line. All scores were measured to the nearest millimeter from the left anchor end to the rater's scribe to give the final aesthetic rating.

Evaluation of facial attractiveness

The photographs were assessed by 24 laypersons (12 males and 12 females, mean age of 34.6 years) and 24 orthodontists (12 males and 12 females, mean age of 37.1 years). They were all Chinese and participated voluntarily, with no history of orthodontic treatment. Each rater received little information on the study design. The slides were presented to each rater in the same order and viewed on a laptop (15-inch, Dell, Austin, Texas, USA). The VAS was numbered according to the corresponding slides shown to them. Each rater was given a booklet with five visual VAS on each page and asked to fill them out without time limit. Attractiveness of the hair, eyes, eyebrows, nose, lips, teeth, chin, and face were evaluated by the raters. The PowerPoint presentation containing 300 photos of 100 patients were evaluated eight times with an interval of no less than 10 days. For example, for the first time, only the hair was evaluated, and for the second time only the eyes were evaluated. To reduce the impact of other facial components on the score, only one facial component was evaluated at a time and thus the raters were able to focus concentration on one part. Two weeks later, 90 repeated

images (15 men and 15 women) were re-evaluated to calculate the error of the method.

Statistical analysis

The number of people enrolled in the study was calculated by a pilot investigation, with at least 48 patients required to reach a power of 0.9 and a significance level of 0.05. In order to conduct a study with as much samples as possible, the sample size of this study was finally determined to be 100 patients. SPSS 22.0 software was used for statistical analysis. The mean and standard deviation were calculated. The two-sample t-test was used to compare the attractiveness scores of the hair, eyes, eyebrows, nose, lips, teeth, chin, and face between laypersons and orthodontists. ICC was used to assess random errors. The Pearson correlation coefficient and stepwise regression were used to calculate the correlation between facial attractiveness and the attractiveness of facial components including the hair, eyes, eyebrows, nose, lips, teeth, and chin.

Results

Values of intraclass correlation coefficient for the VAS scores ranged from 0.72 to 0.89, which demonstrated good intraobserver agreement. Descriptive statistics (mean and standard deviation) for the sample are presented in Table 1.

When assessed by laypersons, a significant correlation was found between facial attractiveness and the chin ($r = 0.671$), eyes ($r = 0.669$), lips ($r = 0.585$), hair ($r = 0.527$), teeth ($r = 0.338$), and nose ($r = 0.247$). When assessed by orthodontists, a significant correlation was found between facial attractiveness and the lips ($r = 0.789$), eyes ($r = 0.646$), hair ($r = 0.613$), chin ($r = 0.565$), nose ($r = 0.264$), and teeth ($r = 0.221$) (Table 2).

When assessed by laypersons, the chin was responsible for 45.1% of the variation in facial attractiveness, the eyes for 14.3%, and the lips for 0.8%. When assessed by orthodontists, the lips were responsible for 62.2% of the variation in facial attractiveness, the eyes for 8.2%, the chin for 1.4%, and the hair for 0.5% (Table 3).

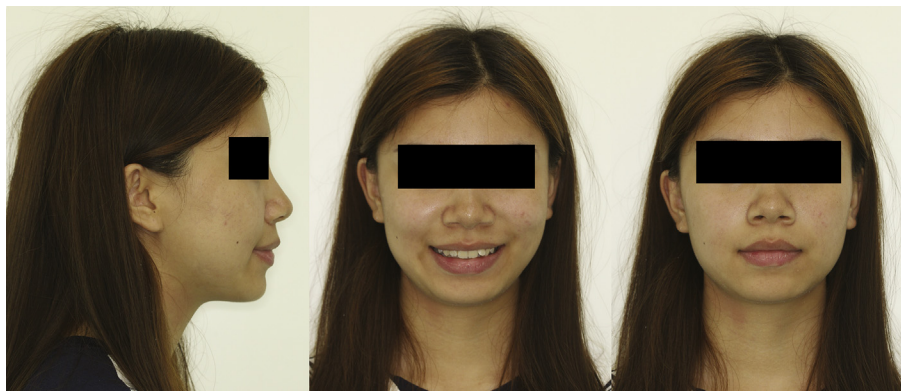


Figure 1 Example of a slide presented to the raters.

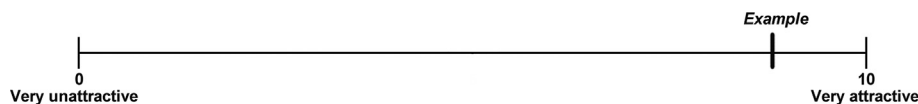


Figure 2 A visual analog scale (and an example scribe) used to evaluate the attractiveness of facial components.

Table 1 Descriptive statistics for attractiveness scores of the hair, eyes, eyebrows, nose, lips, teeth, chin, and face (Mean \pm SD).

Facial feature	Laypersons	Orthodontists	P
Hair	5.90 \pm 1.99	6.26 \pm 1.83	<0.001
Eyes	5.16 \pm 2.06	6.09 \pm 1.94	<0.001
Eyebrows	5.45 \pm 2.17	6.30 \pm 1.87	<0.001
Nose	5.18 \pm 1.98	5.99 \pm 1.79	<0.001
Lips	4.79 \pm 2.00	5.41 \pm 2.02	<0.001
Teeth	4.39 \pm 2.32	4.55 \pm 2.13	0.011
Chin	4.97 \pm 2.27	5.62 \pm 2.27	<0.001
Face	5.12 \pm 1.94	5.77 \pm 1.91	<0.001

Table 2 Pearson correlation results between facial attractiveness and the hair, eyes, eyebrows, nose, lips, teeth, and chin.

Facial feature	Laypersons		Orthodontists	
	Pearson r	P	Pearson r	P
Hair	0.527	<0.001	0.613	<0.001
Eyes	0.669	<0.001	0.646	<0.001
Eyebrows	0.019	0.682	0.078	0.088
Nose	0.247	<0.001	0.264	<0.001
Lips	0.585	<0.001	0.789	<0.001
Teeth	0.338	<0.001	0.221	<0.001
Chin	0.671	<0.001	0.565	<0.001

Table 3 Results of the stepwise correlation.

	r	r ² partial	r ² cumulative	P
Laypersons				
Chin	0.671	0.451	0.451	<0.001
Eyes	0.771	+0.143	0.594	<0.001
Lips	0.776	+0.008	0.602	0.002
Orthodontists				
Lips	0.789	0.622	0.622	<0.001
Eyes	0.839	+0.082	0.704	<0.001
Chin	0.847	+0.014	0.718	<0.001
Hair	0.850	+0.005	0.723	0.006

Discussion

The study of the relationship between facial attractiveness and facial components and its influencing factors will be helpful for orthodontists to communicate with patients and predict the effect of correction. Previous studies have shown the following points: 1. The face is the central

contributor to physical attractiveness;³ 2. Each facial component may be related to facial attractiveness;⁸ 3. Laypersons and dental specialists diverge in the perception of facial attractiveness.^{11,12} However, so far little is known about the difference between laypersons and dental specialists when evaluating attractiveness of facial components.

For the first time, this study aimed to compare the differences between laypersons and orthodontists in assessing the correlation between facial attractiveness and the hair, eyes, eyebrows, nose, lips, teeth, and chin. In clinical practice, the analysis of facial morphology is mainly based on frontal, lateral, and frontal smiling photos, which were often used in similar studies.^{17,19} Subjective facial analysis is a common and effective method to evaluate facial attractiveness. The VAS is also a simple, practical and reliable measurement method widely used in similar researches. When each facial component was evaluated, other facial features were not masked. It was mainly because that we can not evaluate a single facial component in real life. However, in this study only one facial component was evaluated at a time and thus the raters were able to focus concentration on one part to reduce the impact of other facial components on the score.

When assessed by laypersons, a significant correlation was found between facial attractiveness and the chin ($r = 0.671$) and eyes ($r = 0.669$); the chin was responsible for 45.1% of the variation in facial attractiveness, and the eyes for 14.3%. These results show that the chin contributes the most to facial attractiveness for laypersons, followed by the eyes. In an article with three-quarter-view facial photographs, the chin was more critical for laypersons than the eyes, hair, and lips,¹⁷ which is consistent with the result of this study. An aesthetically pleasing face is centered on strength, symmetry and balance. A defined, well-projected chin and jawline are crucial to this harmony.^{9,10} With increasing aesthetic awareness, the chin is now considered as one of the most important parts of the facial skeleton.²⁰ The position and size of these skeletal regions relative to the skull base and their three-dimensional positional relationship with each other are essential and contribute the individuality of a human face.²⁰ The position of the chin has a great influence on the evaluation of facial harmony; its different forms and types dominate the appearance. In addition, the expression of the chin is equivalent to the personality characteristics, so it is an important component of the profile forms. Therefore, lower face contouring surgery has become a popular aesthetic surgery in East Asian countries, and various surgical methods have been used to improve lower face aesthetics.^{21,22} In a recent article with frontal smiling photographs, authors showed that the chin were less critical compared with other facial components such as the smile and eyes assessed by laypersons in facial evaluation.¹⁸ However, the following points in this article must be noted: 1. Only a frontal smiling

photograph was provided; 2. Each facial component was presented separately; 3. Only smiles were evaluated, which could better access the combined aesthetic effects of lips and teeth.

When assessed by orthodontists, a significant correlation was found between facial attractiveness and the lips ($r = 0.789$), and the lips were responsible for 62.2% of the variation in facial attractiveness. These results show that the lips contribute the most to facial attractiveness for orthodontists and that the correlation between facial attractiveness and the lips assessed by orthodontists is significantly higher than that of laypersons. The lips are an essential component of the symmetry and aesthetics of the face. Cosmetic surgery to modify the lips has recently gained in popularity. The projection and relative sizes of the upper and lower lips are as significant to lip aesthetics as the proportion of the lips to the rest of the facial structure.²³ The shape and volume of a person's lips are of great importance in the perception of beauty. The appearance of the lips partly determines the attractiveness of a person's face. However, many studies have shown that dental professionals are more critical of dental aesthetic aberrations than non-professionals.^{11,12} Dentists may tend to place a disproportionate weight on the mouth when assessing a smile close up.²⁴ Therefore, the orthodontists are likely to pay more attention to and exaggerate the effect of the lips on facial attractiveness. However, the patient's opinion and esthetic complaints are important to achieve the best clinical outcomes. Thus, although it is desirable to build beautiful lips in every treatment plan, restricting the analysis of attractiveness to lips may be a big mistake for orthodontists in clinical practice.

In our study, whether in the evaluation of laypersons or orthodontists, a significant correlation was found between facial attractiveness and the teeth. It was reported that persons with normal occlusion are rated as attractive, intelligent, agreeable, and extraverted.⁵ Smile aesthetics is a critical factor for evaluating orthodontic treatment outcomes. A smile with greater maxillary incisor show, number of displayed teeth, and buccal corridor ratio was considered more esthetic.²⁵ The presence of maxillary incisor asymmetries were reported to be a critical factor that can affect the perception of smile aesthetics.²⁶ The most attractive smiles of the men investigated were those without asymmetry and those with 0.5 mm incisor edge asymmetry in the lateral incisor.²⁶ Slightly extruded central incisors are aesthetically more attractive than intruded incisors in men,⁶ and the canine vertical position modifications have a statistically significant influence on the smile esthetic evaluations for both laypersons and orthodontists.⁷ However, few studies have compared the effects of teeth and other facial components on facial attractiveness. In the present study, whether in the evaluation of laypersons or orthodontists, the contribution of teeth to facial attractiveness is significantly less than that of the lips and chin. In an article with three-quarter-view facial photographs, authors showed that in facial evaluation teeth are less critical than other components such as the chin, eyes, hair, lips, and nose,¹⁷ which is consistent with the result of this study. These results indicate that in orthodontic clinical work, if orthodontists only change the arrangement of teeth without making the lips and chin more beautiful, then the

orthodontic treatment may achieve very limited results in improving the attractiveness of patient's whole face.

There are also some limitations in this study. The attractiveness was assessed by photographs. Although popular, they are static two-dimensional representations. In the dynamic record, other emotional patterns can be analyzed, and the judgment of attractiveness may be different.²⁷ However, dynamic recording is uncommon, and the ratings of facial attractiveness in video clips has proven to be similar to those in static images.²⁸ In addition, the laypersons and orthodontists who assessed facial attractiveness in this study represented only a part of the population. It should be cautious to extrapolate these results to the general population, because these aesthetic concepts are influenced by ethnic, cultural, and contemporary aspects.²⁹

In conclusion, when laypersons evaluate, the chin contributes the most to facial attractiveness, and when orthodontists evaluate, the lips contribute the most. Whether in the evaluation of laypersons or orthodontists, the contribution of teeth to facial attractiveness is significantly less than that of the lips and chin. These results indicate that in orthodontic clinical work, if orthodontists only correct the teeth rather than make the lips and chin more beautiful, the orthodontic treatment may achieve very limited results in improving the attractiveness of the whole face.

Declaration of competing interest

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

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