SMILE PERCEPTION IN DENTISTRY

Abdul-Haq A. Suliman¹ and Rawhi H Al-Qaisi²

ABSTRACT

Perception aesthetics is a philosophy which expresses an understanding of how smiles and consequently how results of aesthetic dentistry are perceived. It further studies what influences the perception of size, color and shape of teeth. Beyond rectifying problems for individual teeth, however, patients are often concerned with the collective appearance of the alignment of their teeth. Through cosmetic bonding and laminate veneers, the dentist can control tooth shape by adding or taking away from the tooth, crown, or laminate. The first Golden Proportion relationship, and the most important to be discovered, is a simple tooth to tooth Golden Proportion used for the determination of the tooth size. From the facial perspective, tooth proportions are guided by the Golden Proportion. This article on aesthetic dentistry explores the principles of smile design, such as centre-line, symmetry, smile line, incisal plane, gingival aesthetics, proportion and axial alignment…etc.

INTRODUCTION

Staying healthy and having good appearance is of great emphasis these days. Never before has there been such attention on facial make over. A centerpiece of this revitalization is a pleasing smile. Due to television shows and print media, there is a good marketplace for this matter. We as dental professionals are keenly aware of this major trend and have positioned ourselves accordingly. Along with an understanding of the science and the artistry of this regime, dentists feel that this is indeed a team effort. The goal in attempting this re-creation is not only an admired look, but also the ability to harmonize with hard and soft tissues. As public awareness of esthetic dental treatment increases, patients seek to enhance and resolve several common concerns. The nature and scope of priorities often includes the color and contour of individual teeth. Beyond rectifying problems for individual teeth, however, patients are often concerned with the collective appearance of the alignment of their teeth. Although tooth arrangement problems are often best addressed with orthodontic procedures, restorative dentists are frequently asked to create the illusion of improved tooth alignment with restorative treatment alone. As our interaction with cosmetic dentistry has increased, we have become very aware of what standards guide the dentist who strives for a pleasing smile. Through cosmetic bonding and laminate veneers, the dentist can
control tooth shape by adding or taking away from the
tooth, crown, or laminate. As orthodontists, we have
generally limited our tooth reshaping efforts to incisal
edge “dressing.” In today’s health and image-conscious
society, cosmetic or aesthetic dentistry is becoming
much more of a ‘must have.’ This article on aesthetic
dentistry explores the principles of smile design, such as
centre-line, symmetry, smile line, incisal plane, gingival
aesthetics, proportion and axial alignment…etc.

**Principles of dental esthetics**

Dental esthetics is a rapidly changing field, but like all fields that involve esthetic concerns there are some principles considered to be timeless. One such concept is that of the Golden Ratio (1:1.618). The first Golden Proportion relationship, and the most important to be discovered, is a simple tooth to tooth Golden Proportion used for the determination of the tooth size. The concept of the “golden proportion” as applied to a smile indicates that the apparent width (which is visible from a straight view of the patient from the midline) of each tooth on one side of the midline should be approximately 63% of the width of the tooth mesial to it. As seen in the Figure 1, the lateral incisor is ideally 60-63% of the width of the central incisor. The canine should be 60-63% of the width of the lateral incisor (1,2).

From the facial perspective, tooth proportions are guided by the Golden Proportion(3). These guidelines state that if the lateral incisor has a width value of 1, then the central incisor’s is 63% more than the lateral incisor (1.618) and the canine is 63% less than the lateral (0.618) accordingly (Fig. 1). Because this relationship is observed throughout nature, it creates a naturally harmonious appearance for the ideal smile.

Simply restoring two individual teeth in a proportional fashion of length to width to close a diastema does not mean that the final result will be esthetic if altering the golden proportion disrupts the symmetry of the entire smile (3). It should be noted that these measurements are taken on a photograph and not three dimensionally as would be done on the face (1).

**Considerations for creating an esthetic smile**

The literature on esthetic dentistry contains excellent definitions of desirable characteristics of tooth shape and proportions, gingival esthetic characteristics, and what constitutes esthetic teeth and gingival relationships. In order to achieve optimal esthetic results, the dentist must be familiar with these characteristics. This must include the proper position of the incisal edges, incisal plane, midline position, the length and width of the teeth, tissue height, axial inclination, contact points, connectors, embrasure form, line angles, and surface texture(4-6).

Restorative dentists must evaluate cases on an individual basis to discern how smile design principles can be best applied to create beautiful, durable, and functional results. Whereas each esthetic principle can be recognized and assessed individually, it is the collective influence of all the esthetic elements combined that creates the ultimate impact of a smile(6). Smile form sets standards for the relationship of the teeth to the facial form, lip shape and mouth form. The following is a review of some of these features:
Symmetry and Mid-line

An attractive smile will tend to display a significant degree of symmetry. Smile esthetics looks at how the teeth fit within the frame of the lips, relate to each other and harmonize with the face with visual effect of symmetry across the midline of the body. Maximum esthetics often hinges around symmetry and symmetry starts with the establishment of the correct centre line(7). Miller et al found that the centre line of the upper central incisors coincided with the median line of the face only 70% of the time. A centre line through philtrum should ideally pass through the centre of two central incisors if not in the median line of the face is acceptable if it is not too exaggerated and gives an illusion of a natural dentition. Maxillary and mandibular midlines also fail to coincide in 75% of cases. This means that the lower midline should not be used as a reference for the placement of the maxillary midline (9). The interpupillary line and the smile line of the incisal edges of the teeth create an overall sense of harmony with the centre line perpendicular to these two lines (Fig. 2). Maxillary central incisors must be kept as symmetrical as possible within reasonable limits (10), but maxillary lateral incisors, however, display more variations in shape than centrals and are often bilaterally asymmetrical in the same mouth. As stated in the American academy of Cosmetic Dentistry (AACD) Guide, the term “midline” or “center-line” refers to the vertical contact interface between two maxillary centrals(11). As dictated by the Human biologic Model (HBM), the midline should be perpendicular to the incisal plane or interpupillary line and should be parallel to the midline centered on the face. Asymmetry in facial structure can make this difficult (6).

The dental midline is the focal point of the smile and must be carefully determined when creating esthetic restorations such as anterior veneers. Teeth on either side of the midline should be balanced or symmetrical. Perfect symmetry is rare and can be artificial in appearance. The goal should be to create relative radiating symmetry where the left side is a relatively close mirror image to the right side. Patients may demand artificial perfection in symmetry and mirror image. It is important to communicate with patients regarding esthetic expectations and the unnatural appearance of restorations created without any slight variation.

Width and Height

Tooth size is relative to face size and other teeth. Visual inspection and a rule of individual teeth being one-sixteenth the dimensions of the face is a good starting point (6). The visual dominance of a tooth in the smile is determined by its relative proportions of width and height. The comparison of the width of teeth within an arch represents a regressive series. Because the dental arch is curved, less of each tooth is revealed toward the distal of the arch when viewed from the frontal aspect. When a smaller proportion of a tooth is visible, it appears smaller and less important in the display. Since maxillary central incisors are positioned in the front of the arch, they should appear to be the widest and most predominant teeth when viewed from the frontal aspect (12).

Lombardi pointed to the importance of the proportion between width and height in the dimensions of individual teeth and between the respective sizes of anterior teeth. The ideal maxillary central incisor (Fig. 3) should be approximately 80% width compared with height (13), but it has been reported to vary between 66% and 80% (14). A higher width/height ratio means a squarer
tooth, and a lower ratio indicates a longer appearance. Many smiles exhibit disproportional ratio, so that these measurements should not be taken as an absolute rule. The ranges of height and width are important to note\(^{(15,16)}\), because the disproportionality of a tooth can then be evaluated with regard to what parameter is at fault and in need of improvement. The basic question in assessing its disproportion is whether it is too short or too wide. For example if the width of central is 8.0 mm, and its height is 8.5 mm. When compared with the range of ideals (Fig. 3), the width is within normal range, but the height is significantly short. The tooth disproportion is due to short clinical crown height (either inherent or secondary to attrition), incomplete passive eruption, or vertical gingival encroachment. The corresponding solutions to the tooth height problem are all different, including bonding or laminates to increase the length of the tooth, awaiting completion of passive eruption, or periodontal crown lengthening. Many authors point out the need for achieving proportions in the smile that harmonize with the face\(^{(3,17)}\), and the golden proportion is suggested as a guide\(^{(1,18,19)}\).

Shape and color

Subtle changes in the apparent size of teeth can be achieved by altering line angle, texture, and color. Teeth can be made to appear thinner, longer, shorter, smaller, or wider without changing the actual outline shape of a tooth. Such alterations only apply to incisor teeth, since all other teeth are only seen in profile from a straight-on view. Shape includes both smile form and individual tooth structure. Analysis of smile form may be necessary in more extensive restorative cases.

Inclinations

The axial inclination of teeth becomes more medial as the teeth are further from the apparent midline and out into the buccal corridor and should be used together with correct axial alignment to produce a beautiful smile (Figure 1). The axial alignment of the anterior tends to be more pronounced from centrals to canines and in the posterior segment responds to the phenomenon of balance of lines around a central fulcrum.

Smile line and form

The smile line is convex and approximates the curvature of the lower lip and there is tooth prominence in the buccal space (Fig. 4). The smile line also appears to be the most important factors contributing to a beautiful smile. The smile line can be defined as a hypothetical curved line along the edges of the maxillary anterior teeth that has to coincide or run parallel with the curvature of the inner border of the lower lip. Observations show that the degree of curvature of the incisal line is more pronounced for women than for men. A flat or reverse incisal line deeply affects the degree of attractiveness of the female smile.

![FIG. (3) The ideal “Width Height” ratio of central incisor.](image)
The American Academy of Cosmetic Dentistry Accreditation Guide states: “The smile line refers to an imaginary line along the incisal edges of the maxillary anterior teeth, which should mimic the curvature of the superior border of the lower lip while smiling. Another frame of reference for the smile line suggests that the centrals should appear slightly longer or, at the very least, not any shorter than the canines along the incisal plane” (11). According to the HBM, the lengths of the maxillary central incisors in a healthy and attractive human mouth are found to be approximately 12 mm for the maxillary canines, 10 mm for the mandibular central and lateral incisors, and 12 mm for the mandibular canines (22, 23). The length of the maxillary lateral incisors is somewhat shorter than that of the central incisors to allow the mandibular canines to pass freely during the incisive movements.

Establishing proper curvature of the overall incisal line of the maxillary teeth follows the lower lip lines. Central incisors are the lowest point of the curve and each tooth gets a little shorter except for the cuspids. The relation of incisal edges from tooth to tooth will vary primarily with age (19).

Position, shape and size of the arches

The position and size of one jaw in relation to the other may determine tooth placement, tooth size and factors such as space management with use of overlapping or diastemas. The shape of arches can be square tapering, tapering and ovoid. The square arch form gives a broad, straight line smile from cusp to cusp. There tends to be very little overlapping, crowding or labial tipping. The tapering arch is narrow from cusp to cusp with the centrals being quite anterior to the cuspids. A decrease in space usually means there is considerable overlapping and crowding. The square tapering arch combines both square and tapering arch characteristics. There is little crowding and overlapping of teeth. The incisors show their full labial surfaces but the cuspids tend to have more distal rotation sometimes referred to as turning the corner. The ovoid arch resembles the tapering arch form but is wider from cusp to cusp forming an arc around the ridge (24).

Gingival esthetics Tissue contours

Two concepts of cosmetic dentistry that are important to the final esthetic outcome of orthodontic patients are gingival shape and gingival contour. In cosmetic dentistry, care is taken in the assessment of the gingival architecture for the anterior teeth to have certain characteristics. Gingival shape refers to curvature of the gingival margin of the tooth, determined by the cemento-enamel junction and the osseous crest. According to the accreditation criteria for the American Academy of Cosmetic Dentistry (11), “The gingival shape of the mandibular incisors and the maxillary laterals should exhibit a symmetrical half-oval or half-circular shape. The maxillary centrals and canines should exhibit a gingival shape that is more elliptical. Thus, the gingival zenith (the most apical point of the gingival tissue) is located distal to the longitudinal axis of the maxillary centrals and canines. The gingival zenith of the maxillary laterals and mandibular incisors should coincide with their longitudinal axis.” (13, 25).

In smiling, the position of the upper lip relative to the teeth is ideally located at the gingival margin of the maxillary central incisors and appears an important factor in attractiveness (26). An excessive amount and display of gingiva can result in a “gummy” smile appearance with
teeth having a proportion close to unity (length to width ratio equal to 100 percent) or a perfect square. Surgical periodontal treatment, specifically esthetic crown lengthening, becomes imperative in these situations in order to restore the esthetic “frame work”; i.e. tooth proportion and “the golden proportion.” The design of the smile is affected by the health and contours of the gingiva. The amount of pink gingiva is a balance to the amount of white tooth display.

The shape of teeth at the gingival margin determines the gingival outline. Tissue contours are different for teeth, which are straight, rotated or tipped. Periodontal disease will also have a profound effect on tissue contours.

### Tooth structure

Tooth structure refers to overall and detailed shape of each tooth. These standards are established as averages and altered in particular instances.

1. **Long axis**

   The long axis of a tooth can have a mesial, straight, distal, lingual facial tilt. The long axis varies from normal to accommodate inadequate space, arch form or to match existing symmetry. The maxillary incisors normally have mesial labial tilt and cuspids have pronounced lingual tilt with the gingival third appearing prominent.

2. **Surface contours and surface texture**

   Surface contours can be concave, convex or straight. Surface contours are viewed as overall or small-detailed surfaces.

   The surface of teeth is textured or smooth. It determines light reflection and blending into other teeth. Placement of lines as developmental grooves or craze lines and dimples can affect perceptions of width and length and alter light reflection patterns. Concave lines that run gingival to incisal increase perception of tooth height while lines that run mesial distal alter perception of tooth width.

3. **Line angles**

   Line angles are defined as the transition from one surface to another. Altering the degree of curvature and placement of line angles can change perception of tooth width and length. Line angles closer to the midline result in a shorter incisal edge, a smaller tooth face and larger embrasures. The teeth look smaller.

4. **Contact areas**

   The elements of tooth contacts, connectors and embrasures can be of real significance in planning the treatment of the smile. Placement of contact areas is a critical aesthetic result in anterior teeth. Contact establishes embrasures and tooth size. Contacts (interdental contact points) are defined as the exact place that the teeth touch. The contact points progress apically as the teeth proceed from the midline to the posterior. Normal placement in the maxillary anterior would be the incisal third for the central incisor to central incisor, the incisal to middle third for central incisors to lateral incisors and the middle to gingival third for the lateral incisors to cuspids.

   The connector size (the apparent contact area not the actual contact area) tends to be 50% of the incisal-gingival length of the central incisor between the centrals, 40% between the central and the lateral and 30% between the lateral and the canine.

5. **Embrasure form**

   Embrasure form defines the outline of a tooth. There are gingival, incisals, lingual, and facial embrasures. The shape of embrasures alters the perception of tooth size such that large embrasures make teeth look smaller and small embrasures make teeth look larger.

   There is a progression of the size and shape of the incisal embrasures in the maxillary anterior teeth (Fig. 5) with the smallest and most symmetric between the centrals and the largest and most asymmetric between the lateral and canine.
CONCLUSION

The literature on esthetic dentistry contains excellent definitions of desirable characteristics of tooth shape and proportions, gingival esthetic characteristics, and what constitutes esthetic teeth and gingival relationships. Smile form sets standards for the relationship of the teeth to the facial form, lip shape and mouth form.

Tooth structure refers to overall and detailed shape of each tooth. The surface of teeth is textured or smooth. Concave lines that run gingival to incisal increase perception of tooth height while lines that run mesial distal alter perception of tooth width. Embrasure form defines the outline of a tooth. The shape of embrasures alters the perception of tooth size such that large embrasures make teeth look smaller and small embrasures make teeth look larger.

REFERENCES


