



**SMILE ANALYSIS: DENTAL COMPONENT**

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**ABSTRACT**

To evaluate, diagnose and resolve esthetic problems predictably, an organized and systematic approach is required. It is of prime importance that the final result is not dependent only on the looks alone. Our ultimate goal as clinicians is to achieve pleasing composition in the smile by creating an arrangement of various esthetic elements. This article reviews the dental component of smile designing.

**KEYWORDS:** To evaluate, diagnose To evaluate, diagnose.

**INTRODUCTION**

The search for beauty can be traced to the earliest civilizations; both the Phoenicians (app 800 BC) and Etruscians (app 900 BC) carefully carved animal tusks to simulate the shape, form and hue of natural teeth. It was not until the 18th century that dentistry was recognized as a separate discipline and its various branches were established. Pierre Fauchard (1678-1761) of France, the leader of the movement, together with several colleagues modernized and promoted dentistry and also advocated esthetic practices.<sup>[1]</sup> Harmonizing an esthetic smile requires a perfect integration of facial composition and dental composition. The facial composition includes the hard and soft tissues of the face. The dental composition relates more specifically to teeth. A smile design should always include the evaluation and analysis of both facial and dental composition.<sup>[2]</sup> This article focuses on the dental composition involved in smile design.

**Dental components of smile designing**

It includes dental midline, tooth types, color, incisal lengths, illusionary perception, tooth dimensions.

**Dental midline**

In most individuals (approximately 70%) a coincidence is found between the facial midline and the maxillary interincisal line. However, coincidence between the maxillary and mandibular interincisal lines is much less common, occurring in around 25% of the population.

A slight misalignment between the maxillary and mandibular interincisal lines is seldom perceived by patients and therefore does not represent an obstacle in achieving ideal esthetics; in fact, it can give the smile an interesting natural appearance.<sup>[3]</sup> However, as pointed out by Kokich and co-workers, an axial variation, even if

slight, is immediately noticeable by any observer, thus giving a displeasing esthetic appearance. The maximum allowed discrepancy can be 2 mm and sometimes greater than 2 mm discrepancy is esthetically acceptable so long as the dental midline is perpendicular to the interpupillary line. Various anatomical landmarks such as midline of the nose, forehead, chin, philtrum, interpupillary plane can be used as guides to the midline assessment. The philtrum of the lip is one of the most accurate of these anatomical guide posts. It is always in the center of the face except in surgical, accident or cleft cases.<sup>[4]</sup>

**Tooth type**

Tooth form, which can be categorized into three fundamental types: basically tapering, basically square, and basically ovoid. Only in theory can we presuppose the existence of a typically female tooth and a purely male one, because, as several authors have demonstrated, there does not seem to be such a marked correlation between sex and tooth form. The logical reference for recreating correct tooth type lies in the natural teeth adjacent to those being restored or, in their absence, those in the opposing arch.

**Color**

When observing the natural dentition, a significant difference in color can be seen between the teeth in both arches. The maxillary central incisors are the lightest teeth in the mouth and therefore dominate the tooth composition not only because of their size, but also because of their brightness. In most individuals, the lateral incisors appear to be the same hue as the central incisors but slightly less intense, therefore looking less bright. The canines, both maxillary and mandibular, often show a much more intense chroma, sometimes

appearing much darker than the teeth adjacent to them. Further back, it is easily seen that the premolars are of a similar color to the lateral incisors, therefore distinguishing themselves from the canines. The color that our eyes are able to perceive is the result of light refraction and reflection phenomena on the tooth surface, which give the tooth its color depending on the thickness of the enamel and the level of saturation of the dentin. In the cervical area, the reduced thickness of the enamel makes the color of the dentin more evident, producing greater chromatic saturation. Thicker enamel, on the other hand, produces a marked translucency in the incisal third, where phenomena of fluorescence and opalescence combine with those of total light reflection caused by the inclination of the incisal edge.

### Incisal lengths

Maxillary incisal edge position is the most important determinant in smile creation because once set, it serves as a reference point to decide the proper tooth proportion and gingival levels. The parameters used to help establish the maxillary incisal edge position are:

1. degree of tooth display,
2. phonetics and
3. patient input

### Degree of tooth display

When the mouth is relaxed and slightly open, 3.5 mm of the incisal third of the maxillary central incisor should be visible in a young individual. As age increases, the decline in the muscle tonus results in less tooth display.

### Phonetics

Phonetics is a major determinant of the tooth length. In order to determine proper lip, tongue and incisal support and tooth position, it is necessary that the patient sits either erect or stands during the phonetic exercises.<sup>[5,6]</sup> The various phonetics used are as follows:

- M sound: After pronunciation, the lips return to their normal rest position, allowing evaluation of the amount of the tooth display in rest position.
- E sound: The maxillary incisal edge position should be positioned halfway between the upper and lower lip during the "E" sound.
- F and V sounds: Fricative sounds are produced by the interaction of the maxillary incisal edge with the inner edge of the lower lips' vermilion border. Thus, fricative sounds help to determine the labio-lingual position and length of the maxillary teeth.
- S sound: During pronunciation, the mandibular central incisors are positioned 1 mm behind and 1 mm below the maxillary incisal edge.

Correct incisal edge position is crucial because it is related to the pitch of the anterior teeth, labial contours, lip support, anterior guidance, lingual contours and tooth display. The pitch of each anterior tooth is determined by the combination of correct lip support and the lingual labial position of the incisal edge. This location influences anterior guidance and the labial and lingual

contours. In short, all these factors play a dominant role in both esthetics and function.

### Illusory Perception

#### Illusion of dimensional variation through color change

Of two teeth of the same hue, the more buccally positioned tooth will appear lighter; if the two teeth are of different sizes (e.g., maxillary central incisor versus maxillary lateral incisor), the larger of the two will appear considerably brighter because of its greater surface area.

A high value will allow the clinician to give the restorations a marked prominence, emphasizing more those teeth that, because of their natural form and size, must be made more visible. Conversely, a low value will make them, of necessity, less prominent.

#### Illusion of dimensional variation through surface and contour modification

This result can be achieved by working on both the transition line angles and on the buccal surface, as well as on the horizontal and vertical lines and ridges found on the surfaces of all the teeth.

### Modifying the transition line angles

The light that directly strikes the buccal surface between the line angles is reflected, while the mesial and distal areas outside these lines deflect it and are therefore less noticeable. By modifying the orientation and the arrangement of the transition lines, the area of light reflection can therefore be increased or decreased. Moving these lines, along with producing consequent changes to the size of the light reflection areas, produces the impression of size variation in the eye of the observer, although the tooth perimeter has not actually been touched at all.

### Accentuating horizontal and vertical lines and ridges

The tooth surface has a strange topography made up of macrot textures and micro textures. These surface features tend to disappear over time, reducing the optical illusions associated with the way light is reflected. Re-establishing the horizontal lines and ridges will make the tooth look wider and shorter, while accentuating the vertical lines and ridges will contribute to creating the illusion of a longer and narrower tooth.

### Modifying the buccal contour

Flattening the buccal contour allows the creation of wider areas of reflection that give a sense of increased tooth width and length. Conversely, an enhanced curvature, achieved by increasing the areas of deflection, will create a greater area of shadow in the mesial and the distal areas, as well as in the cervical and incisal thirds. This will increase the sense of depth and produce an impression of reduced tooth length and width.

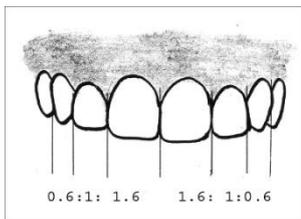
### Tooth Dimensions

Central dominance dictates that the centrals must be the dominant teeth in the smile and they must display pleasing proportions. The shape and location of the centrals influences or determines the appearance and placement of the laterals and canines.

The important point to be noted is that it is not the actual size, but instead the perceived size, that these proportions are based on when viewed from the facial aspect.

### Golden proportion (Lombardi)

When viewed from the facial, the width of each anterior tooth is 60% of the width of the adjacent tooth (mathematical ratio being 1.6:1:0.6) [Figure 1]. It is difficult to apply as patients have different arch form, lip anatomy and facial proportions. Strict adherence to golden proportion calculations limits creativity and this may lead to cosmetic failure.<sup>[7]</sup>



**Figure 1: Golden proportion based on apparent width from the frontal.**

It is used as a guide rather than a rigid mathematical formula. Most authors recommend creating harmony and balance by eye via proper adjustment and evaluation of provisionals rather than any formula.<sup>[8]</sup> The factors guiding individual tooth dimensions are as follows.

**Maxillary central incisor:** Centrals are the focal point of an esthetic smile and create the central dominance as described earlier. Approximate length of the central should be 10-11 mm and the width is calculated accordingly so that the ratio falls between 75 and 80%.

**Maxillary lateral incisor:** These are the playful part of the smile. They provide individuality, are never symmetrical and influence gender characterization.

**Maxillary canine:** They play a critical point in creating a pleasing smile as they are

- The junction between the anterior and posterior dental segments; hence, only the mesial half of the canine is visible from the frontal view when the patient smiles;
- Support the frontal muscles - the size and characteristic of the buccal corridor is determined by the size, shape and position of the canine and
- Canine depicts the personality characterization (masculine: vigorous and aggressive; feminine: delicate and soft).

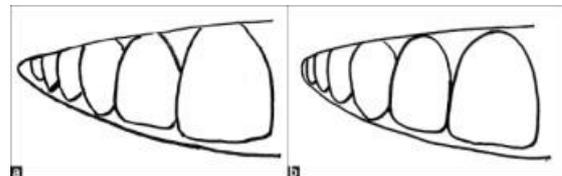
Also, we have to keep in mind that

- Central incisor is wider than the lateral by 2-3 mm and canine by 1-1.5 mm;
- Canine is wider than the lateral by 1-1.5 mm and
- Canine and central are longer than lateral by 1-1.5 mm.

**Maxillary bicuspids:** They play a very important role for arch design. They should fill the buccal corridor.<sup>[5]</sup>

Buccal corridor refers to dark space (negative space) visible during smile formation between the corners of the mouth and the buccal surfaces of the maxillary teeth (figure 2). Its appearance is influenced by

1. the width of the smile and the maxillary arch,
2. the tone of the facial muscles,
3. the positioning of the labial surface of the upper premolars,
4. the prominence of the canines particularly at the distal facial line angle and
5. any discrepancy between the value of the premolars and the six anterior teeth.



**Figure 2.**

Arch form has a direct influence on the buccal corridor.<sup>[9]</sup> The ideal arch is broad and conforms to a U shape. A narrow arch is generally unattractive. The unattractive, negative space should be kept to a minimum. This problem can be solved or minimized by restoring the premolars. The buccal corridor should not be completely eliminated because a hint of negative space imparts to the smile a suggestion of depth.

### Zenith points

Zenith points are the most apical position of the cervical tooth margin where the gingiva is most scalloped. It is located slightly distal to the vertical line drawn down the center of the tooth. The lateral is an exception as its zenith point may be centrally located.<sup>[10]</sup> Establishing the proper location of zenith points is a critical step in alteration of mesial and distal dimensions,

1. closure of diastema: move the zenith points to
2. provide the illusion of bodily movement and reduce exaggerated triangular form and
3. correction of tooth angulation.

### Incisal embrasures

The incisal embrasures should display a natural, progressive increase in size or depth from the central to the canine. This is a function of the anatomy of these teeth and as a result, the contact point moves apically as we proceed from central to canine. The contact points in their apical progression should mimic the smile

line.<sup>[6]</sup> Failure to provide adequate depth and variation to the incisal embrasure will,

1. make the teeth appear too uniform and
2. make the contact areas too long and impart to the dentition a box like appearance. The individuality of the incisors will be lost if their incisal embrasures are not properly developed.

Also, if the incisal embrasures are too deep, it will tend to make the teeth look unnaturally pointed. As a rule, a tooth distal to incisal corner is more rounded than its mesioincisal corner.

## CONCLUSION

The crafting of an ideal smile requires analysis and evaluation of the face, lips, gingival tissues and teeth and an appreciation of how they look collectively. Such an ideal smile depends on the symmetry and balance of facial and dental features. The color, shape and position of teeth are all part of the equation. Recognizing that form follows function and that the anterior teeth serves vital role in the oral health of the patient is paramount. Using a comprehensive approach to diagnosing and treatment planning of esthetic cases can help achieve the smile that best enhances the overall facial appearance of the patient and provides the additional benefit of enhanced oral health.

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