

An Internet Evaluation of Chinese Public Preferences for Asymmetrically Altered Incisor Angulations

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Objective: To evaluate the Chinese public preferences for asymmetrically altered incisor angulations, with the goal of linking preferences to gender.

Methods: Five variations of 5 separate digital smiling photographs were used in this survey. The alterations included discrepancy between the dental and facial midlines, inclination of dental midline and two central incisors, inclination of left central incisor (mesially or distally) and occlusal cant. The raters used a 100-point visual analogue scale to evaluate each image on a web page.

Results: Overall 1,022 raters joined the evaluation and they were reliable (intraclass correlation coefficient = 0.76–0.80). Raters identified range of approval for several smile characteristics. A 2 mm dental to facial midlines discrepancy was the maximum acceptable deviation for females and 3 mm was the maximum for males. Females could accept a 4-degree occlusal cant and males could accept a 6-degree cant. These two characteristics were related to gender. The dental midline and relevant two central incisors with a 5-degree slope or less were generally acceptable. The approval of a left central incisor inclination was 5 degrees mesially and 10 degrees distally. These three characteristics were unrelated to gender.

Conclusion: The approval for five smile characteristics could be identified reliably. The ranges of acceptability were large and slight changes in the angulations of incisors did not influence the smile attractiveness.

Key words: public preferences, dental aesthetics, incisor angulations, internet evaluation, visual analogue scale

In modern society, people's demand for beauty is growing higher. Studies showed that, in a face-to-face situation, the eyes primarily scan the other persons' eyes and the oral region, with little time spent in observation of other features¹. The social attractiveness of a young adult was influenced by his or her dentofacial appearance². Since lots of patients' decisions to undertake prosthodontic and orthodontic treatment were based primarily on aesthetic considerations, the aim of modern

dentistry should include not only a perfect restoration of the masticatory function but also rehabilitation of the aesthetics.

Achieving optimal dental and facial appearances was a well-established objective in dental treatment. However, a scientific approach to decision-making in prosthodontics should reconcile evidence-based information not only of diagnosis, prognosis and therapy, but also of the patients' subjective desirability³. Aesthetic perception varied from person to person and was influenced by their personal experiences and social environments⁴. Several studies about aesthetic perceptions found that dentists were less tolerant than the general public for some dental conditions⁵. Therefore, not everything that dentists believe should be corrected in the name of aesthetics would be perceived by most of the lay public⁶. Some dentists might overestimate the

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Fig 1 The original smile view.

need for dental treatment⁷. In addition, in certain cases, corrections of minor esthetical disfigurements were not straightforward and might increase both the complexity and duration of dental treatment. To date, little work has been produced to establish the threshold levels of several symmetric aesthetic alterations that maintain dentofacial aesthetics for laypersons⁵. Unfortunately, asymmetric alterations made teeth more unattractive than symmetric alterations⁶.

This study was designed to investigate the approval of Chinese laypersons to asymmetrically altered incisor angulations, and to determine whether differences in preference exist between females and males.

Materials and methods

A dentofacial photograph of a young Chinese woman, who was smiling and had good dental alignment and tooth size without any fillings or periodontal diseases, was taken for this study. Using image processing software (Adobe Photoshop; Adobe Systems), the photograph was transformed into a symmetrical image and used as the original smile view (Fig 1). In this photograph, the dental midline vertically coincided with the facial midline. The vertical axes of two central incisors were parallel to the dental midline and the occlusal plane was perpendicular to the facial midline. In order to reduce the number of confounding variables, we did not choose a full smiling face view. However, laypeople appeared to be more aware of dental aesthetics when represented as a ‘close up’ view⁴. Therefore the nose and chin were partially contained in the final image instead of a mouth-only or tooth-only photograph.

Afterward, the original smile image was used to make further digital manipulations to create smiles with variations from aesthetic norms. Each of the five aesthetic characteristics was altered with 4 progressive variations of the original smile. Only the dentition was altered when modifying the images, with the soft tissues being unaffected. This generated 20 digitally altered photographs. Together with the 5 original smile views as the first images in the 5 groups, 25 photographs were evaluated in this study. The 5 variations of 5 separate smiling photographs were as follows:

Discrepancy between dental and facial midlines

The dental midline was moved to the left of the facial midline by 1 mm, 2 mm, 3 mm or 4 mm (Fig 2). The dentition was only moved to the left side as the laypeople’s preference was unrelated to the direction of the midline discrepancy (left or right)⁸.

Inclination of dental midline

The dental midline, together with 2 relevant central incisors, was turned in a clockwise direction by 5 degrees, 10 degrees, 15 degrees or 20 degrees (Fig 3).

Inclination of left central incisor (mesially or distally)

The axis of the left central incisor was inclined mesially or distally by 5 degrees, 10 degrees, 15 degrees or 20 degrees (Fig 4 and Fig 5).

Occlusal cant

The occlusal plane was turned in a clockwise direction by 2 degrees, 4 degrees, 6 degrees or 8 degrees (Fig 6).

A web-based survey was used for data acquisition. All of the 25 images were randomly presented in 5 pages on an online website www.sojump.com. The web pages were not allowed to view back. The raters who were interested in the survey were requested to score the acceptability of each smile view using a 100 point visual analogue scale (VAS) where a score 100 represented “very acceptable” and 0 represented “very unacceptable”. The data were analysed using the SPSS statistical package (version 13.0, SPSS). Paired *t* test and two-way ANOVA were used to compare the means of different genders and alterations. An intraclass correlation coefficient (95% confidence interval) was calculated to test the inter-rater reliability. Statistical significance was set at $\alpha = 0.05$. The score 50 was defined as the threshold level of approval.



Fig 2 Discrepancy between the dental and facial midlines.



Fig 3 Inclination of the dental midline and two central incisors.



Fig 4 Mesial inclination of the left central incisor.



Fig 5 Distal inclination of the left central incisor.



Fig 6 Inclination of the occlusal plane.

Results

Overall 1,022 judges joined the evaluation. The raters were composed of 624 (61.1%) females and 398 (38.9%) males. The subjects ranged in age between 18 to 40 years, and the median age was 26 years. All the elected raters had a college degree or higher. The intraclass correlation coefficient (ICC) was 0.78 (0.76–0.80) ($P < 0.05$). Descriptive analyses of preferences were summarised in Figs 7 to 12 and Tables 1 to 6. The images in each group were judged to be less acceptable as the alterations increased ($P < 0.05$).

When the discrepancy between the dental and facial midlines was 2 mm, it was accepted by both females and males and the mean score was 58.56. When the discrepancy increased to 3 mm, female raters scored 43.94 and male raters scored 51.70; further analysis showed that there was a statistically significant difference between females and males ($P < 0.05$) (Fig 7 and Table 1). Females were less tolerant of this alteration than males.

When the clockwise inclination of dental midline and two central incisors was 5 degrees, the mean score was 65.21; along with the inclination increased to 10

degrees, the mean score decreased to 43.47. There was no statistically significant difference between females and males ($P > 0.05$). Therefore, the approval of lay-people to inclination of dental midline and two central incisors was 5 degrees (Fig 8 and Table 2).

Raters scored 62.77 for the image with the left central incisor inclined 5 degrees mesially and 46.95 for 10 degrees mesially (Fig 9 and Table 3). However, the score was higher for the same level of inclination distally than mesially. When the inclination was 10 degrees distally, the mean score was 58.02, which was still higher than the threshold level of approval (Fig 10 and Table 4). Further analysis showed that the raters were more tolerant of a distal inclination than a mesial inclination of the left central incisor ($P < 0.05$) (Fig 11 and Table 5). There was no statistically significant difference between females and males ($P > 0.05$).

Female and male raters accepted an occlusal cant of 4 degrees or less. When the occlusal cant was 6 degrees, female raters scored 46.60 and male raters scored 50.60 (Fig 12 and Table 6). Further analysis showed that there was a statistically significant difference between females and males ($P < 0.05$). Females were less tolerant of this alteration than males.

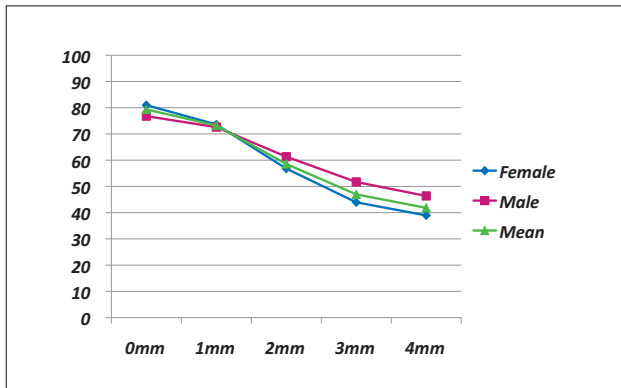


Fig 7 Approval of laypeople to the discrepancy between the dental and facial midlines (the dental midline was moved to the left of facial midline).

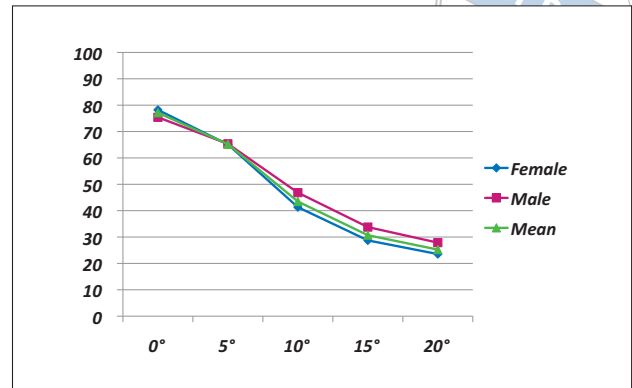


Fig 8 Approval of laypeople to the inclination of the dental midline and two central incisors.

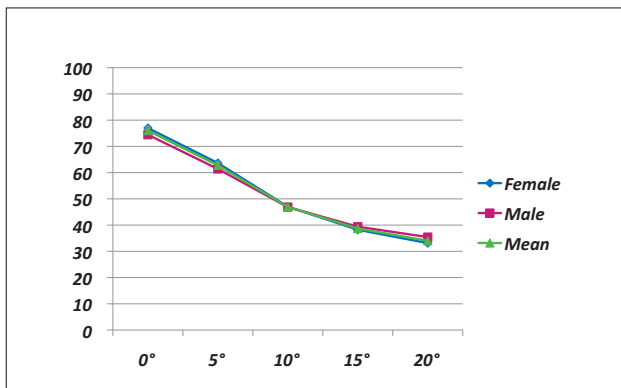


Fig 9 Approval of laypeople to the mesial inclination of the left central incisor.

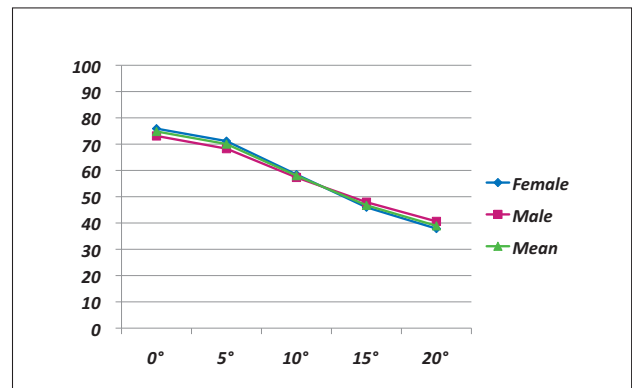


Fig 10 Approval of laypeople to the distal inclination of the left central incisor.

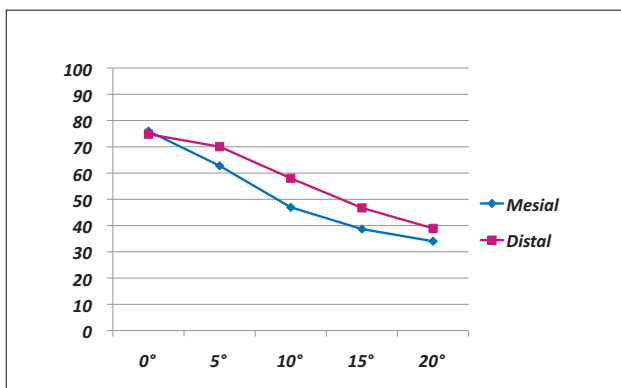


Fig 11 Approval of laypeople to the mesial and distal inclination of the left central incisor.

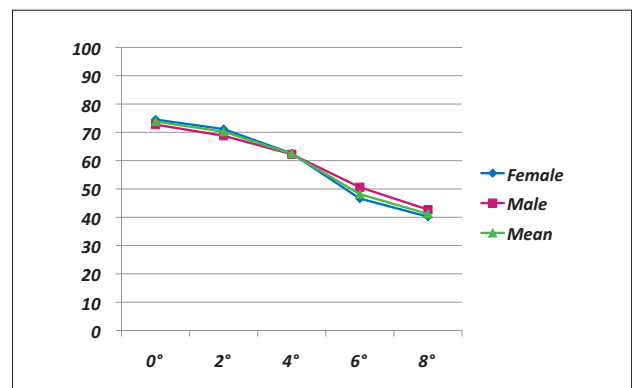


Fig 12 Approval of laypeople to the occlusal cant.



Table 1 Approval of laypeople to the discrepancy between dental and facial midlines (the dental midline was moved to the left of the facial midline)

Group	0 mm	1 mm	2 mm*	3 mm†	4 mm
Female	80.98	73.60	56.79	43.94	38.95
Male	76.78	72.60	61.33	51.70	46.36
Mean	79.35	73.21	58.56	46.96	41.83

* The acceptance threshold for females; † The acceptance threshold for males.

Table 2 Approval of laypeople to the inclination of the dental midline and two central incisors

Group	0 degrees	5 degrees*	10 degrees	15 degrees	20 degrees
Female	78.22	65.11	41.32	28.73	23.54
Male	75.40	65.35	46.83	33.78	27.87
Mean	77.12	65.21	43.47	30.70	25.23

* The acceptance threshold.

Table 3 Approval of laypeople to mesial inclination of left central incisor

Group	0 degrees	5 degrees *	10 degrees	15 degrees	20 degrees
Female	77.00	63.64	47.01	38.23	33.14
Male	74.43	61.40	46.86	39.38	35.43
Mean	76.00	62.77	46.95	38.68	34.03

* The acceptance threshold.

Table 4 Approval of laypeople to distal inclination of left central incisor

Group	0 degrees	5 degrees	10 degrees*	15 degrees	20 degrees
Female	75.90	71.16	58.46	45.99	37.86
Male	73.12	68.28	57.33	47.92	40.61
Mean	74.82	70.04	58.02	46.74	38.93

* The acceptance threshold.

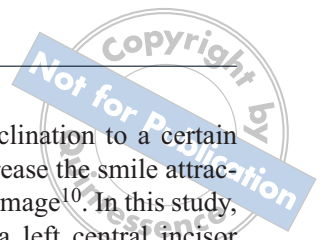
Table 5 Approval of laypeople to mesial and distal inclination of left central incisor

Group	0 degrees	5 degrees	10 degrees	15 degrees	20 degrees
Mesial	76.00	62.77	46.95	38.68	34.03
Distal	74.82	70.04	58.02	46.74	38.93

Table 6 Approval of lay people to occlusal cant

Group	0 degrees	2 degrees	4 degrees*	6 degrees†	8 degrees
Female	74.51	71.14	62.54	46.60	40.21
Male	72.72	68.79	62.25	50.60	42.70
Mean	73.82	70.22	62.42	48.16	41.18

* The acceptance threshold for females; † The acceptance threshold for males.



Discussion

We evaluated the approval of Chinese laypeople to several dentofacial characteristics based on computer and online web technique. It appeared to be an effective method of exploring aesthetics owing to its consistency of variable manipulation and controlled presentation⁹. Internet access and an interest in the survey were the only conditions to join the study. And the anonymous survey could possibly lead to more honest answers without being pressurized to fill in the 'right' answers¹⁰. This method has been used for researching in other studies^{5,9,10} and was adopted in this survey.

In a previous study, dentofacial attractiveness was rated to be acceptable or unacceptable¹¹. However, this approach was limited by the possibility that marginally acceptable dentofacial appearances received the same 'acceptable' score as did optical dentofacial appearances¹². In this study, we required the judges to assess the acceptability of each smile view using a visual analogue scale. An interexaminer reliability test showed that the results were able to consistently reflect the opinions of the general public. However, the tendency to score toward the middle of the scale, which was also reported previously¹², was visualised in this study.

It has been confirmed that the images were obviously less attractive as the dental to facial midlines discrepancy was more than 2 mm⁸ or 2.9 mm⁹, whereas another study found that laypeople did not notice a 4 mm midline shift⁵. In addition, the perception was unrelated to the direction of midlines discrepancy or the gender of judges⁸. In this study, we confirmed that the midlines discrepancy of 2 mm or less were acceptable for females and 3 mm or less were acceptable for males, which was related to gender ($P < 0.05$). We did not test the influence of midline shift direction.

Increasing the axial maxillary midline angulations consistently decreased the attractiveness of a smile¹¹. A previous study has suggested that a midline inclination of 10 degrees was acceptable for 59% of laypeople but the mean attractiveness score was lower than the middle point on a five-level Likert scale¹¹. The present study found that the mean score for 5 degrees inclination was 65.21 and for 10 degrees inclination was 43.47. Therefore, axial midline angulations of 5 degrees or less were generally acceptable and, if there was no dysfunction, less necessary to be prosthodontically or orthodontically treated.

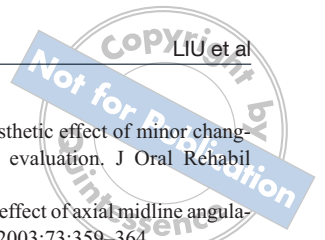
One central incisor with an inclination to a certain degree, e.g. 9 degrees, would decrease the smile attractiveness than the golden standard image¹⁰. In this study, we proved that the approval of a left central incisor inclination was 5 degrees mesially and 10 degrees distally. Laypeople were more critical to mesial inclination of one central incisor than distal inclination. However, the symmetrical alterations of the central incisor were not tested in this survey and will be focused on in the future.

Clockwise rotating of the occlusal plane changed the smile arc, which is an important factor in dentofacial aesthetics¹³. Previous studies have shown that deviations in cant were not noticeable unless they exceeded 2 degrees¹⁴, 3 degrees¹⁵ or 4 degrees¹⁶. We found that when the cant was 4 degrees or less, the negative influence to dentofacial aesthetics was minimal. When the cant was 6 degrees, the image was not acceptable for females but still acceptable for males, which was gender-related ($P < 0.05$). It should not be restored in the name of aesthetics until this cant has an influence on the physiological function.

Overall, dental attractiveness depended on kinds of features of the dentition but not any particular one¹⁷. This study surveyed five aesthetic alterations of the anterior incisors, and the approval of laypeople was determined. There were controversies over aesthetic issues in this research and previous studies. It could be illuminated by the reason that people's tastes and preferences were affected by their cultural, traditional and historical backgrounds and beliefs and were, of course, subject to change with time¹⁸. The raters in the present study were restricted to Chinese young adults with a higher education, and it was one of the limitations of this study. In addition, the validity of the data of a web-based survey was not controllable¹⁰. Further comprehensive studies should be carried out with a wide range of general population involved and the quantity of the data should be discriminated carefully.

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