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Smile Design: A Modern Approach

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ABSTRACT
Confident attractive smile is the most important social bonding gesture and key to professional enhancement. Smile design refers to the many scientific and artistic principles that can collectively create a beautiful smile. These principles are established through data collected from patients, diagnostic models, dental research, scientific measurements, and basic artistic concepts of beauty. The ultimate objective of aesthetics in dentistry is to create a beautiful smile, with teeth of pleasing inherent proportion to one another and pleasing tooth arrangement in harmony with gingiva, lip and face of the patient. From the patient's perspective, beauty measures that individual's perception of beauty as noted in the saying: ''Beauty is in the eye of the beholder.''
KEYWORDS: Elements of smile design, esthetic smile, Digital smile design, cosmetic dentistry

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I. INTRODUCTION

Smile, a person's ability to express a range of emotions with the structure and movements of the teeth and lips, can often determine how well a person can function in society. Of course, the importance given to a beautiful smile is not new.[1] Pierre Fauchard (1678-1761) of France, the leader of the movement, together with the several colleagues modernized and promoted dentistry and also advocated esthetic practices.[2] The concept of smile and dental esthetics represents a complex interaction between skeletal structures, alveolar casing teeth and the overlying soft tissue covering.[3]

The two main objectives in dental esthetics are[4]

- To create teeth of pleasing inherent proportion and of pleasing proportion to one another, and
- To create a pleasing tooth arrangement in harmony with the gingiva, lips and face of patient.

Smile designing is a process whereby the complete oral hard and soft tissues are studied and evaluated and certain changes are brought about which will have a positive influence on the overall esthetics of the face. These changes are governed by the principles of esthetic dentistry. Hence, a good smile design would naturally and effortlessly blend with the rest of the face to provide an esthetic and functional complex.[5]

DIGITAL SMILE DESIGN:

A beautiful confident smile is desired by all. When a patient wishes to attain that smile but is skeptical to undertake the treatment procedure, for not being able to visualize his or her treatment outcome, is when, a clinician can use the Digital smile designing (DSD) tool.[6] DSD is a multipurpose digital tool with the clinically relevant advantages. It can strengthen esthetic diagnostic abilities, improve communication among team members, create predictable system throughout the treatment phases, enhance patient's education and motivation through visualization, and increase the effectiveness of case presentation.[7]

CLASSIFICATION OF SMILE

There are millions of different smiles essentially as many as individuals. Three basic smile patterns can be identified.[8] (Fig. 1)

1.) Commissure smile:

- Most common pattern
- Seen in 67% of the population
- Typically, **Cupid's bow – Shape**
- Average direction of movements of the commissure is 40 degree
- Direction of movements of smiles is to the HELIX-SCALP JUNCTION

2.) Complex smile:
- Seen in approximately 31% of the population
- Smile pattern is identified by the dominance of Levator Labii Superioris.
- Typically, "Gull Wing Effect" shown by the gingival tissues, correspondingly mimic the shape of the upper lip

3.) Cuspid smile:
- Characterizes 2% of population
- Shape of the lips are typically illustrated as two **parallel Chevrons**.
- Key characteristics of smile is the strong muscular pull and retraction of lower lip downward and back.

Fig 1: Classification of smile: a) commissural smile, b) complex smile c) cuspid smile

Depending on the exposure of teeth, gingiva and mucosa during smile (solomon, 1999)
- **Tooth smile (Low Smile):** Exposure of labial surface of the maxillary anterior teeth only.
- **Gingival smile / Papilla smile (Average Smile):** Exposure of labial surface of the teeth and interdental papilla/gingiva.
- **Mucosa smile (High Smile):** Exposure of labial surface of the teeth, interdental papilla, free marginal gingiva and the labial and buccal mucosa.

Depending on the lip component/ Shape of vermillion border of upper lip from the commissures of lips during smile:
When smile line is convex or concave it is also referred as smile curve.
- **Convex smile:** Line accentuates the quality of smile and therefore it is a positive smile line. A convex smile line and parallelism of smile line to lower lip are two desirable qualities of smile which gives pleasantness to smile
- **Concave smile:** Gives an unpleasant, harsh, distracted character of smile and therefore a negative smile line.
- **Straight smile:** Line can have a positive or negative effect depending on its harmony to the lip curvature and to the presence or absence of buccal corridor.

COMPONENTS OF AN ESTHETIC SMILE:

Harmonizing an esthetics 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 and their relationship to gingival tissues. A smile design should always include the evaluation and analysis of both facial and dental composition.[9]

Facial composition-
Facial beauty is based on standard esthetic principles that involve proper alignment, symmetry and proportion of face. There are two facial features which do play a major role in the smile design:
1. The Interpupillary line- Should be perpendicular to the midline of the face and parallel to the occlusal plane. Lips are important since they create the boundaries of smile design.
2. Lips.

In classical terms, the horizontal and vertical dimensions for an ideal face are as follows:
1. Horizontal:

- The width of the face should be the width of five "eyes".[10]
- The distance between the eyebrow and chin should be equal to the width of the face (Fig.2).

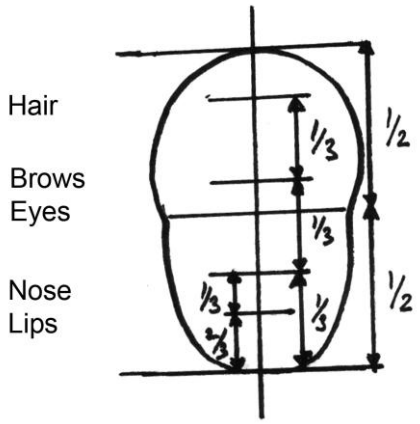

Fig 2. Horizontal dimensions of face

2. Vertical:

- The facial height is divided into three equal parts from the fore head to the eyebrow line, from the eyebrow line to the base of the nose and from the base of the nose to the base of the chin.
- The full face is divided into two parts, eyes being the midline. (Fig.3)

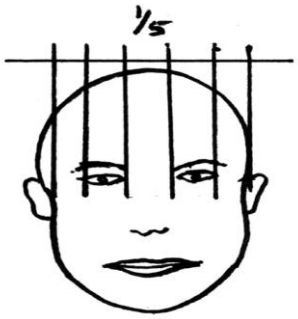

Fig 3. Vertical dimensions of face

The basic shape of the face when viewed from the frontal aspect can be one of the following:

1. Square
2. Tapering
3. Square tapering
4. Ovoid

These factors play a role in determining the tooth size, shape and the lateral profile; in short, the tooth morphology is dependent on the facial morphology.[11,12]

Dental Composition- [Vital elements of smile designing]

The vital elements of smile designing include the following:

1. Tooth components-

a) Dental midline
b) Incisal lengths
c) Tooth dimensions
d) Zenith points
e) Axial inclinations
f) Interdental contact area (ICA) and point (ICP)
g) Incisal embrasure
h) Sex, personality and age
i) Symmetry and balance

2. Soft tissue components-

a) Gingival health

b) Gingival levels and harmony
c) Interdental embrasure
d) Smile line
The role of each of the above-mentioned factors in smile designing is given below.

Tooth Components Of Smile Designing-
Dental Midline
The midline refers to the vertical contact interface between two maxillary centrals. It should be perpendicular to the incisal plane and parallel to the midline of the face.
1. Maximum allowed discrepancy can be 2 mm
2. Midline is perpendicular to the interpupillary line.
3. Various anatomical landmarks such as midline of the nose, forehead, chin, philtrum, interpupillary plane can be used as guides to the assessment.[13]
4. The philtrum of the lip is one of the most accurate of these anatomical guide posts. The center of the philtrum is the center of the cupids bow and it should match the papilla between the centrals.
Incisal Lengths (Incisal Edge Positions):-
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.[13]
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 labiolingual 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.

Patient input: Intraoral cosmetic preview and provisional restorations help to confirm proper placement of the final incisal edge position. The patient desires must be met as best as possible.

Tooth Dimensions-
Correct dental proportion is related to facial morphology and is essential in creating an esthetically pleasing smile. Central dominance dictates that the centrals must be the dominant teeth in the smile and they must display pleasing proportions.

Various guidelines for establishing correct proportions in an esthetically pleasing smile are[14]
1. Golden proportion (Lombardi),
2. Recurring esthetic dental proportions (Ward),
3. M proportions (Method) and
4. Chu's esthetic gauges.

1.) **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). It is difficult to apply as patients have different arch form, lip anatomy and facial proportions (fig. 4).[77]

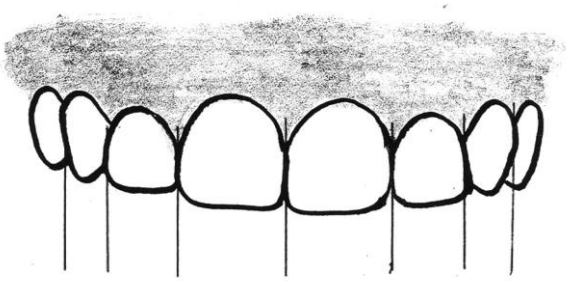

Fig 4 Golden proportion based on apparent width from the frontal view

2.) **Recurring Esthetic Dental Proportion** (Ward): The successive width proportion when viewed from the facial aspect should remain constant as we move posteriorly form midline. This offers great flexibility to match tooth properties with facial proportions (Fig 5).

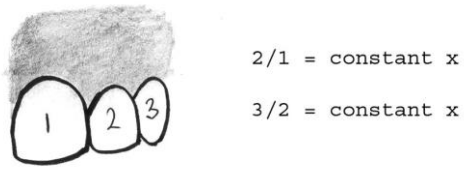

Fig 5. Recurring esthetic dental proportion

3.) **M Proportions** (Method):- This method compares the tooth width with the facial width using a software. The whole analysis is done in the computer and hence involves more of mathematics rather than artistic analysis.

4. **Chu's Esthetic Gauges**:-
Dr. Chu's research supports Levin's RED concept and refues the golden proportion.
These principles are used as a guide rather than a rigid mathematical formula.
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.78

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 (Fig. 6). 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.

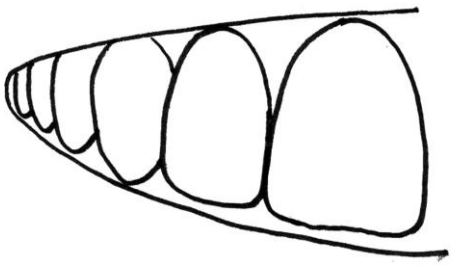

Fig 6. Buccal Corridor,

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. (fig.7). 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.[15]

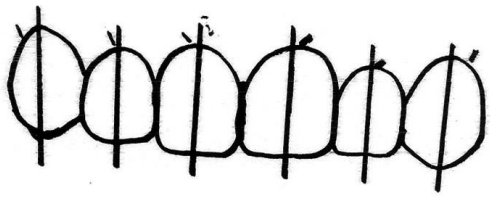

Fig 7. Zenith points and its relation to midline

Tooth inclinations-
Axial inclination compares the vertical alignment of maxillary teeth, visible in the smile line, to central vertical midline. From the central to the canine, there should be natural, progressive increase in the mesial inclination of each subsequent anterior tooth.
The guide for labiolingual inclination is as follows:
1. Maxillary central incisor – positioned vertically or slightly labial.
2. Maxillary lateral incisor – cervical is tucked in, incisal edge inclined slightly labially.
3. Maxillary canine – cervical area positioned labially, cusp tip lingually angulated.

Interdental Contact Area and Point-
1. **Interproximal contact area (ICA)**:
• It is defined as the broad zone in which two adjacent teeth touch.
• It follows the 50:40:30 rule in reference to the maxillary central incisor.
• The increasing ICA helps to create the illusion of longer teeth by wider and also extend apically to eliminate black triangles.
2. **Interproximal contact point (ICP)**:
• It is the most incisal aspect if the ICA.
• As a general rule, the ICP moves apically, the further posterior one moves from the midline (Fig 8)

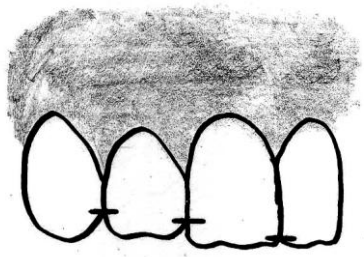

Fig .8 ICPs – moves apically as we move from central to canine

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.

Sex, Age And Personality-SPA
Minor differences in the length, shape and positioning of the maxillary teeth allow for dramatic characterization.[16]
• **Age** – Maxillary central incisor
Youthful teeth: unworn incisal edge, defined incisal embrasure, low chroma and high value

Aged teeth: shorter; so less smile display, minimal incisal embrasure, high chroma and low value
• **Sex** – Maxillary incisors
Female form: round smooth, soft delicate
Male form: cuboidal, hard vigorous
• **Personality** – Maxillary canine
Aggressive, hostile angry: pointed long "fangy" cusp form Passive, soft: blunt, rounded, short cusp form.

Symmetry and Balance-
Symmetry is the harmonious arrangement of several elements with respect to each other. Symmetrical length and width is most crucial for the centrals. Static symmetry: mirror image, maxillary central incisors
▪ Dynamic symmetry: two objects very similar but not identical. Playing with perfect imperfection in the laterals and canines allows for a more vital, dynamic, unique and natural smile.

Soft Tissue Component of Smile Design-
Gingival Health-
The gingiva acts as the frame for the teeth; thus, the final esthetic success of the case is greatly affected by the gingival health. Healthy gingiva is usually
1. Pale pink in color, stippled, firm and it should exhibit a matte surface;
2. Located facially – 3 mm above the alveolar crestal bone and
3. Located interdentally – 5 mm above the intercrestal bone papilla should be pointed and should fill the gingival embrasure right up to the contact area.

Gingival Level and Harmony-
Establishing the correct gingival levels for each individual tooth is the key in the creation of harmonious smile. The cervical gingival height (position or level) of the centrals should be symmetrical.
The gingival margin of the lateral incisor is 0.5–2.0 mm below that of the central incisors. The least desirable gingival placement over the laterals is for it to be apical to that of the centrals and or the canines.

Interdental embrasure (cervical embrasure)-
The darkness of the oral cavity should not be visible in the interproximal triangle between the gingiva and the contact area. If the most apical point of the restoration is 5 mm or less from the crest of the bone, then black triangles will be avoided (fig. 9).[17]

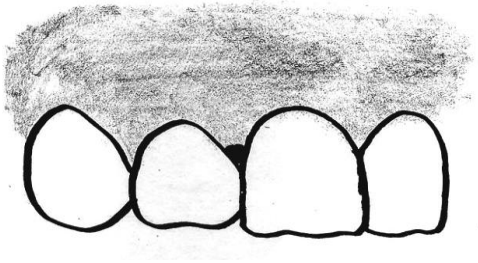

Fig 9. Interdental embrasure – showing black triangle

Smile Line-
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. (fig 10). Reverse smile line or inverse smile line occurs when the centrals appear shorter than the canines along the incisal plane.
Under ideal conditions, the gingival margin and the lip line should be congruent or there can be a 1–2 mm display of the gingival tissue. Showing 3–4 mm or more of the gingiva (gummy smile) often requires cosmetic periodontal recontouring to achieve an ideal result.

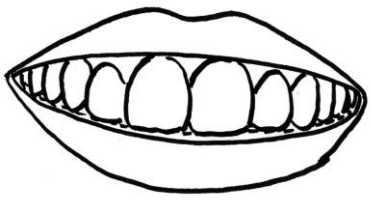

Fig 10. Smile line that follows the superior border of the lower lip

II. CONCLUSION

The crafting of an ideal smile requires analyses and evaluation of the face, lips, gingival tissues, and teeth and an appreciation of how they appear collectively. Such an ideal smile depends on the symmetry and balance of the facial and dental features. These principles are established through the data collected from the patients, diagnostic models, dental research, scientific measurements, and basic artistic concepts of the beauty.[18]

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