REVIEW ARTICLE

A REVIEW ON SMILE DESIGN ANALYSIS

Kanwar Anoop Kaur[1], Mohit Makkar[2]

[1]Adesh Institute of Dental Sciences and Research, Bathinda, Punjab, [2]B.D.S Private Practice, India

ABSTRACT:
Orthodontics is a branch of dentistry that has been creating attractive and stunning smiles for centuries. Dentofacial appearance is one of the main determinants of physical attractiveness. Esthetic smile design is a multifactorial decision-making process that allows the clinician to treat patients with an individualized, interdisciplinary approach. This review aims to discuss various smile patterns and anatomical parameters for assessing and designing beautiful smiles.
Keywords: Esthetics; Digital smile analysis; Smile patterns; Lip lines.

Corresponding Author: Dr. Mohit Makkar, The Dentist Sco-42, First floor, Sector 9, Panchkula, Haryana India

INTRODUCTION:
Dentofacial appearance is one of the main determinants of physical attractiveness. During interpersonal interaction, individuals' focus is mainly centered on the other person's eyes and mouth, with little time spent on the other facial characteristics. In the opinion of the public, the smile appears in second place, losing out only to the eyes as the most important feature in facial attractiveness.[1] Photographs of a patients face provide an enormous amount of information and are mandatory to guide in diagnosis and treatment planning for smile design.[2] The photography in orthodontics, records the external manifestations of health, disease or deformity, as related to the teeth, gums or adjacent tissues and the development of facial characteristics and can be categorised into diagnostic criteria and records.[3] Additionally, traditional anthropometry produces inaccurate values due to soft tissue compression and has many sociological, logistical and technical drawbacks such as prolonged time, skilled researcher for consistency and accuracy of measurements.[4]

ANATOMY OF THE SMILE
The upper and lower lips frame the display zone of the smile. Within this framework, the components of the smile are the teeth and the gingival scaffold. The soft-tissue determinants of the display zone are lip thickness, intercommissure width, interlabial gap, smile index (width/height), and gingival architecture.[5]

CLASSIFICATION OF SMILE PATTERNS
There are three styles:
Commissure smile is the most common pattern, seen in approximately 67% of the population.[6] In this smile, typically thought of as a Cupid's bow, the corners of the mouth are first pulled up and outward, followed by the levators of the upper lip contracting to show the upper teeth. In this classic smile pattern, the lowest incisal edge of the maxillary teeth are the central incisors.[7]
The cuspid smile is found in 31% of the population.[6] The shape of the lips are commonly visualized as a diamond. This smile pattern is identified by the dominance of the levator labii superioris. They contract first, exposing the cuspid teeth, then the corners of the mouth contract to pull the lips upward and outward. However, the corners of the mouth are often inferior to the height of the lip above the maxillary cuspids.[7] The complex smile characterizes 2% of the population.[6] The shape of the lips are typically illustrated as two parallel chevrons. The levators of the upper lip, the levators of the corners of the mouth, and the depressors of the lower lip contract simultaneously, showing all the upper and lower teeth concurrently.[7]
There are two basic types of smiles: the social smile and the enjoyment smile. Each type involves a

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different anatomic presentation of the elements of the display zone.

The social smile, or the smile typically used as a greeting, is a voluntary, unstrained, static facial expression. The lips part due to moderate muscular contraction contraction of the lip elevator muscles, and the teeth and sometimes the gingival scaffold are displayed. The enjoyment smile, elicited by laughter or great pleasure, is involuntary. It results from maximal contraction of the upper and lower lip elevator and depressor muscles, respectively. This causes full expansion of the lips, with maximum anterior tooth display and gingival show.[5]

SMILE DESIGN ANALYSIS

Smile design should involve the evaluation of certain elements in a specific sequence; Facial analysis (general facial balance), dento-facial analysis that involves maxillo-mandibular relationships to the face, and the dental midline relationship to the face, dento-labial analysis which involves the relationship of the teeth to the lips, dento-gingival analysis which analysis the relationship of the teeth to the gingiva and dental analysis which study the inter tooth and intra tooth relationships, ie, form and position along with color. [1]

PHOTOGRAPHICAL TECHNIQUES FOR SMILE DESIGN ANALYSIS

Photographs include include intraoral and extraoral types. There are five required intraoral photographs: frontal (in occlusion), right buccal (in occlusion), left buccal (in occlusion), upper and lower occlusion. Upper and lower occlusion photographs are called as mirror shots as they require the use of dental mirrors. In case extraoral photographs four shots are required: face frontal (lips relaxed), face frontal (smiling), profile (right side preferably with relaxed lip) and 45^0 profile also known as ¾ profile –smiling.[8]

The subject should be made to stand on the floor with blue background.[9] The background makes the image stand out properly and for this reason it is important to improve the visualization of the object. A non reflective background of black, light-gray or light-blue is commonly used.[10] The Frankfort horizontal plane should be parallel to the floor.[9] The digital camera should be set on manual exposure shooting chosen from the model dial that determines the desired function.[11]

ANATOMICAL PARAMETERS FOR SMILE DESIGN

Maximum incisor exposure: Amount of vertical display of the maxillary central incisors

Upper lip drape: Amount of vertical coverage of the maxillary central incisors by the upper lip (or amount of gingival display).

Lower lip to maxillary incisor: Vertical distance from the incisal edge of the maxillary right central incisor to the deepest midline point on the superior margin of the lower lip.

Inter-labial gap: Distance between the most inferior portion of the tubercle of the upper lip to the deepest midline point on the superior margin of the lower lip.

Smile width: Distance from the right outer commissure to the left outer commissure.

Smile index: Ratio of smile width divided by interlabial gap.[5]

Buccal corridor: In the smile, bilateral spaces appear between the vestibular surface of the maxillary posterior teeth and the internal mucosa of the cheek, denominated buccal corridor.[12]

Upper lip thickness: Vertical distance from the most superior margin of the upper lip to the most inferior portion of the tubercle of the upper lip.

Lower lip thickness: Vertical distance from the deepest midline portion of the superior margin of the lower lip to the most inferior portion of the lower lip.

Outer commissure width: Horizontal distance from the left outer commissure to the left outer commissure.

Inner commissure width: Horizontal distance from the right inner commissure to the right inner commissure.[13]

Facial composition for smile design includes lip line and interpupillary line. When smiling, the inferior border of the lip as it relates to the teeth and gingival tissues is the lip line. Average lip line-exposes the maxillary teeth and only the interdental papilla. Low lip line exposes no gingival tissues when smiling. High lip line exposes the teeth in full display also gingival tissues above the gingival margins. In cases where there is a high lip line and an excessive gingival display exists, an unwanted gummy smile become evident. The vertical maxillary excess can be determined with cephalometric analysis. Orthodontics and orthognathic surgery to impact the maxilla are ideal when these conditions are confirmed as skeletal dysplasia in nature. Interpupillary line should be parallel with the horizon line and perpendicular to

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the midline of the face as well as it should be parallel with the commisure line and occlusal plane.[14]

Dentofacial analysis evaluates position of upper lip, alignment of upper incisal edge to lower lip, tooth-lower lip position and midline relationship of central incisors to philtrum. Ideally it should pass through the centre of two central incisors. The smile may be canine to canine, premolar to premolar and molar to molar.[1]

ESTHETIC SMILE:
GOLDEN PROPORTIONS:

The concept of the golden proportion has often been offered as a cornerstone of smile design theory. This proportion mathematically denotes that the ratio of a smaller to a larger length is equal to the ratio of the larger length to the total length.

MAXILLARY TOOTH	GOLDEN PROPORTION RATIO	GOLDEN % CALCULATION(RATIO)
Right canine	0.618	0.618/6.472 (10%)
Right lateral incisor	1.000	1.000/6.472 (15%)
Right central incisor	1.618	1.618/6.472 (25%)
Left central incisor	1.618	1.618/6.472 (25%)
Left lateral incisor	1.000	1.000/6.472 (15%)
Left canine	0.618	0.618/6.472 (10%)
TOTAL	6.472	6.472/6.472 (100%)

The Golden Proportion has been applied to the total canine-canine width to become the "Golden Percentage": 10%:15%:25%:25%:15%:10%. This is more meaningful tool to analyse the esthetic properties of a smile. The principle of the golden percentage in evaluation and treatment planning appears to be of significant benefit in esthetic smile design.[14]

DIGITAL SMILE DESIGN

The Digital Smile Design (DSD) is a multi-use conceptual tool, simple to use and with clinically relevant advantages: it can strengthen the esthetic diagnostic abilities, improve the communication between the team members, create predictable systems throughout the treatment phases, enhance the patient's education and motivation. It is indicated for esthetic diagnosis, communication and a tool to help in team work, patient management, case presentation and education.[15]

Digimizer Image Analysis 3.7 (Medcalc Software) is image analysis software which is used to analyse smiles. It is easy-to-use and flexible image analysis software package that allows precise manual measurements as well as automatic object detection with measurements of object characteristics with the help of the Unit Line tool in this software and, actual life-sized measurements could be calibrated by the computer. Since the photographs should be taken on a 1:1 ratio, there would be no length width discrepancy.[16]

The drawing of reference lines and shapes over extra-and-intra-oral digital photographs performed in presentation softwares such as Keynote (Apple iwork) or MS Powerpoint (Microsoft Office), following a predetermined sequence, will widen the diagnostic vision. It also helps the team to assess and understand limitations and risk factors such as asymmetries, disharmonies, and esthetic principles violations, adding critical data to the process of treatment planning.[15]

CONCLUSION

The excellence is never achieved by chance, but consistently from a systematic approach for diagnosis, communication, treatment planning and finally by implementation. The incorporation of protocols and checklists for quality control and information management is required for best outcomes.[15] Smile design is a relatively new discipline in this era of cosmetic dentistry, and it involves several areas of evaluation and treatment planning, which simply means that cosmetic dentistry is a multidisciplinary branch, wherein all treatments like orthodontics, periodontics, and surgical procedure have to be performed whenever deemed necessary.

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