Review Article

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SMILE PERCEPTION - AN ART BLENDING WITH SCIENCE: A REVIEW

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ABSTRACT:

'It all begins with a smile' is a proverb which highlights the importance of smile in social outlook and quality of life. 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 centerline, symmetry, smile line, incisal plane, gingival aesthetics, proportion and axial alignment.

Keywords: Elements of smile designing, esthetic smile, smile designing, smile proportions.

INTRODUCTION:

The importance of beauty and attractiveness in today's society has been well established. Physically attractive people are perceived to be more kind, sensitive, interesting, strong, poised, modest, sociable, outgoing, exciting and responsive [1,2]. It is also believed that attractive people are more likely to obtain better jobs, have more successful marriages, and experience happier, more fulfilling lives. These societal biases begin early in life and impact a person's future for a lifetime [3]. Dentofacial attractiveness is particularly important to a person's psychosocial well being. People with a normal dental appearance are judged more socially attractive over many personal characteristics than those with malocclusions. Those with poor dental esthetics have been linked to lack of self-confidence and are thought to be disadvantaged in social, educational, and occupational settings [4,5,6].

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. Along with an understanding of the science and

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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. 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.

Esthetic Principle

Clinicians must be mindful of esthetic standards in evaluating how best to meet patient expectations. The more the elements of appearance deviate from known visual principles, the more likely patients will be disappointed with their smile. These principles are not dogmatic rules that must be applied and achieved for every patient [7]. Some patients are often disappointed with their appearance; however, they compare themselves to social and entertainment icons and perceive that they don't measure up.

Esthetic principles can be categorized in three general groups: facial esthetic principles, dental esthetic principles, and dento-facial esthetic principles [7].

FACIAL ESTHETIC PRINCIPLES comprise the overall skeletal relationships that affect the appearance of the middle and lower face. From the frontal perspective, the nasal, dental, and mental midlines ideally should coincide with the facial midline- a perpendicular line that bisects the interpupillary distance. The occlusal plane should be perpendicular to the midline and parallel to the horizon [8,9]. Attractive faces generally conform to the rule of thirds — with the upper, middle, and lower face segments each occupying approximately equal proportions of the vertical dimension of the face.[8,10,11]

DENTAL ESTHETIC PRINCIPLES comprise the nuances of contour and color characteristics of individual teeth. The contour of a tooth can be analyzed in three-dimensional views: from the facial, interproximal, and incisal. The "face" of a tooth has been defined as reflective area inside the transitional line angles of the facial surface [12]. Although the silhouette of each tooth contributes to its appearance,

the light reflection from the face of the tooth defines its apparent shape.

DENTOFACIAL ESTHETIC PRINCIPLES are somewhat more complex in that they represent a blend of both facial structures and dental structures [13]. These principles are determined by tooth arrangement, the position of a tooth in space relative the others in the arch. These principles include the relative width and height of the teeth in the anterior segment [7,12]. The Golden Percentage of 1.618:1(Fig 1) can be converted and modified to the Golden Percentage for assessment of proportions and central incisor dominance as well as bilateral symmetry of maxillary anterior tooth width [14].

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 [15,16,17]. 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 [17]. 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 it within the frame of the lips, relate to each other and 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 [18]. Miller et al [19] 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 [20]. 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 [21], 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 [22]. 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.

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. 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 [23]. Lombardi [23] 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[24], but it has been reported to vary between 66% and 80%[25]. A higher width/height ratio means a squarer tooth, and a lower ratio indicates a longer appearance.

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 straighten 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 (Fig 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 one 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. 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 [26].

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 diastema. The shape of arches can be square tapering, tapering and ovoid. The square arch form gives a broad, straight line smile from cuspid to cuspids. There tends to be very little overlapping, crowding or labial tipping. The tapering arch is narrow from cuspid to cuspid 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 cuspid to cuspid forming an arc around the ridge [27].

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 [22], "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 [24]." 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. 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 [28].

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 [28].

2. Surface contours and surface texture

Surface contours can be concave, convex or straight. Surface contours are viewed as overall or small-detailed surfaces[29]. 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 [29].

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 [29].

4. Contact areas

The elements of tooth contacts, connectors and embrasures can be of real significance in planning the treatment of the smile [30]. Placement of contact areas is a critical aesthetic result in anterior teeth. Contact establishes embrasures and tooth size. Contacts (inter-dental 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 [28]. 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 [31].

5. Embrasure form

Embrasure form defines the outline of a tooth. There are gingival, incisal, lingual, and facial embrasures. The shape of embrasures alters the perception of tooth size such that large embrasures make teeth look smaller and 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 [31].

CONCLUSION:

Today, well occluding casts and pleasing profiles can no longer be considered to be adequate treatment goals. Since most people interact with each other facing each other directly or obliquely, the smile of the patient should be given adequate importance in treatment planning. In order to correctly diagnose and treat problems associated with the smile, meticulous clinical observation and record taking in the form of photos and videos is warranted, in various dimensions. 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.

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FIGURES:

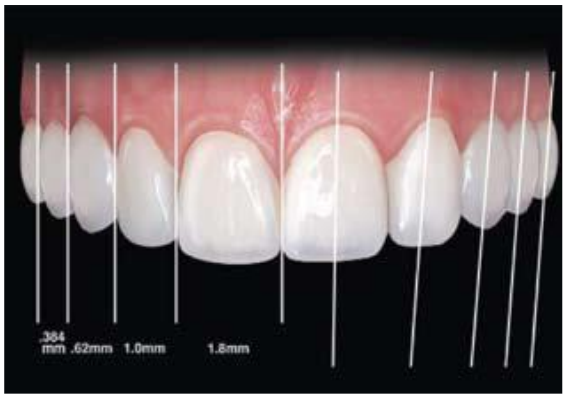

Fig. (1) Diagram of the Golden Proportions and the axial inclination of the teeth in a natural, harmonious smile.

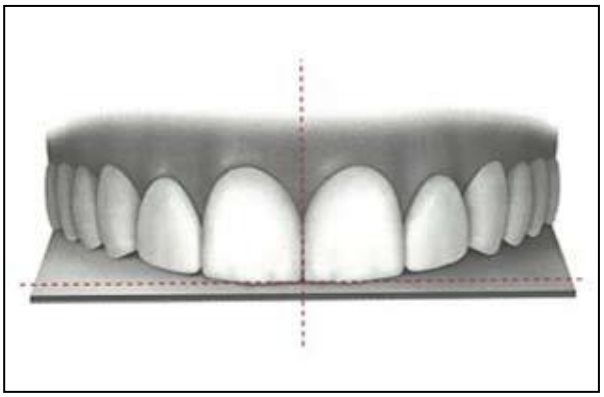

Fig. (2) The midline of the teeth is perpendicular on the incisal plane.

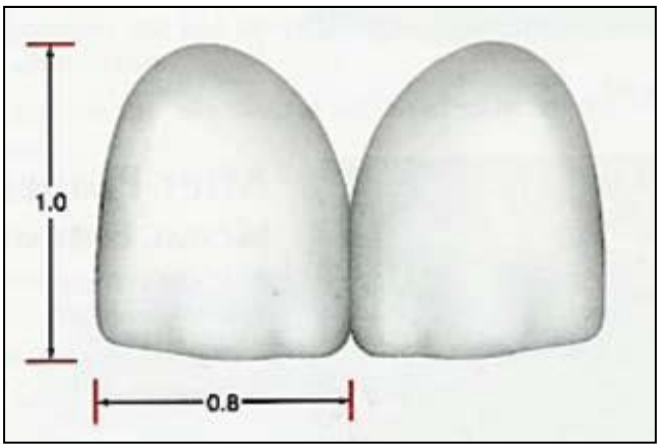

Fig (3) The ideal "Width Height" ration of Central incisor

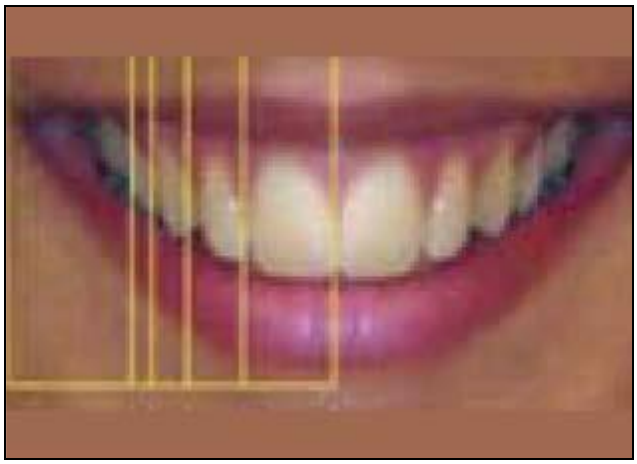

Fig. (4) The relation of the smile line to the curvature of the lower lip.

Fig. (5) Diagram of incisal embrasures, which are progressively open as one view distally along the maxillary arch