# Evaluation of Different Esthetic Smile Criteria

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***Purpose:*** The aim of this study was to evaluate the existence of different esthetic smile criteria as determined on the smiles of celebrities, which were considered by lay people to be beautiful. ***Materials and Methods:*** An Internet search for "best smile" and "female celebrities" in the years 2007 and 2008 identified 50 celebrities who were voted to have beautiful smiles. Another search was made for images of these celebrities that showed the entire face with an open smile. The images were analyzed using Digimizer image analysis software for different esthetic smile criteria. ***Results:*** Eighty percent of the sample was classified as having an average upper lip position, 62% showed upward upper lip curvature, and 78% had a parallel smile line. Forty-two percent of the images showed the maxillary anterior teeth not touching the lower lip, while 34% were touching, and 24% slightly covered it. Sixty percent displayed up to the second premolar, and 32% displayed up to the first molar when smiling. Midline deviation was detected in 36% of the sample. Diastema and golden proportion were not seen in any of the subjects. ***Conclusion:*** Female celebrities voted to have the best smile by lay people showed most of the esthetic smile criteria with slight variations, except for the golden proportion. The opinions and perceptions of lay people about beauty should be studied and evaluated. *Int J Prosthodont 2011;24:64–70.*

Dentistry has experienced a paradigm shift from an emphasis on restoration to elective cosmetic treatment.[1] Although dental professionals are subjected to the same environmental trends and media perspectives, educational experiences might bias a clinician's esthetic preferences away from those of the general public.[2,3] Clinicians are obligated to understand beauty, harmony, balance, and proportion as perceived by society when planning treatment.[4] Dentofacial attractiveness is particularly important to an individual's psychosocial well-being. People with a normal dental appearance are judged to be more socially attractive over many personal characteristics than those with malocclusions.[5] Those with poor dental esthetics have been linked to a lack of self-confidence and are thought to be disadvantaged in social, educational, and occupational settings.[6,7] During interpersonal interactions, the eyes primarily scan the eyes and mouth of the other person, with little time spent on other features.[8] Thus, it is not surprising that the general public considers the smile to rank second, only to the eyes, when considering the features most important to facial esthetics.[3]

Esthetics denotes concern about beauty or the appreciation of beauty. The perception of esthetics varies from person to person and is influenced by personal experiences and social environments.[9] For the same reasons, there can be differences in opinion between lay people and professionals regarding beauty.[10] One study reported that lay people preferred more natural profile drawings than dental specialists.[11] Another report pointed out an opinion difference between orthodontists and their patients when the same smiles were evaluated.[12] Recent studies also confirmed that there is a difference in esthetic perceptions between orthodontists, general dentists, and lay people.[12–14]

The most influential factors contributing to a harmonious anterior dentition are the size, shape, and arrangement of the maxillary anterior teeth, particularly the maxillary central incisors, as viewed from the front.[2,15–17] Lombardi[18] was the first to emphasize the

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importance of order in dental composition, with a recurring ratio noted between all teeth from the central incisor to the first premolar. Levin,[19] and more recently other authors,[15,16] indicated that the most harmonious recurrent tooth-to-tooth ratio was that of the golden proportion.

The golden proportion is based on the theory that a relationship exists between beauty in nature and mathematics.[20] Applied to smile design, it states that the width of the maxillary lateral incisor, as viewed from the front, should be in golden proportion to the width of the maxillary central incisor.[19] The maxillary lateral incisor should be 62% of the width of the maxillary central incisor, and the width of the maxillary canine should be 62% of the width of the resulting lateral incisor.[21] Conflicting reports indicate that the majority of beautiful smiles did not have proportions coinciding with the golden proportion formula.[1,17,21–25]

The smile arc is defined as the relationship between the curvature of the incisal edges of the maxillary anterior teeth and the curvature of the upper border of the lower lip.[26–28] The esthetics of the smile are affected by the upper lip position, the upper lip curvature, the parallelism of the anterior incisal curve with the lower lip, the relationship between the maxillary anterior teeth and the lower lip, and the number of teeth displayed in the smile.[29] It has also been found that the presence of a diastema between the maxillary central incisors is unacceptable among lay people.[30,31]

The facial midline is usually the starting point of the esthetic treatment plan.[32] The practical approach to locating the facial midline references two anatomical landmarks.[33] The first is a point between the eyebrows known as the nasion; the second is the base of the philtrum, also referred to as the Cupid's bow, in the center of the upper lip. A line drawn between these landmarks not only locates the position of the facial midline, but also determines the direction of the midline.

Who, for example, should be the judge of dental esthetics, the clinician or the patient, when their views diverge frequently?[1,34–36] There is substantial difference among clinicians, technicians, and nondental subjects, both nationally and internationally, in their beliefs and perceptions relating to dental appearance.[31] Pinho et al[37] concluded that laypersons, orthodontists, and prosthodontists have different perceptions of attractiveness when evaluating the gingival margin height of a maxillary central incisor and a dental midline shift.

The purpose of this study was to evaluate the existence of different esthetic smile criteria on the smiles of celebrities voted by lay people to have the best or beautiful smiles, which was determined by photographs obtained from the Internet.

**Fig 1** Example photograph illustrating how the images were cropped to show only the smile and a small portion of the surrounding structures.

## Materials and Methods

The Internet was searched using the Google search engine for the key words "best smile" and "female celebrity" in 2007 and 2008. The search identified 50 celebrities (25 per year) voted by lay people to have beautiful smiles. Another search was made for images of these celebrities that showed the entire face with an open smile. The photographs had to be from the frontal view and taken at public events to ensure that they had not been edited or modified digitally. In the image search engine preferences, the size of the searched photographs was set to large or extra large so that the necessary details could be appreciated (Fig 1). Each photograph was analyzed and evaluated by one examiner with the aid of Digimizer image analysis software (MedCalc Software). The following specific esthetic criteria for an open smile were evaluated:

- Upper lip position. The upper lip was divided into three categories: a high smile revealed the entire cervicoincisal length of the maxillary anterior teeth and a contiguous band of gingiva, an average smile revealed 75% to 100% of the maxillary anterior teeth and the interproximal gingiva only, and a low smile displayed less than 75% of the anterior teeth.[29]
- Upper lip curvature. A point was placed on each corner of the mouth, and another was placed on the center of the lower border of the upper lip (Fig 2). If the two points at the corners of the mouth were higher than the point at the center of the lower border of the upper lip, the upper lip curvature was categorized as upward. If these three points were on a straight line, it was categorized as straight; if the

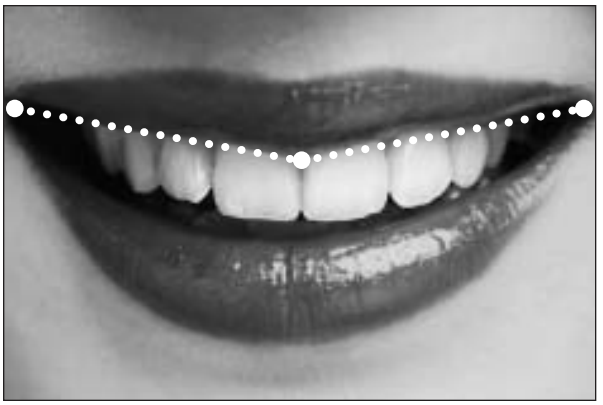

**Fig 2** A point was placed on each corner of the mouth and a third point on the center of the lower border of the upper lip to determine the upper lip curvature.

**Fig 3** Two lines were drawn on the photograph—one connecting the incisal edges of the maxillary incisors and the cusp tips of the maxillary canines and the other through the upper border of the lower lip—to show the parallelism of the maxillary anterior incisal curve with the lower lip.

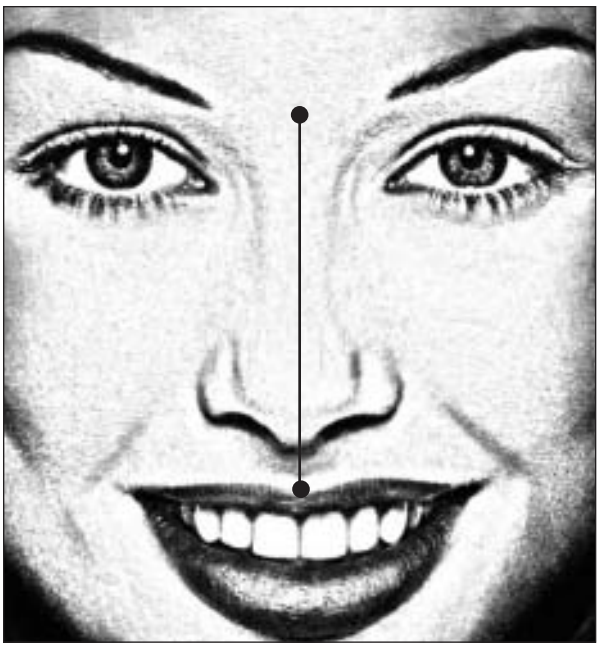

**Fig 4** The facial midline was located by drawing a line connecting a point between the eyebrows and the base of the philtrum in the center of the upper lip.

two points at the corners of the mouth were lower than the point at center of the lower border of the upper lip, the upper lip curvature was categorized as being downward.[29]

- Parallelism of the maxillary anterior incisal curve with the lower lip (smile arc). Two lines were drawn on the photographs—one connecting the incisal edges of the maxillary incisors and cusp tips of the maxillary canines; the other, through the upper border of the lower lip (Fig 3). The smile arc was considered parallel when the two lines were parallel to each other and considered straight when the incisal edges of the maxillary anterior teeth were in a straight line. A reverse smile arc meant that the line drawn connecting the incisal edges of the maxillary anterior teeth curved in reverse to the line drawn though the upper border of the lower lip.[29]
- Relationship between the maxillary anterior teeth and the lower lip. The lower lip either slightly covered, touched, or did not touch the incisal edge of the maxillary anterior teeth.[29]
- Number of maxillary teeth displayed in the smile. The smile displayed teeth up to either the first premolar, second premolar, or first molar.
- Presence of diastema between the maxillary central incisors.
- Midline assessment. The presence of a discrepancy between the dental and facial midlines was evaluated. The facial midline was located by drawing a line connecting two anatomical landmarks: the point between the eyebrows and the base of the philtrum in the center of upper lip (Fig 4).[33]
- Golden proportion existence assessment. The perceived mesiodistal width (the widest distance between the mesial and distal aspects of the tooth as viewed from the front) of each tooth was measured using the Digimizer software by drawing two parallel lines at the mesial and distal aspects of each tooth (Fig 5). The zoom function of the software was used to locate the mesial and distal contour of the anterior teeth precisely. On each photograph, the width of the lateral incisor was not measured in millimeters; instead, it was considered as a

measuring unit. The widths of the maxillary central incisors and canines were measured using the unit established by the width of the lateral incisor. According to the golden proportion theory, if the width of the lateral incisor is 1 unit, then the width of the central incisor should be 1.618 of this unit, and the canine should be 0.618 of this unit.[19]

After the assessment of the sample using the Digimizer software, the data were collected and analyzed using SPSS 17.0 (SPSS).

## Results

### *Upper Lip Position*

The analysis revealed that the majority of the sample, 40 subjects (80%), was classified as having an average upper lip position, and 10 subjects (20%) had a high upper lip position; none of the subjects had a low upper lip position (Fig 6a).

### *Upper Lip Curvature*

Thirty-one subjects (62%) showed upward curvature, 18 subjects (36%) showed straight, and only 1 subject (2%) had a downward curvature of the upper lip (Fig 6b).

### *Parallelism of the Maxillary Anterior Incisal Curve with the Lower Lip*

Most of the subjects (n = 39, 78%), had an anterior incisal curve that was parallel with the lower lip, and 11 (22%) showed a straight rather than curved line. None of the subjects showed a reverse curvature in relation to the lower lip (Fig 6c).

### *Relationship Between the Maxillary Anterior Teeth and Lower Lip*

The data showed 21 subjects (42%) whose maxillary anterior teeth did not touch the lower lip, 17 subjects (34%) whose did, and 12 subjects (24%) who had the incisal portions of their maxillary anterior teeth covered by the lower lip (Fig 6d).

### *Number of Teeth Displayed in the Smile*

Only 4 subjects (8%) displayed the six anterior teeth and first premolars, 30 subjects (60%) displayed the six anterior teeth and both premolars, and only 16 subjects (32%) displayed the six anterior teeth, both premolars, and the first molars (Fig 6e).

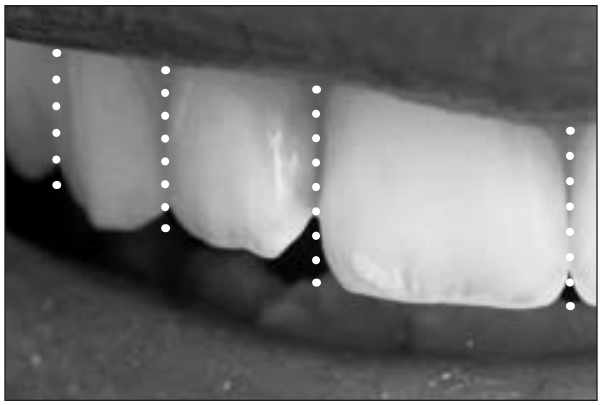

**Fig 5** Zooming allowed the precise location of the mesial and distal contours of the anterior teeth to determine presence of the golden proportion.

### *Dental Midline in Relation to the Facial Midline*

Thirty-two subjects (64%) had dental midlines that coincided with the facial midline, while 18 subjects (36%) showed a midline shift (Fig 6f).

According to the definition of the golden proportion, none of the sample subjects' smiles showed widths of the anterior teeth to be in golden proportion to each other, as seen from the front. Also, diastema was not detected between the maxillary central incisors in any subject.

## Discussion

Several criteria for esthetic treatment planning have been proposed in the literature. These criteria are crucial for facilitating the work of the dentist and dental laboratory technician. Consideration of lay people's perceptions of esthetics and beauty can be a valuable tool in improving the esthetic value of restorations. The media has an important impact on the awareness of lay people regarding beauty standards. Such a study could help in identifying what features people consider beautiful in an esthetic smile.

The use of the Internet in collecting the photographs of the sample was done because it is a cost- and time-effective method. However, there were some complications with this method, as expected. The standardization of the pictures was found to be difficult in regard to head position and lighting effects. Also, the photographs needed to be large enough to detect the details of the smile elements for performing the analysis. Combining these factors led to difficulties in collecting the photographs and limited the sample size.

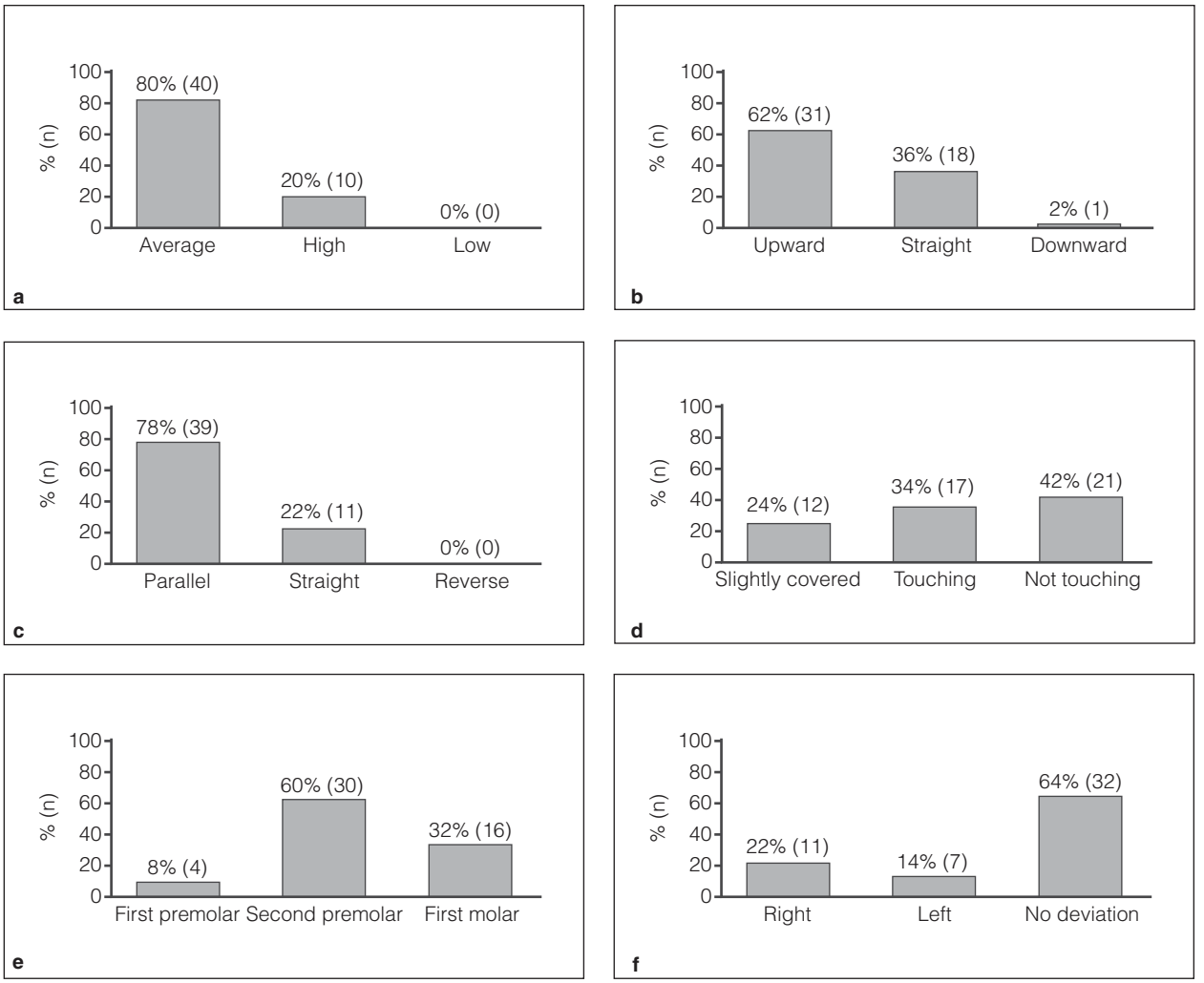


**Fig 6** Results of the photograph analysis for **(a)** upper lip position, **(b)** upper lip curvature, **(c)** parallelism of the maxillary anterior incisal curve with the lower lip, **(d)** relationship between the maxillary anterior teeth and lower lip, **(e)** number of teeth displayed in the smile, and **(f)** dental midline in relation to the facial midline.

Regarding the age and sex of the voters, Carlsson et al,[31] in their international multicentered comparison of dental esthetics using computer-altered images on a printed questionnaire, found that neither age nor sex affected the responses significantly. Past dental treatment was not considered because the aim of this study was to evaluate what lay people described as the best or beautiful smiles, regardless of whether they were natural or modified by dental treatment.

Dong et al[29] reported that an attractive smile had the overall cervicoincisal length of the maxillary anterior teeth shown between the upper and lower lips, an upward curved or straight smile with a parallel smile arc to the lower lip, and displayed up to the first molar. The current study supported these findings, except for teeth displayed in the smile, where the majority of the subjects showed up to the second premolar.

The presence of a black triangle was not one of the criteria evaluated in this study because not all photographs evaluated showed the interproximal area completely. However, none of the photographs evaluated that showed the full interproximal area had black triangles.

In the study by Carlsson et al,[31] it was found that the presence of diastema between the maxillary central incisors was unacceptable to clinicians, dental technicians, and nondental persons. Also, Rosenstiel and Rashid[30] reported that over 90% of respondents preferred images without diastema. The results of the existing study support those findings, since none of the sample showed the presence of diastema between their maxillary central incisors.

For the dental midline, more than one third of the sample showed a dental midline deviated from the

facial midline, with a slightly higher percentage deviating to the right than the left. This result was not expected, but it might be explained by the findings of Kokich et al,[14] who found that lay people were not able to detect deviations up to 4 mm. A slight deviation between the right and left side may be acceptable by lay people, but such a comparison was not made in this study, which may be considered a limitation. It would be difficult to do such a comparison, but having those results may add more value to the final conclusion of this study.

Whenever possible, the midline between the maxillary central incisors should coincide with the facial midline. In cases in which this is not possible, the midline between the central incisors should be parallel to the facial midline.[38–40]

According to Preston,[22] the golden proportion rarely exists in natural teeth, which was determined after measuring 58 computer-generated images of dental casts with an image measurement program. Also, Gillen et al[24] found that the golden proportion was rarely seen after examining 58 subjects. Their measurements were made directly on casts rather than frontal images. Mashid et al[25] conducted a study with 157 dental students (75 females, 82 males) that were selected as having an esthetic smile. They found that the golden proportion was not found to exist between perceived maxillary widths. The results of the current study support the absence of golden proportion in the evaluated smiles. However, certain subjects, including those with rotation, overlapping, and other malalignments, were not excluded, which could have a negative effect on the relative proportion of each anterior tooth, as seen from the frontal view.

### *Clinical Significance*

Whenever possible, clinicians should design esthetic restorations to show the entire cervicoincisal length of the maxillary anterior teeth with only the interdental papillae, and the smile line should be parallel with the lower lip curvature. The maxillary first molar should be considered as part of the esthetic zone for many subjects when any type of restoration is planned.

In smile design, the dental midline should coincide with the facial midline, or they should at least be parallel to each other to avoid canting—a major design flaw in any natural or restored dentition. But a slight deviation to the right or left is still acceptable. Harmony between dentofacial characteristics should be emphasized over the application of the golden proportion, since esthetics in dentistry may not be only mathematically justified.

## Conclusion

Female celebrities voted to have the best smile presented most of the esthetic criteria for a good smile with slight variation, except for the golden proportion. The opinions and perceptions of lay people regarding beauty must be studied and evaluated to improve the quality of treatment provided to dental patients.

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*Literature Abstract*

**Implant treatment in patients with osteoporosis**

Osteoporosis is a common skeletal disease characterized by alteration of the bony microstructure, bone loss, and reduced bone strength. Such reduced bone strength predisposes people to an increased risk of fractures. It has been hypothesized that osteoporosis affects the jaws in the same way as other bone in the body, and has been considered a risk factor for dental implant placement. Experimental animal studies have shown that the alteration in trabecular bone does produce a reduction in the bone-implant contact. However, histologic analysis in humans has demonstrated that there was no difference between patients with and without osteoporosis regarding the percentages of bone-implant contact. Studies on implants with subjects with osteoporosis have shown similar success rates to those obtained with healthy subjects. The use of bisphosphonates (BPs), a group of drugs used to treat various bone diseases including osteoporosis, has been linked to a complication known as osteonecrosis of the jaw (ONJ). This consists of the appearance of foci of bone necrosis with exposure of the jaw bone and can slow down the healing process. Several reviews have demonstrated that dentoalveolar intervention may be responsible for the development of ONJ in patients treated with BPs. The cases are mostly for the use of intravenous BPs for the treatment of multiple myeloma and breast or prostate cancer. A small percentage of cases were found in patients seeking treatment for osteoporosis. Some of the systemic risk factors for the development of ONJ include the type of BP used, dosage/administration time, concomitant medications, and systemic diseases. Local risk factors may include oral surgery, trauma of the mucosa, periodontal disease, and poor dental hygiene. Despite all the risk factors, the success rate of implants in patients treated with oral BPs is comparable to patients not treated with BPs. Implant placement and osseointegration during the first 3 years of treatment with oral BPs can be conducted in a safe manner; patients treated for more than 3 years have a higher risk of ONJ in cases of surgical intervention. However, most cases of ONJ associated with oral BP consumption, according to the literature, are found in patients treated for longer than 10 years. As preventive measures, some recommend the use of antibiotic prophylaxis and stopping treatment with oral BPs 2 to 3 months before intervention. Although the risk of ONJ in subjects treated with BP is very low, it is recommended that patients should be informed of this specific point when consenting to treatment.

**Mellado-Valero A, Ferrer-García JC, Calvo-Catalá J, Labaig-Rueda C.** *Med Oral Patol Oral Cir Bucal* 2010;15:e52–57. **References:** 20.
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