

REVIEW ARTICLE



## Smile analysis: A review Part II

Suchita Madhukar Tervade (Daokar), Gauri Agrawal

Department of Orthodontics, CSMSS Dental College, Aurangabad, Maharashtra, India

### Correspondence

Dr. Suchita Tervade (Daokar), Plot No. 1, Bharatnagar Housing Society, Jyotinagar, Aurangabad, Maharashtra, India. Phone: +91-9822523556, E-mail: suchitadaokar@gmail.com

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### Abstract

Smile design is the important aesthetic goal of every clinician. As in today's era smile is more important than ideal occlusion. But it's a multi-factorial process. There is no universal "ideal" smile. Smile analysis is first based on soft tissue repose, how the lips animate on smile, gingival display, crown length, and other attributes of the smile. The second is the facial change throughout a patient's lifetime. Clinician should rank these smile attributes in order of their importance in creating a balanced smile. There are various methods of smile analysis. Developing a "standard of normalcy" for smiles is important as it would give guidelines for orthodontist and clinicians to have better treatment results. This article deals with all the different process of smile designing and lays norms for a beautiful smile.

**Keywords:** Balanced smile, smile analysis, smile design

### Smile Design

Smile design is the next step in giving you a new, more radiant smile. Smile design is a multi-factorial process, with clinical success determined by an understanding of the patient's soft-tissue, treatment limitations and the extent to which orthodontics or multidisciplinary treatment can satisfy the patient's and orthodontist's esthetic goals.

Janzen emphasized that a well-balanced smile is the utmost treatment objective. It must be understood that there is no universal "ideal" smile. The dentist must work with two dynamics. The first is that of soft tissue repose and animation assessed at the patient's examination and includes how the lips animate on smile, gingival display, crown length, and other attributes of the smile. The second is the facial change throughout a patient's lifetime - the impact of skeletal and soft tissue maturational and aging characteristics.

The clinician should rank these smile attributes in order of their importance in creating a balanced smile. The final problem list will help the orthodontist to assess the viability of different treatment options and select the appropriate mechanotherapy for optimal smile design.

### Methods of Smile Analysis

#### Diagram of facial aesthetic references (DFAR)<sup>[1]</sup>

This method was given by Carlos Alexandre Câmara.

The diagram consists of six frames that surround the maxillary

incisors and canines. DFAR is evaluated at a 90° view from the frontal plane.

The objective of this method was to give an exact idea of the positioning and ratios between teeth in the frontal plane as well as their relationship with the gum and lips. DFAR will have four lines, formed by the following structures.

- Cervical line - gingival apexes
- Papillary line - papillary tips
- Contact points line - contact points
- Incisal line - incisal edges.

#### *Cervical line*

Line formed from the union of the apexes of the canines, maxillary lateral and central incisors is the cervical line. The apex in maxillary teeth is usually located distal to the long axis of the tooth. But in maxillary lateral incisors, the gingival limit may be centered on the long axis.

Because the apexes of the maxillary canines are higher than the lateral incisors and about the same level as the central incisors, the cervical line attains a convex aspect in relation to the occlusal plane. That would be the ideal form of the cervical line.

The line becomes plain when the lateral incisors are positioned more apical, at the same height as the canines and central incisors. Line becomes concave when the gingival contour of the canines is below the lateral incisor and is the least pleasing among the three possibilities.

### Incisal line

The incisal line follows the edges of anterior maxillary teeth. The ideal is that in young patients in the frontal plane the incisal edges of the central incisors be below the edges of the lateral incisors and canines. So that incisal line resembles the outline of a “deep plate.”

When the incisal edge of the central incisors is no longer below the lateral incisors, the outline will become concave in relation to the frontal occlusal plane, giving an aged and anti-aesthetic appearance. Also known as “shallow plate,” “inverted plate” “inverted smile.” Other frequently used terms to describe the incisal line are the “smile arch,” “incisal curvature,” and “seagull wing.”

### Contact points line

Whenever there is no discrepancy between the sizes, shapes, and angles of anterior teeth line that unites contact points will be parallel to the incisal line. The contact between anterior maxillary teeth is done in a descending fashion, starting from the canine. For practical purposes, we consider the most apical site as the reference for the contact point.

Whenever a contact takes place over an area instead of in a single point.

### Papillary line

Ideal line would be parallel to the line formed by the contact points. The papillary line is formed by the tips of the gingival papillae located between the canines and lateral incisors, and between the maxillary lateral incisors and central incisors.

### Connector band

Connecting spaces are larger, broader, and contact points are small areas in which teeth touch. The best aesthetic relationship of anterior teeth is the 50-40-30 rule for the connecting space.

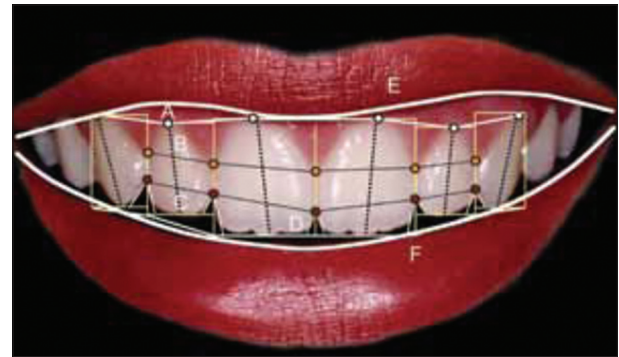
This rule establishes that the connecting space between the central incisors should be 50% of the size of those teeth, between the central and lateral incisor should be 40% of the length of the central incisors, whereas between the lateral incisor and the canine is 30% of length of lateral incisor. Small changes in this band can make a difference in dental aesthetics. The Figure of this band resembles the shape of a “hang glider.”

### Lip analysis

In addition to the four dento-gingival lines, there are also upper and lower lip lines. Lip separation can be called “labial unveiling.” Evaluation of the relationship between the white (teeth) and pink (gums) aesthetics, and their relationship with the lips is possible because of labial unveiling [Figure 1].

## Using Visual Analog Scale<sup>[2]</sup>

In the method given by Akyalcina *et al.* using the numeric version of the visual analog scale digital smile photographs of the subjects taken in a standardized manner were rated.



**Figure 1:** The six horizontal smile lines. Cervical line (a); Papillary line (b); contact points line (c); incisal line (d); upper lip line (e); lower lip line (f)<sup>[1]</sup>

Three groups were formed: Unattractive, average, and attractive smiles. Eleven smile characteristics were digitally measured on the photograph. Visible incisor height/smile height ratio (%), smile arc (consonant, non-consonant) smile arc discrepancy/smile frame (%), gummy smile (present, not present), gingival display/visible dentition display (%), gingival display (right)/visible dentition display (%), gingival display (left)/visible dentition display (%), visible dentition width/inter-commissure width (%) dentition during smiling/distance between the left cheilion to right cheilion during smiling visible dentition display/smile frame (%) right buccal space/visible dentition display (%).

### Left buccal space/visible dentition display (%)

According to ABO standards, a harmonious smile arch relationship and less gingival display during a smile are significantly associated with smile attractiveness in successfully treated patient.

### Digital Vediography<sup>[3]</sup>

Van der Geld *et al.* suggested following method of smile analysis. The dynamics smile was captured, and the selected video frames were measured with the help of the digora program. For each record, the measurement program was recalibrated with the filmed reference standard. Displays of teeth and gingivae were measured on the smiling and speech records. In the maxilla and mandible, a central and a lateral incisor, a canine, a first and a second premolar, and a first molar were measured.

The most incisal point of each tooth and the lip edge were marked with a horizontal line, parallel to the pupil line. The vertical distance between these lines was measured. If a tooth was not visible, tooth display was denoted as zero. To test the suitability of the method for general use, the 4 situations (full dentition, spontaneous smile, posed social smile, and speech) were captured twice (selections 1 and 2), and 2 raters were included in the setup of the study design [Table 1].

**Table 1:** Design of study

Selection (video capture)	Rater 1	Rater 2	Rater 2
1	A	B	
2		C	D

Analysis of sources of error: Part 1, A versus B - evaluation of rater facet (interexaminer reliability); Part 2, B versus C - evaluation of selection facet (video captures 1 and 2); Part 3, C versus D - evaluation of replication facet (intraexaminer reliability); Part 4, A versus C, A versus D - joint evaluation of facets.

This resulted in a total of 3840 measurements (20 subjects - 4 situations - 2 selections - 2 ratings - 12 teeth). Based on this design, various sources of error could be analyzed. Four parts of the study design were defined in which 4 aspects were investigated: the error related to different raters (Part 1), different records of the same subjects (Part 2), replications with the same rater (Part 3), and combinations of different raters and records (Part 4). Part 4 addresses the measurement method in clinical settings; the other parts were included to investigate the importance of the various potential sources of error.

Application of the videographic method is used when obtaining an emotional smile is difficult, such as cleft lip and palate or disfigured patients

#### Smile analysis using digital video and computer technology<sup>[4]</sup>

Ackerman and Ackerman suggested the following technique.

The clinician can evaluate the patient's dynamic anterior tooth display and smile analysis Using digital video and computer technology. Esthetic smile design depends on multiple factors and allows the clinician to treat patients with an individualized, interdisciplinary approach.

#### Smile analysis by questionnaire<sup>[5]</sup>

Van der Geld *et al.* suggested the method in which specific questionnaire was made for Participants to judge their smile attractiveness. The questionnaire contained a spontaneous smiling photograph of the participant. Digital videographic method was used to measure objective smile-line height. Dutch personality index was used to assess personality.

Cronbach's for the smile judgment questionnaire was 77. Critical factors in self-perception of smile attractiveness are size of teeth, visibility of teeth, and upper lip position while color of teeth and gingival display were critical factors in satisfaction with smile appearance. Most esthetic smile is smiling with teeth entirely displayed and some gingival display (two to four millimeters). Smiles with disproportional gingival display were judged negatively.

The results of this research showed the psychosocial importance and the dental significance of an attractive smile.

#### Direct measurement as a biometric tool<sup>[6]</sup>

According to Singh and Sharma direct measurement also has application in research efforts and the repeatability of the social smile.

The following frontal measurements should be performed.

- Philtrum and commissure height,
- Interlabial gap,
- Incisor show at rest and smile,
- Crown height, Gingival display,
- Smile arc<sup>[7,8]</sup>

#### Conclusion

Occlusion that meets every criterion of American Board of Orthodontics for a successful treatment may not produce an esthetic smile.<sup>[9]</sup> In today's era smile of the patient is given adequate importance than ideal occlusion and pleasing profiles.<sup>[10]</sup> In order to diagnose and treat problems associated with the smile, clinical observation, photos, and video records in various dimensions are required. But, smile design depends on multiple factors and can vary among different races. Developing a "standard of normalcy" for smiles is important as it would give guidelines for orthodontist and clinicians to have better treatment results.

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