REVIEW ARTICLE

Smile analysis: A review Part I

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Abstract

The main objective of any aesthetic dental treatment is obtaining a beautiful smile. The integral parts of any individual are smile. But still smile is little discussed. The key elements of orthodontic diagnosis and treatment planning are smile analysis and smile design over the last decade. According to Hulsey, "Smile is one of the most effective means by which people convey their emotions." Evaluating beauty is always subjective. Hence, we need to find adequate tools to overcome the challenge of this subjectivity. This article deals with various aspects of smile analysis and the recent trends in recording, analyzing, and improving a smile.

Keywords: Smile, smile analysis, smile designing

Introduction

Main objective of any aesthetic dental treatment is obtaining a beautiful smile. Intrinsic characteristics are the integral parts of individual and it can sometimes be altered and sometimes not.[1] In spite of its importance, the intrinsic characteristics of the smile are little discussed.

The key elements of orthodontic diagnosis and treatment planning are Smile analysis and smile design over the last decade.[2,3] The desire for an attractive smile and improved esthetics often motivate persons in modern society to seek dental treatment (Sheets 1987, Levine 1995).[4] According to Hulsey, "Smile is one of the most effective means by which people convey their emotions."[5]

Evaluating beauty is always subjective. Hence, to overcome the challenge of this subjectivity.[1] Buccal corridors, smile arc, incisor protrusion, and gingival display were used as adequate tool.[6]

The records needed for contemporary smile visualization and quantification can be divided into three groups:

1. Static records: Static photograph and/or lateral cephalogram.
2. The dynamic record: Digital videography.
3. Direct biometric measurements.[7]

The orthodontist must work with two dynamics. The first is that of soft tissue response. The second is the facial change throughout a patient's lifetime – the impact of skeletal and soft tissue maturational and aging characteristics.[8]

The most esthetic smile is the smile that entirely display the teeth including some gingiva.[9] People have more positive acceptance and better behavior against attractive faces this phenomenon is called "attractiveness halo."[10]

Historical Aspects

Egyptians depicted ideal facial esthetics as the "golden proportion." According to Edward Angle optimal facial esthetics always coincided with ideal occlusion, and it took care of itself. And it was also believed that, soft tissues would fall in line once the ideal tooth jaw positions were achieved. This was checked on lateral cephalogram as these X-rays were used in orthodontic practice since long time.[11]

Anatomy of Smile

On smiling one can see teeth and the gingival scaffold framed by upper and lower lips.

The curve formed by the incisal edges of the maxillary anterior teeth is called as "smile arch."[12] The sagittal cant of the maxillary occlusal plane and the arch form are responsible for the appearance of smile arch. When there is parallelism between the smile arc and the curvature of the lower lip, it is consonant.[5,12-15] This can be improved by increasing the cant of maxillary occlusal plane to Frankfort horizontal (FH)

plane. Lateral profile photographs now taken in natural head position will increase maxillary anterior tooth display. If the arch form is broad, curvature of the anterior segment will be less, and the smile arc will be flat. A flat smile arc is usually less esthetic.

Both skeletal and dental relationships contribute to these smile components. Maxillary anterior tooth display, upper lip drape, and gingival display are the vertical aspects of smile anatomy. In young smile, 75-100% of the maxillary central incisors should be positioned below an imaginary line drawn between the commissures.[2]

Smile Classification

Smiles are classified as: The social smile and the enjoyment smile.

The social smile is a voluntary, static facial expression, unstrained.[12] Due to moderate muscular contraction of the lip elevator muscles the lips part, and the teeth and sometimes the gingival scaffold are displayed.

The enjoyment smile is involuntary. It results from maximal contraction of the upper lips elevator and lower lip depressor muscles causing full expansion of the lips, with maximum anterior tooth and gingival display.

Smile can also be classified into three types of smile depending upon the exposure of tooth and gingival: [16]

a. High smile: The smile in which complete cervico-incisal length of the maxillary incisors and the band of gingival is visible is called as high smile.
b. Average smile: The smile in which 75-100% of the maxillary incisors is visible is called as average smile.
c. Low smile: In this type of smile about less than 75% of maxillary incisor is only visible.
d. Gummy smile: There can also be a category of excess gingival exposure called as gummy smile. This anatomical feature is defined by Peck and Peck as gingival smile line.

Prevalence

Tjan evaluated the smile of 454 dental students of age 20-30 and found that 11% had high smile. 69% had average smile and remaining 20% had low smile.

Smile Style

Smile style is another soft-tissue determinant of the dynamic display zone. According to the classification of Rubin, there are 3 smile styles:

1. Cuspid (Commissure) smile:
   The smile in which teeth and gingival scaffold is seen as all the elevators of the upper lip are raised like a window.
2. Complex (Complete denture) smile:
   In this smile elevators of the upper lip raise the upper lip like a window shade and the depressors of the lower lip depress, the lower lip like a window.
3. Mona Lisa smile:[17]
   In this smile, zygomaticus major muscles, draw the outer commissures outward and upward, followed by a gradual elevation of the upper lip. Patients with Mona Lisa smiles tend to display less teeth and gingival structure.

Sexual dimorphism

Peck and Peck have shown that there are significant differences in smile in both the genders.

Vig and Brundo found that females have significantly more maxillary and less mandibular tooth exposure than males at all ages.

Tjan *et al.* (1984) found a high and very high smile line being more frequent in women (14% and 75%, respectively) than in men (7% and 63%, respectively).

Age variation

Dr. Burstone gathered his own "longitudinal" data for actors Sally Field, Yule Brenner, Jane Russell, Don Southerland, and Ronald Reagan, by comparing their smiling photos at various ages. He concludes he does not see less upper incisor exposure with age for any of these subjects.[18]

Vig and Brundo described a gradual drooping of lip position as an aging phenomenon leading to decrease maxillary incisor exposure and increase mandibular incisor exposure during smiling in older age as compared to younger age.[19]

Smile analysis

In a smile analysis, we should look at all the factors that compose a smile; these are the shape of a smile, the size, the smile line, and the position of the patients' teeth, lips, and gums when a smile is produced.

Factors to Evaluate a Smile

The smile Arc/smile line

The smile line is an imaginary line that extends from the incisal edges of the maxillary incisors and is parallel to the curvature of the lower lip. The upper incisal edges need to follow the lower lip line in an even curve during relaxed confident smiling, in natural head posture [Figure 1].

If the lines are not congruent, we aim to correct them.

Variations may result from:

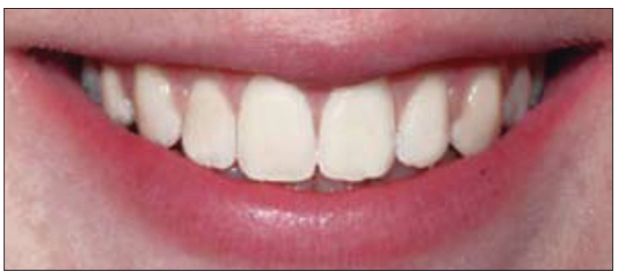

Figure 1: Smile line parallel to the curvature of lower lip[4]

- Worn edges that need restoring
- Reduced overbite or open bite
- Deep bite requiring leveling.

Men may have a flatter smile arc than women.

Factors contributing to the smile arc

Two factors that contribute to the appearance of the smile arc are the:

1. Sagittal cant of the maxillary occlusal plane: Maxillary anterior tooth display is increased, and the consonance of the smile arc is improved by increasing the cant of the maxillary occlusal plane to FH in natural head position. Dr. Burstone believes this phenomenon occurs because the occlusal plane is parallel to the lower lip from the 45° facial view. He states that if the cant of the occlusal plane is changed smile arch can be changed[4]
2. The archform

Degree of curvature of the smile arc is influenced by the configuration of the anterior segment: The broader the archform, less is the curvature of the anterior segment and the greater the likelihood of a flat smile arc.

Buccal corridor/lateral negative space (LNS)

The buccal corridor/LNS is the triangular area as seen in a frontal view, between the Commissure and the buccal surfaces of the teeth usually the premolars [Figure 2].[20]

Factors contributing to buccal corridor:

1. Size: It looks best when small in relation to the upper 3-3 group. The maximum proportion of the LNS should be no more than one-third of the upper midline-to-canine dimension on each side. This may be modified either through modifying tooth sizes or tooth positioning.
2. Photography: Note that the camera flash can create or eliminate LNS. The LNS is "lighting sensitive."
3. Mandibular opening: Their size depends on the amount of mandibular opening.
4. Dental arch: The width of the dental arches is one of many factors involved in the presence of buccal corridors during smile.

The upper gingival margin line

The anterior gingival margin needs to follow the upper lip so that the teeth are framed within the lips on smiling. Husley stated that in most attractive smile the upper lip rested at the height of the gingival margin of the maxillary central incisors [Figure 3].

Axial inclination

A midline which is off center by 3-4 mm may still remain unnoticed, but small deviations in incisal axial inclination are easily noticed. Hence, it is of paramount importance to maintain the axial inclinations of anterior teeth.

Incisal edge morphology

Canine tips should not be flat or pointy. Upper incisors should have rounded corners rather than sharp corners. Sharp edges, notches, and facets are signs of ageing and can easily be restored for youthful appearance.

Tooth proportions

Golden proportions state that upper lateral incisors should be 0.618 of width of central incisors, and canine should be 0.618 of width of lateral incisors. The width of central across the contact point should be 80% of its height from the zenith to that line across the contacts.

Connector Lengths, Embrasures Height and Zeniths

Rufenacht in 1993 showed that embrasure levels ideally changed upwards as we move distally along the arch and Zenith of crown is slightly distal to the vertical axis of the crown with anterior teeth having a slightly mesial inclination.

Sarver in 2004 showed that the contact points are not points but lengths. The contact length decreases distally along the arch.

Allignment of smile

Smile seems to be well-aligned if it lies perpendicular to the midline of the face. Furthermore, it is seen that the corner of the smile arc should be in alignment with the interpupillary line.

Golden proportions (The proportion between teeth an d smile).

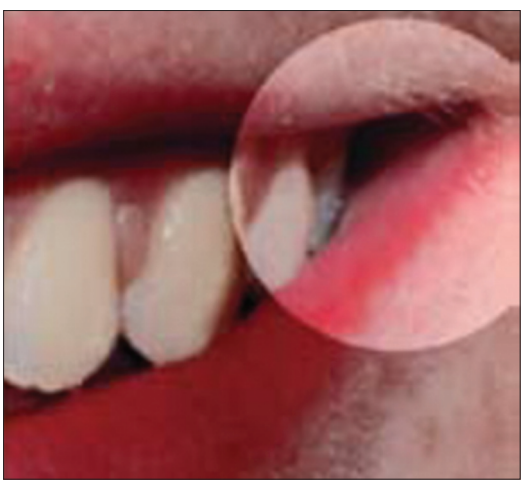

Figure 2: Buccal corridor/lateral negative space[20]

Figure 3: Anterior gingival margin follows the upper lip[4]

The smile can be horizontally divided into tooth part and non-tooth part (buccal corridor). A perfect smile displays larger tooth part and a smaller non-tooth part.

Contemporary orthodontists evaluate smiles in 3 dimensions: transverse, vertical, and sagittal. A fourth dimension, time, should also be considered.[20]

Smile Capture Method

Conventional photography use in capturing patient smile has some major drawbacks.

1. Its extremely difficult to standardize photographs (camera angles, distance to the patients, position of head and variation in intraoral and extraoral photographic techniques.
2. It is difficult to repeat the same social smile in one photography session.

In standardized digital videography, the patient should be seated in a cephalostat in natural head position with ear rods. Standardization should be done by mounting the video camera on to a tripod at a fix distance from the patient in such a way that the lens of the camera lies perpendicular to the midsagittal plane of the patient and be leveled at the lower third region of the patients face. The patient should be allowed to sit in a relaxed position with natural head position. Smile videography has to be taken after the patient becomes relaxed. The patient should be instructed to say "Cheese" allowed to relax and then smile again.

Anterior tooth display varies during speech and in smiling. The anterior tooth display can be evaluated by taking a video clip of both,[21] Videography makes it possible to study the smile at various functions such as speech, oral, and pharyngeal function, and smile at the same time.

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