Original Article

Young People's Esthetic Perception of Dental Midline Deviation

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ABSTRACT

Objective: To test the hypothesis that young people's esthetic perception of dentition midline deviation or the threshold below which they find the deviation "acceptable" depends on the gender and face type of the person with the deviation and the gender of the evaluator.

Materials and Methods: Facial images of six young subjects with three different face types were captured, and their dentition midlines were altered digitally. The images were evaluated by young people with no dental training. Statistical analysis was carried out to determine the threshold for acceptable dentition midline deviation and factors influencing perception.

Results: The mean value for the threshold below which a deviation was judged "acceptable" was 2.403 mm (95% confidence interval, 2.315–2.491). The preferences of evaluators did not significantly depend on the direction of the deviation. Both male and female evaluators were significantly less tolerant of deviation in female subjects than in male subjects. However, female evaluators were significantly more tolerant of midline deviations in male subjects than were male evaluators. In addition, the same degree of deviation was most noticeable in male subjects with a tapered face type and least noticeable in female subjects with a square face type.

Conclusions: The gender and face type of an individual with dentition midline deviation and the gender of the evaluator do affect young people's esthetic perception of a dentition midline deviation and the threshold below which they find the deviation "acceptable." (*Angle Orthod.* 2010;80:515–520.)

KEY WORDS: Dental esthetics; Facial asymmetry

INTRODUCTION

Facial attractiveness is an important objective of orthodontic treatment, and frontal symmetry is considered one of the evaluation standards of facial appearance. Therefore, coincidence between the maxillary and facial midlines is a treatment target of orthodontic therapy.[1] However, a mild degree of facial asymmetry commonly occurs in individuals[2] and is barely recognized by the general public. In certain cases, modification of the maxillary midline to achieve perfect frontal symmetry may require complex procedures,[3] increased treatment time, and substantial cost, although its benefits to the patient are uncertain.

Much has been written about the diagnosis and treatment of facial asymmetry, but esthetic standards to evaluate dentition midline deviation have not been established because of the subjective nature of judgments about attractiveness and abnormality. In practice, dentists generally resort to their own visual esthetic evaluation based on years of training and experience. However, a study shows that orthodontists and dentists are significantly less tolerant of midline deviations than are patients.[4] Furthermore, the results of several studies that attempted to determine the threshold of acceptability of dental midline deviation are conflicting. Beyer et al[4] and Johnston et al[5] reported that the threshold for the public is 2 mm, and Pinho[6] concluded that shifts of up to 4.0 mm are not perceived by the public. The conflicting results may reflect methodological differences in such components as image alteration, rating system, and statistical

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analysis. It is also possible that because most studies have focused on one or two subjects and have not taken their face type into consideration, the different results may reflect the influence of the shape of the skeleton, soft tissue, and teeth on esthetic perception.

Several studies[7,8] on human visual perception led to a model of how people detect symmetry: the axis of the face was identified, certain salient features were located, and the symmetry of this feature was examined over a long distance. When the symmetry of dentition has been evaluated, facial structures near the dentition will influence the process. We therefore hypothesized that the face type of the person with a dentition midline deviation would affect whether and how others perceived the deviation.

Because young people make up the majority of patients undergoing orthodontic treatment, and because the appraisal of their peers has a considerable influence on their level of satisfaction with treatment, young people were chosen as both subjects and evaluators in this study. The purpose of this study was to determine a clinically significant threshold of dentition midline deviation for young people that might serve as a reference for dentists. In addition, we aimed to examine the following factors that might influence the esthetic evaluation of deviation: (1) direction of midline deviation to the left or right, (2) gender of subjects and evaluators, and (3) face type of subjects.

MATERIALS AND METHODS

Three male and three female subjects aged 20–25 were selected in this study and classified into square, oval, and tapered face types,[9] with one man and one woman in each group (Figure 1). They exhibited no discernible dentofacial asymmetry, dental abnormity, frontal deformity, or trauma. The classification was made on the basis of key features of face types,[9] including face width-height ratio, incisor shape, and mandibular angle. The inclusion and classification were carried out by three orthodontists independently, and the six included subjects received unanimous classifications. Informed consent and written permission to publish their images were obtained from the subjects. Frontal face images of the six volunteers were captured electronically under the same circumstances. The subjects were trained in advance to display a standard smile: upper and lower lips apart, exposing 75%–100% of maxillary teeth from left premolar I to right premolar I.[10] These images were digitally altered by moving the maxillary dental midline incrementally 0.5 mm both to the right and to the left, with deviations ranging from 0 to 4.0 mm.

The evaluators included 61 men and 47 women aged 19–25 years with no background in dental
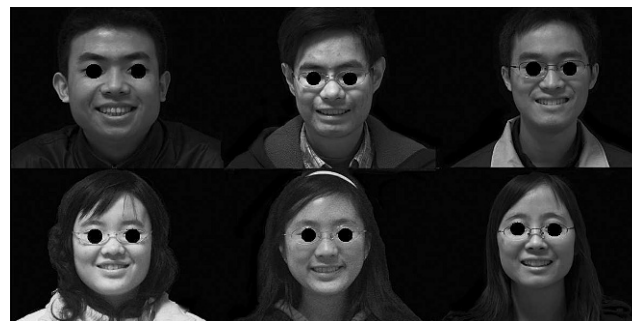
Figure 1. Images of the six subjects. From left to right: square, oval, tapered face types.

medicine. None of them was aware of the aims of the study. They were shown slides of the facial images (including both original and altered photos) in a predetermined, random order. The evaluators were not permitted to revisit a photo once they had moved to the next one. They were asked to score the attractiveness of the smile on a scale of 1 to 10, where 10 stood for very attractive and 1 for very unattractive. They also were asked to judge whether the smile was "acceptable" or "unacceptable" to them. We defined "unacceptable" as meaning that the attractiveness of subjects was impaired to the degree that the evaluator believed that orthodontic treatment was needed. Evaluators gave their ratings independently of one another.

To eliminate confounding factors such as discrepancies in the baseline attractiveness level of subjects, the ratings of each evaluator were adjusted by the evaluator's rating for the original image (0 mm). The scores of each evaluator were also adjusted by the standard deviation of that evaluator to take into account the fact that some evaluators use the full range of a rating scale, while others tend to award scores within a narrow range on the scale.[5] The standardized attractiveness scores were therefore defined as (Score − Score of 0 mm)/(Standard deviation of the evaluator). Each assessor's threshold for each subject was recorded as the largest "acceptable" value.

The Statistical Package for the Social Sciences (SPSS), version 13.0 (SPSS Inc, Chicago, Ill) was used for statistical analysis of data. Descriptive statistics were reported as means and standard deviations where appropriate. Numerical data were tested by analysis of variance (ANOVA) followed by least significant difference (LSD) multiple comparisons test; ordinal data were compared using Friedman and Wilcoxon signed rank tests.

RESULTS

The mean age of the evaluators was 21.037 ± 1.176 years. The mean deviation threshold for all evaluators
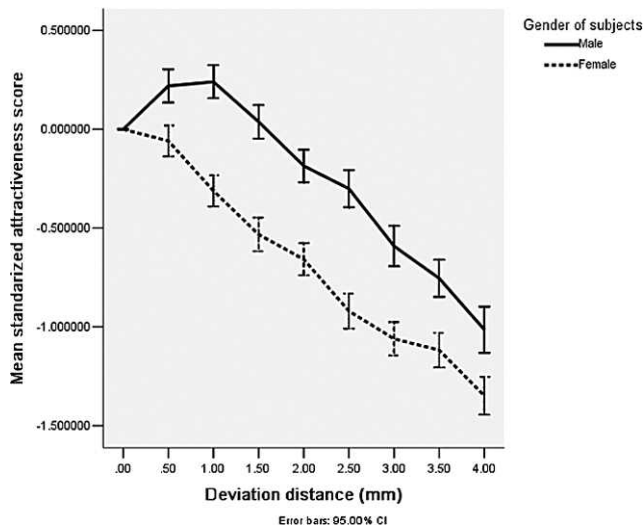
Figure 2. Comparison between the attractiveness scores of male and female subjects.

Figure 3. Comparison between the attractiveness scores of male and female subjects rated by male and female evaluators.

was 2.403 ± 1.372 mm (95% confidence interval [CI], 2.315–2.491).

Wilcoxon signed rank test and ANOVA showed that the direction of midline deviation (left or right) did not significantly affect the acceptance thresholds (P = .137) or the attractiveness scores (P = .812), so this variable was not included in further analysis.

Evaluators were significantly less tolerant of midline deviation in female subjects than in male subjects. Female subjects received both lower attractiveness scores and lower acceptance thresholds than were received by male subjects ($P <$ .0001 in both cases; Figure 2). The mean acceptance threshold for men was 2.574 ± 1.280 mm (95% CI, 2.458–2.690), and the threshold for women was 2.232 ± 1.438 mm (95% CI, 2.102–2.326). The attractiveness scores revealed that as the midline deviation increased in female subjects, altered images were consistently rated as less attractive; in strong contrast, the scores for male subjects with deviations of 1.5 mm or less were higher than for male subjects with no deviation (Figure 2).

The gender of the evaluators did not significantly affect the ratings for female subjects (P = .468). However, female evaluators were significantly more tolerant of midline deviations in male subjects than were male evaluators of male subjects (P = .003), especially when the deviation measured no more than 1.5 mm (Figure 3). Because the gender of subjects significantly affected the perceptions of evaluators, tests comparing the three face types were carried out separately for male subjects and female subjects.

ANOVA tests comparing attractiveness scores for the three different face types in male subjects (Table 1, Figure 4) revealed that the same degree of deviation was most noticeable in a male subject with a
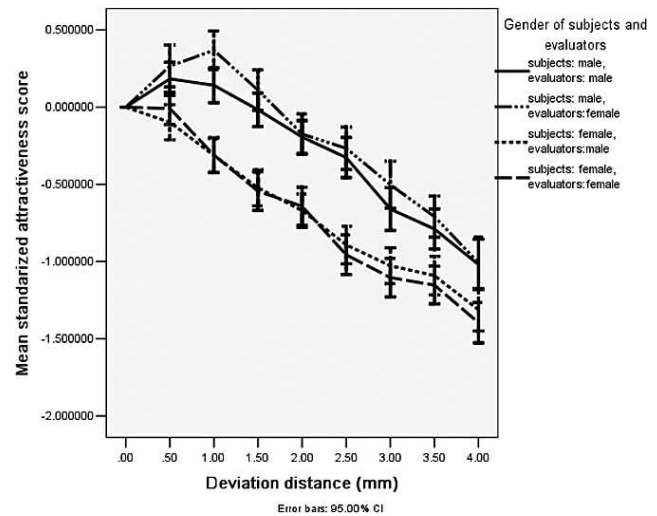
tapered face type and least noticeable in a male subject with an oval face type. However, when the deviation measured no more than 2.0 mm, the difference between the tapered face type and the other face types was not significant. When the deviation measured more than 2.0 mm, significant differences were noted among the three face types and the scores for male subjects with a tapered face type were significantly lower than those for male subjects with the other face types (Table 2). Moreover, deviations of 1.0 mm or less in male subjects were not rated as less attractive than no deviation for any of the three face types.

Comparison of the attractiveness scores for the three different face types in female subjects (Table 1, Figure 5) showed that a given degree of deviation was least noticeable in female subjects with a square face type. When the deviation measured no more than 2.0 mm, scores were significantly lower for female subjects with a tapered face type than for subjects with the other face types. When the deviation measured larger than 2.0 mm, female subjects with an oval face type received the lowest scores (Table 3). Moreover, the mean scores for deviations of 0.5 mm were not significantly lower than those for no deviation in female subjects with square or oval face type. Scores for female subjects with a tapered face type decreased consistently as the midline deviation increased.

DISCUSSION

Disagreement about what midline deviations are esthetically acceptable leads to unnecessary costs and surgical complications. In this study, we examined a clinically significant threshold of dentition midline deviation for young people and factors that might

Table 1. Results of Comparisons Among Different Face Types

	Attractiveness Scores			P Value[a]
	Square	Oval	Tapered	
Male	−0.289 ± 1.106	−0.080 ± 1.074	−0.460 ± 1.492	<.0001*
Square vs oval				<.0001*
Square vs tapered				<.0001*
Oval vs tapered				<.0001*
Female	−0.604 ± 1.207	−0.747 ± 1.155	−0.707 ± 1.158	<.0001*
Square vs oval				<.0001*
Square vs tapered				<.0001*
Oval vs tapered				.529

[a] Analysis of variance (ANOVA) test followed by least significant difference (LSD) test.
* Statistically significant at $P < .05$.

Table 2. Results of Comparisons Among Different Face Types in Male Subjects

	Attractiveness Scores			P Value[a]
Deviation Distance	Square	Oval	Tapered	
≤2.0 mm	0.003 ± 0.966	0.129 ± 0.941	0.764 ± 1.180	.025*
Square vs oval				.007*
Square vs tapered				.114
Oval vs tapered				.258
>2.0 mm	−0.618 ± 1.161	−0.314 ± 1.164	−1.064 ± 1.575	<.0001*
Square vs oval				<.0001*
Square vs tapered				<.0001*
Oval vs tapered				<.0001*

[a] Analysis of variance (ANOVA) test followed by least significant difference (LSD) test.
* Statistically significant at $P < .05$.

Table 3. Results of Comparisons Among Different Face Types in Female Subjects

	Attractiveness Scores			P Value
Deviation Distance	Square	Oval	Tapered	
≤2.0 mm	−0.243 ± 1.048	0.328 ± 0.994	0.469 ± 1.009	.011*
Square vs oval				.058
Square vs tapered				<.0001*
Oval vs tapered				.002*
>2.0 mm	−1.010 ± 1.246	−1.219 ± 1.142	−1.107 ± 1.110	.001*
Square vs oval				<.0001*
Square vs tapered				.081
Oval vs tapered				.045*

[a] Analysis of variance (ANOVA) test followed by least significant difference (LSD) test.
* Statistically significant at $P < .05$.

influence the esthetic evaluation of deviation. Images of young people with digitally altered midline deviations were evaluated for attractiveness by persons of a similar age, who were also instructed to state whether the image was "acceptable" to them. The scores were standardized to eliminate discrepancies in the baseline attractiveness levels of subjects. Our results showed that the total threshold was 2.403 ± 1.372 mm (95% CI, 2.315–2.491); this relatively large standard deviation was expected, given the subjective nature of the research question. We also showed that the gender of

subjects and evaluators and the face type of subjects served as factors that may influence young people's esthetic perceptions of dentition midline deviation.

Our first goal was to test whether the direction of deviation played a role in facial esthetic evaluation. The analysis showed that the direction of deviation did not affect the ratings, which was consistent with the findings of previous studies.[4–6] It is important to note that subjects in this study were chosen on the basis of dentofacial symmetry and were instructed to display a symmetrical smile. Thus, further study is needed to
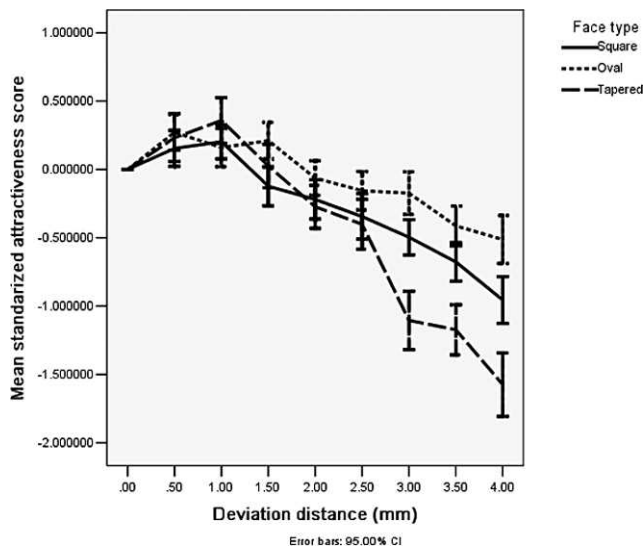
Figure 4. Comparison of attractiveness scores for different face types in male subjects.

Figure 5. Comparison of attractiveness scores for different face types in female subjects.

understand whether the direction of deviation is a factor in patients with facial asymmetry such as that seen with unbalanced facial muscle strength.

We next wanted to test the effects of subjects' gender on how they were evaluated by their peers. Beyer[4] reported a significant difference in average acceptability thresholds between male and female subjects, with less tolerance of midline deviation in the female subject. However, because that study used only one male subject and one female subject, it was difficult to generalize that there was more tolerance for male midline deviation. In addition, the result may reflect only that people are generally more critical of women's appearance[11] rather than the influence of subjects' gender on perception of midline deviation. In contrast to previous studies, the present work uses a larger number of subjects and a baseline-adjusted scoring system, yet the gender effect remains clear. It is interesting to observe that, in our study, young people tended to regard a slight degree of midline deviation in young men as acceptable, if not more attractive. In contrast, ratings for female subjects decreased consistently as deviation increased.

Contrary to former studies,[4,5] which showed no significant difference between male and female evaluators, the present study revealed that the gender of the evaluator affects his or her esthetic evaluation of midline deviation. Female subjects were more tolerant of male dentition midline deviation than were male subjects. In addition, young women tended to regard a slight degree of dentition midline deviation in male subjects as more attractive than no deviation.

We also tested the influence of subjects' face type on evaluation of midline deviation; this is the first study to our knowledge to explore this influence. On the basis of
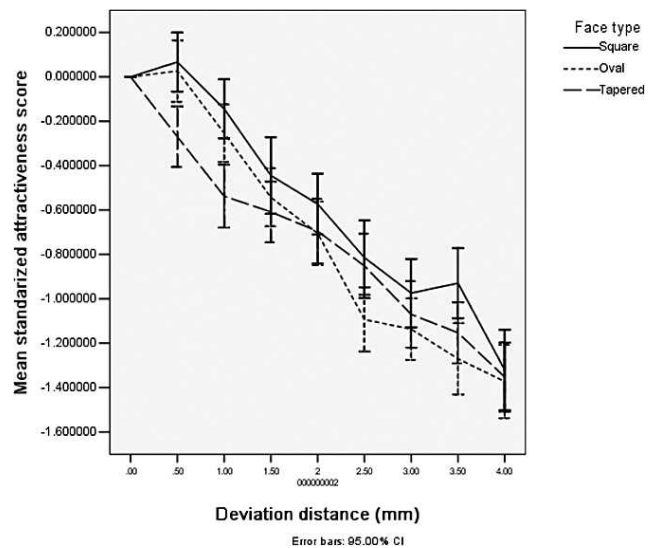
findings in visual perception, symmetry of a certain feature was examined over a long distance. Thus facial structures near the dentition influence the process of asymmetry evaluation. However, this knowledge has not been used in previous studies regarding dental midline deviation. It is our hypothesis that skeleton and soft tissue characteristics such as face width, mandibular angle, and maxillary incisor shapes may affect esthetic perception of midline deviation. Because face type is significantly associated with the above variables,[9] six subjects with typical face types were selected for this study. Our data show that evaluators were less tolerant of midline deviation in men with a tapered-type face than of midline deviation in men with other face types. This preference was especially evident for deviations greater than 2.0 mm. This result suggests that orthodontists should correct large degrees of midline deviation in male patients with a tapered face type whenever possible. On the other hand, when the deviation measured no more than 1.0 mm, the altered images of male subjects were not rated as less attractive than those with no deviation for any of the three face types. Thus for male patients, deviations less than 1.0 mm can be left untreated because the esthetic benefits of midline coincidence are uncertain.

When the deviation measured no more than 2.0 mm, scores for female subject with a tapered face type were significantly lower than those for other face types. In addition, as deviations increased, ratings for female subject with a tapered face type decreased consistently, even when deviations were slight (≤0.5 mm). Therefore, orthodontists should correct midline deviations in female patients with a tapered face type whenever possible, even when the deviation is minor. However, ratings for deviations of 0.5 mm in square and oval face

types were not significantly lower than ratings for no deviation. The scores of female subject with a square face type were the highest for all deviations tested. Therefore, the evaluators in our study were most tolerant of midline deviations in women with a square face type.

The influence of a tapered face type seemed to act differently between male and female subjects: among the three face types, male subjects with a tapered face type received the lowest scores when the deviations were greater than 2.0 mm; female subjects with a tapered face type received the lowest scores when the deviations measured no more than 2.0 mm. We believe that this apparent discrepancy resulted from another result of this study, namely, that people were significantly more tolerant of minor deviations in male subjects. Thus the trend of lower scores for a tapered face type appeared at higher deviations in male subjects than in female subjects.

One limitation to this preliminary finding is that only one subject stands for a certain face type for each gender. Additional studies with a larger panel of subjects should be carried out to validate these findings and provide more detailed insights into the effects of facial characteristics and perception of deviation.

CONCLUSIONS

- A young person's gender and face type affect how young people perceive the dental midline deviation and how they evaluate it esthetically.
- In general, young people are more tolerant of deviations in male subjects than in female subjects.
- The same degree of deviation was most noticeable in male subjects with a tapered face type and least noticeable in female subjects with a square face type.

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