A digital photograph study evaluating facial taperness and square face perception of Taiwanese females

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Abstract

Background: This study assessed the perception of facial taperness in Taiwanese females among people with dental knowledge and laypersons. Additionally, this study also specified the criteria by which "square face" was defined regarding Taiwanese females' facial taperness.

Methods: A series of digitally modified photos with different levels of facial taperness (Gonion to Gonion/Zygoma point to Zygoma point—Go-Go/Zy-Zy ratio ranges from 65% to 90%) were randomly arranged and presented to the raters. Visual analog scale (VAS) lines were used for scoring the photos on a scale of 0–100. The true or false question about "defining square face" was incorporated in the same questionnaire. The reliability of the true/false square face question and the esthetic evaluation by VAS were assayed. The receiver operating characteristic curve was used to define the cutoff point on "square face." The effects on the raters' genders, orthodontic treatment experience, and their professional background on the perception of a square face were assayed.

Results: The overall reliability of the raters was within the acceptable range. The VAS score evaluation revealed that the average expectation for best facial taperness was 75%, whereas the facial taperness of over 83% was considered as the square face. The facial taperness reaching to 90% was regarded as the most unattractive. Gender, therapy, and professional experience have no impact on the standard of square facial form evaluation.

Conclusion: A face with a taperness greater than 83% was evaluated as a square face, and a face with a taperness around 75% was considered as the most attractive.

Keywords: Facial taperness; Facial type; Square face; Visual analog scale (VAS)

1. INTRODUCTION

Microplastic surgery is becoming popular in Taiwan. An increasing number of females are seeking medical help to reshape their facial forms. Square face is one of these facial forms among Asian females.[1,2] However, "square face" has never been defined appropriately and is generally implicated in people with a wider bigonial width from the frontal view, or a prominent mandibular angle. The square face was first described by Li et al[3] as seen from the lateral view. They stated that patients possessed a square face when the gonial angle—formed by the articular, gonion, and menton (Ar-Go-Me)—was below 110°. Zhao et al[4] evaluated the attractiveness of Han women, and "square face" was initially formally classified as one of the "Eight female

Han face types." In this study, the bigonial width to bizygomatic width ratio was analyzed as one of the indexes to evaluate facial patterns (Fig. 1). In the Chinese female population, a high attractiveness rating was given to those with smaller bizygomatic and bigonial widths, which are thought to represent feminine features.[4]

In addition to a well-aligned dentition, both facial harmony and a balanced facial contour are expected after treatment: in the frontal and lateral view. However, most studies use the lateral view to evaluate the harmony of a profile and the facial contour instead of the frontal view, which is more critically judged by the patients and the people around them.[5] For people seeking esthetics, orthodontic treatment may help improve the protrusion of their lips from the lateral and frontal view. However, after the perioral problem was solved, the demand regarding the improvement of the facial form from frontal view may be considered.

Recently, many patients in Taiwan have been seeking medical help to improve their so-called square face. Although "square-faced females"—who are thought to be less attractive—are widely treated with mandibular angle osteoplasty[6–14] or nonsurgical methods—such as botulinum toxin injection[15–19]—in recent years, the literature on defining "square face" from the frontal view remains inadequate.

To identify the subjective standards for "square face," we designed a questionnaire study that evaluates a series of digitally modified photographs by assessing the facial taperness. Facial
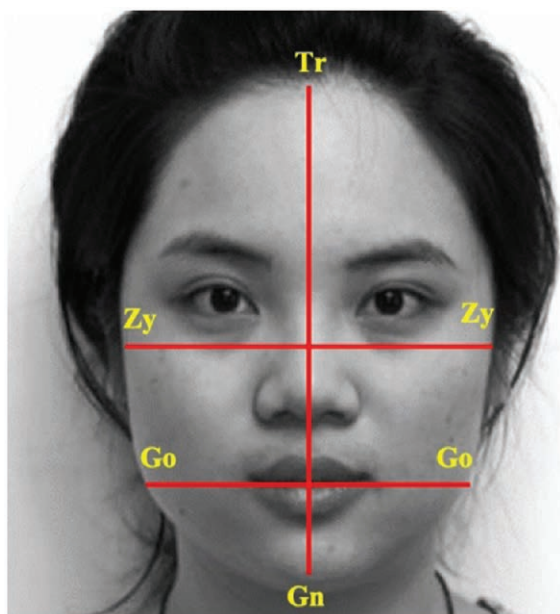
Fig. 1 Facial taperness (Go-Go/Zy-Zy) from frontal photograph. Gn = gnathion; Go = gonion; Tr = trichion; Zy = zygion.

taperness—which is defined as the Gonion to Gonion/Zygoma point to Zygoma point ratio (Go-Go/Zy-Zy)—was initially introduced by the renowned anthropologist Farkas[20] early in 1987 (Fig. 1). The main goal of this study was to assess the critical value defining "square face" for Taiwanese females, based on the value of facial taperness in a frontal photograph. In addition, the perception of facial attractiveness, according to the different types of facial taperness in young Taiwan females, was evaluated using the visual analog scale (VAS) score.

2. METHODS

The ethics committee at VGHTPE approved this study (TPEVGH IRB No. 2020-01-026BC).

2.1. Materials

To control the variations, an extraoral frontal photograph of a female face was obtained from a volunteer using a Sony α5.5 camera. The image was modified with Photoshop CS5 (Adobe, San Jose, CA) through the following steps:

1. Mirroring the image from the right face to create a symmetric model, the vertical proportions of the upper, middle, and lower face were standardized following the "Rule of thirds,"[21] and the proportion for facial height (Trichion to Menton, Tr-Me) to facial width (Zygoma point to Zygoma point, Za-Za) was set as 1.3:1.
2. Modifying the intergonial width to create a series of frontal images with different types of facial taperness (Go-Go/Zy-Zy = 90%, 87%, 85%, 83%, 80%, 75%, 70%, 65%; Fig. 2). The eight images were randomly arranged and presented to the raters on a computer.

2.2. Raters

We enrolled 203 raters; all the raters enrolled voluntarily. Some of them were dental students in their fourth to sixth year in National Yang-Ming University (n = 76) and others (n = 207) were patients and colleagues from the Taipei Veterans General Hospital.

2.3. Questionnaire

Each rater was given a questionnaire to evaluate the attractiveness of the faces using a different facial taper index. There were eight VAS lines (100-mm scale) for each image (A–H) independently on the questionnaire; the scale was anchored from "very unattractive" (score of 0) to "very attractive" (score of 100). To avoid the clustering of scores around the preferred numeric
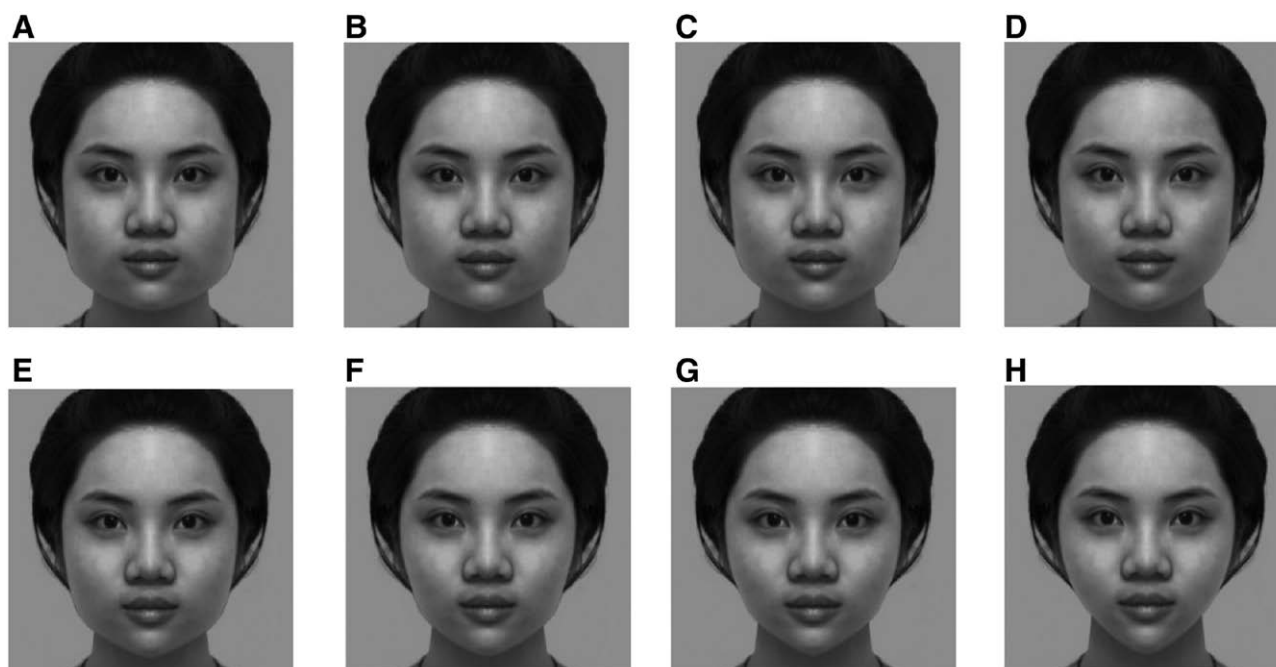

Fig. 2 Faces (A–H) with standardized vertical facial proportion (Rules of thirds) and different facial taperness (Go-Go/Zy-Zy). A, Facial taperness 90%. B, Facial taperness 87%. C, Facial taperness 85%. D, Facial taperness 83%. E, Facial taperness 80%. F, Facial taperness 75%. G, Facial taperness 70%. H, facial taperness 65%. Go = gonion; Zy = zygion.

value, numbers or verbal descriptors at intermediate points were not used. In addition to the VAS score, there was a yes/no question box for subjective perception of "square face" and "non-square face" adjacent to each VAS line (Fig. 3). The raters were instructed to complete the scoring within 20 seconds for each image, by providing a score from 0 to 100 and a yes or no question for "square face opinion." The digitally altered photographs (Fig. 2) were sequentially showed to the raters in a random order, and assessing the same image again was not permitted.

2.4.Statistical analysis

Randomly chosen 12 raters were asked to repeat the questionnaire 2 months later. SPSS v.17.0 (SPSS Inc. Chicago, IL) was used for data analysis. The reliability of the yes/no square face evaluation was performed with McNemar's test, and Wilcoxon test was used to evaluate the reliability of esthetic evaluation by VAS.

For cutoff points of facial tapering as a diagnosis parameter for "square face," the receiver operating characteristic (ROC) curve was used. The Cochran Mantel–Haenszel test was performed to evaluate the effect of gender, orthodontically treated experience, and professional dental knowledge on the perception of square face.

3. RESULTS

3.1. Raters

All the 203 raters were Taiwanese, aged 20 to 40 years, comprising 129 females and 64 males. Among the raters, 114 raters were previously orthodontically treated or were under orthodontic treatment, and 89 raters did not have any experience of orthodontic treatment. From the dental knowledge perspective, 76 raters were undergraduate students from a dental school, and the rest of the raters were laypersons without professional

Fig. 3 Questionnaire. Visual analog scale (VAS) score (0–100) for esthetic evaluation, y/n choice for square face/ non-square face evaluation.

dental knowledge. The reliability of the 12, randomly chosen, raters was within the acceptable range (Table 1).

3.2. Attractiveness evaluation of frontal facial images with different facial taper indexes

Based on a VAS score evaluation, Face f (facial taper index, 75%) obtained the highest score of 74.46. On the other hand, Face a (facial taper index, 90%) obtained the lowest score of 39.33 (Fig. 4).

3.3. The cut-off point of square face and non-square face

From the ROC curve evaluation, the cutoff point of the square face for a female was 83% in facial taperness. Furthermore, the area under the curve level was 0.933, which supports the outstanding discrimination of this ROC curve (Fig. 5). Therefore, according to our study's results, females in Taiwan with a facial taperness of more than 83% can be categorized as having a square facial type.

3.4. Factors influencing the square face/non-square face evaluation

The results of the Cochran Mantel–Haenszel test compared the square and non-square face evaluation among different rater groups. No significant difference was observed within the three rater groups, which included gender, orthodontically treated experience, and professional dental knowledge (Table 2).
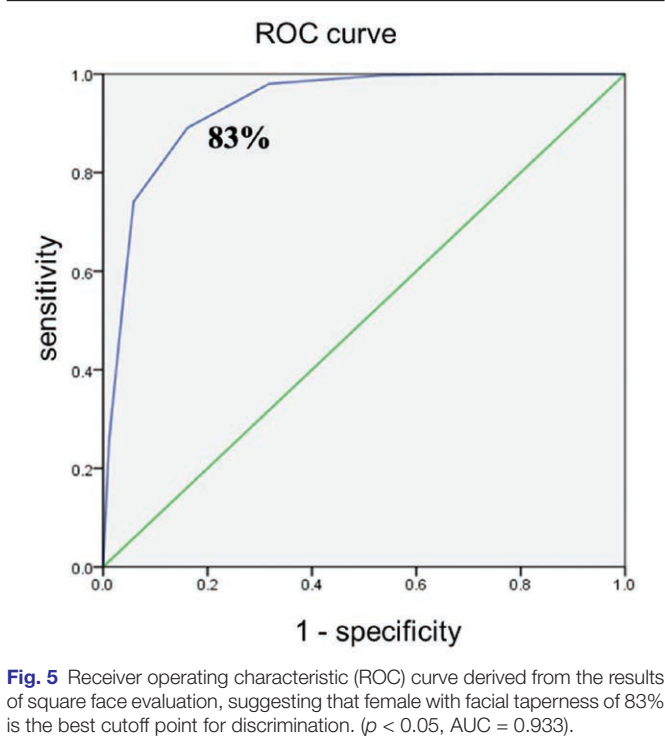

Fig. 5 Receiver operating characteristic (ROC) curve derived from the results of square face evaluation, suggesting that female with facial taperness of 83% is the best cutoff point for discrimination. (*p* < 0.05, AUC = 0.933).

4. DISCUSSION

Facial attractiveness does not only lie within the specific facial angle, point-to point distances but also arises from facial proportion. Facial taperness (bigonial with/bizygomatic width) is the proportional characteristic that is most highly associated with square face esthetics. From our study results, Taiwanese
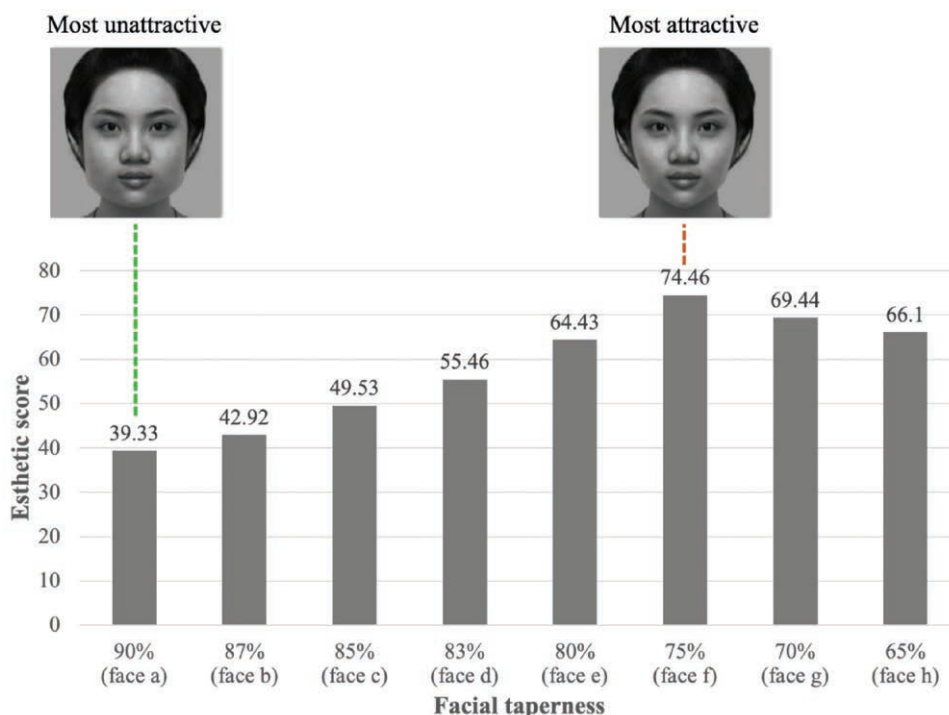

Fig. 4 Esthetic evaluation of visual analog scale (VAS) score of different facial taper types (A–H) by 203 raters.

Table 2.

Cochran's Mantel–Haenszel test for square face/non-square face evaluation

Factors		*p*
Gender	Female (n = 129)	0.606
	Male (n = 74)	
Orthodontic experience	Without orthodontic treatment experience (n = 89)	0.122
	Has orthodontic treatment experience (n = 114)	
Dental knowledge	Not dental student or dentist (n = 127)	0.736
	Undergraduate dental student (n = 76)	

females with a facial taperness of 75% were the most attractive to the 203 raters. In the study of Zhao et al,[4] it was shown that an average of 86.8% facial taperness in Chinese Han females was considered the most attractive, based on the perceptions of seven expert plastic surgeons. Considering that the inclusive samples in the study from Zhao et al included many different study subjects, different characteristics may have been affecting their perception of beauty. Therefore, to focus on the question, we used a digital technique to reduce the affecting factors, including elements like the eyes, nose shape, skin texture, and hairstyles that were thought to influence the perception of a beautiful face.[22] The total facial height, vertical facial proportion, and bizygomatic width were also controlled in normal proportions according to the rule of thirds in order to reduce the confounding effect. Besides regarding study subject design, in Zhao's study, the raters were seven experienced plastic surgeons with facial analysis expertise. In contrast, the raters in our study were 203 subjects with limited knowledge of facial analytical skills. The deviation of the results may thus relate to the different backgrounds of the raters. The results of our study may be more representative of the general public's perception of Taiwanese people.

Anthony Little,[23] a psychologist in Scotland, studied averageness and attractiveness, and he concluded that averageness refers to how similar a face looks to most other faces in a population. Average faces refer to a mathematical average of most people's features. Additionally, in general, people find such faces quite attractive. Moreover, Trujillo et al[24] proposed evidence indicating that faces are perceived as being attractive when they approximate a facial configuration close to the population average. In other words, the "average face" of a given population might represent the most perceived face and thus be judged as the most attractive facial pattern.

Farkas et al[20] developed the first normal proportional indexes of faces, based on measurements from 1312 Caucasians' heads, which continued into the 20th century. The average facial taperness (Go-Go/Zy-Zy) for normal Caucasian males and females in his study was 70.8% and 70.1%, respectively. Although the data of averageness was similar to the measurement of the most attractive face from our study (75% for female), it was still less (70.8%) than ours. The average data of these normal Caucasians were obviously more tapered than what we deemed to be an attractive face, which might relate to racial differences. Another anthropometric study was conducted by Farkas et al[25] on facial morphology from 17 different countries with different races. One similar race to Taiwanese was Singaporeans; the data showed that the average facial taperness of Singapore females was 75.1%. This is similar to our result describing the attractive facial taperness in females.

In our study, the most attractive face that a Taiwanese female had was 75% facial taperness (VAS score, 74.46 ± 12.79), and the most unattractive face had 90% facial taperness (VAS score, 39.33 ± 1 5.45). The second most attractive face revealed by this study was a face with 70% facial taperness (VAS score, 69.44

± 14.57). In summary, females with an increased intergonial width—which results in an increased facial taperness—were the most unattractive in the scoring. Furthermore, females with a 75%–70% facial taperness were the most attractive; however, those with 65% facial taperness may be viewed as unattractive (Fig. 3).

A square face was mainly related to increased bigonial width, and it was one of the unattractive facial types among eight female Han face types.[4] According to our study results, the average expectation for best facial taperness was 75%, whereas the facial taperness of over 83% was considered as the square face (Fig. 4). The intergonial width reaching to 90% of facial taperness was regarded as the most unattractive. And the average preference for best facial taperness was 75%. Therefore, for patients seeking gonial plastic surgery, the results from our study may provide a general guide on the preferred Taiwanese female facial patterns.

In conclusion, we identify that gender, orthodontic treatment experience, and dental professional knowledge have no significant impact on the standard of square facial form evaluation. A face with a facial taper greater than 83% will be judged as a square face in Taiwan. Furthermore, a face with a facial taper of 75% was evaluated as the most esthetic facial form.

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