EVALUATION OF A BALANCED SMILE —
A CLINICAL APPROACH

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Abstract:
A beautiful smile has a tremendous impact on the perception of one's attractiveness and personality. A smile is a window through which people perceive the personality of an individual. The goal of enhancing patient's appearance requires knowledge of the fundamental concepts of art and beauty. Although ideal occlusion should certainly remain the primary functional goal of orthodontics, the esthetic outcome is also critical for patient satisfaction and therefore essential to the overall treatment objectives. The importance of an attractive smile is unquestionable. A pleasant smile is a composite outcome of structural & harmonious balance between various elements of face including harmonious relationship between teeth, gingival scaffold & the lip framework. The importance of physical and facial attractiveness has been related to initial impressions, social interactions, etc. The subject of smile should greatly interest orthodontists as it forms a key aspect of communication & expression of emotions. There should be established criteria that identifies and quantifies elements of a smile that need correction and/or enhancement.

Keywords: Smile, Gingival scaffold, Lip framework.
INTRODUCTION
Esthetics in orthodontics has been defined mainly in terms of profile enhancement, but if you ask lay people what an orthodontist does, their answers will include something about creating beautiful smiles. Mackley has demonstrated that the profile is not a reliable predictor of the appearance of a person's smile. A resurgence of the soft tissue paradigm in orthodontics has shifted diagnostic thinking toward a focus on the relationships between soft and hard tissue and how they contribute to the overall facial esthetic make up of the patient.

The universal appeal of a pleasant, beautiful smile is undeniable and an orthodontist can greatly contribute in enhancing a patient’s smile, appearance and subsequently self-confidence. According to Dierkes, the beauty of the face can be divided into horizontal, vertical and transverse components and all of these must harmonize with the contours of the face to produce a beautiful smile.

The concept of an optimal smile and its esthetic is not new but is often overlooked in orthodontic treatment planning. According to Sabri eight major components of the smile are reviewed and discussed the impact of each on orthodontic diagnosis and treatment planning.

Need for smile analysis-
Why is there no accepted standard for smile analysis?

Because the current interest in smile enhancement is overdue, the orthodontic paradigm was geared toward achieving optimal proximal and occlusal contacts of teeth within the framework of a balanced profile.

Now in contemporary orthodontic paradigm the orthodontic specialty has only focussed its attention on the multifactorial nature of the smile, combined with a shift towards patient driven esthetic diagnosis and treatment planning.

The orthodontist should establish a diagnosis. The orthodontists are the first line in a decision making process that identifies & quantifies various elements of a smile which need correction, improvement or enhancement. Problem oriented diagnosis & treatment planning should entail identifying the positive elements of the smile that should be maintained throughout the treatment plan. The orthodontist must work with two dynamics-

i) Soft tissue repose and animation assessed during patient examination.

ii) Facial change throughout a patient's lifetime the impact of skeletal & soft tissue maturation and ageing characteristics.

Despite extensive research on facial esthetics, studies incorporating smile and its various other factors are still lacking. This seems to be important because smile enhancement is one of the main reasons for seeking orthodontic treatment.

So, the main purpose of the present study is to:

i) Review various aspects and components of smile.

ii) Importance of smile in orthodontic diagnosis and treatment planning.

iii) Various methods by which orthodontic treatment can enhance the smile of an individual.

How to diagnose the smile-
To analyse the smile in detail the orthodontist has to clinically review from all the aspects ie from frontal, sagittal and oblique dimensions. To fulfill this, one has to further increase our diagnostic records.

i) Clinical evaluation – Anterior tooth display during social smile should be evaluated clinically.

ii) Extraoral photographs – should be further increased to – Frontal at rest, Frontal smile by saying the word “cheese”, Profile at rest, Profile smile, Oblique smile at 45, Oblique smile close up.

SMILE CLASSIFICATION-
i) Social smile/posed smile (Figure 1) – This smile is typically used as a greeting, is a voluntary, unstrained static facial expression.

ii) Enjoyment smile/spontaneous smile (Figure 2) - It is elicited by laughter or great pleasure, is involuntary. It results from maximal contraction of the upper lip elevator and lower lip depressor muscles, respectively. This causes full expansion of the lips, with maximum anterior tooth display and gingival show. 

Peck & Peck classified them as: Stage I – POSED, Stage II – SPONTANEOUS

Smile style - An individuals smile style depends on the direction of elevation and depression of the lips and the predominant muscle groups involved.

i) The cuspid/commissure smile (Figure 3) - It is characterised by the action of all the elevators of the upper lip, raising it like a windowshade to expose the teeth and gingival scaffold.
ii) The complex smile/ Full denture smile\(^4\) (Figure 4)- It is characterised by the action of the elevators of the upper lip and the depressors of the lower lip acting simultaneously, raising the upper lip like a window shade and lowering the lower lip like a window.

iii) The Monalisa smile\(^4\) (Figure 5) - It is characterised by the action of the zygomaticus major muscles, drawing the outer commissures outward and upward, followed by a gradual elevation of the upper lip.

SMILE ANATOMY –

The smile arc is the relationship between a hypothetical curve drawn along the edges of the maxillary anterior teeth and the inner contour of the lower lip in the posed smile\(^5,9\).

Consonant (Figure 6) – Optimal smile curve is described as consonant if the curvature of the maxillary incisal edges coincides with or parallels the border of the lower lip in smiling\(^10\).

Non consonant (Figure 7) – maxillary incisal edges are either flat or reversed relative to the curvature of the lower lip\(^3\).

Components of social smile should be visualized from four dimensions\(^11\) (Figure 8)

i) Frontal dimension - vertical
   Transverse

ii) Sagittal dimension

iii) Oblique dimension

iv) Time

i) Frontal dimension - To visualize and quantify the frontal smile, Ackerman and Ackerman\(^12,13\) developed a ratio, called as smile index which is described as the area framed by the vermilion borders of the lips during social smile.

Smile index= intercommissure width/ interlabial gap

a) Vertical component -

i) Incisal display - It depends on various factors described below-
   (a) Lip line
   (b) Upper lip length
   (c) Crown height

a) Lip line (Figure 9) - Amount of vertical tooth exposure in smiling. This variable depends on height of the upper lip relative to the maxillary central incisor. The Lip line is optimal when the upper lip reaches the gingival margin and total cervicoincisal length of maxillary central incisors is displayed\(^4\).

A High lip line exposes the gingival tissues whereas low lip line displays less than 75% of maxillary anterior teeth\(^14\). In males slight amount of gingival display is considered normal. With ageing, there is gradual decrease in exposure of maxillary incisors at rest accompanied by an increase in mandibular incisor display.

Average maxillary incisor display in males is nearly 1.91mm and it is twice the value in females. In males - 1.191 mm, in females - 3.40mm.

b) Upper lip length (Figure 10) - The average upper lip length is measured from subnasale to the inferior most portion of the upper lip at midline and it is nearly about 23mm in males and 20mm in females\(^15,16,17,18,19\) (Table 1).

Upper lip length is mainly related to maxillary incisors and commissures of the mouth should be roughly equal to the commissure height. In a youthful smile, 75% -100% of the maxillary central incisors should be positioned below an imaginary line drawn between the commissures.

Short lip length leads to unesthetic, reverse resting upper lip line but considered normal in adolescents because lip lengthening continues even after the vertical growth is complete\(^20\).

c) Crown Height (Figure 11) - The average crown height of maxillary central incisor is 10.6mm in males and 9.8mm in females\(^21\). A short clinical crown mainly contributes to inadequate tooth display and this may be due to excessive gingival encroachment or due to attrition. So, short clinical crown with a gingival smile should be corrected by gingivectomy or crown lengthening procedure\(^22\) with crestal bone removal. The attrited crown height can be increased incisally with cosmetic dentistry.

ii) Gingival display (Figure 11) - Gingival margins should be coincident with the margins of upper lip in social smile. Gingival margins of the canines should be co-incident with the upper lip and lateral incisors positioned slightly inferior to the adjacent teeth. A gingival smile is not as objectionable as gingival display with pleasing facial esthetics. Geron\(^23\) perceived the oral and smile esthetics with different gingival display, concluded that 1mm of upper gingival exposure at smile and speech was within in esthetic range.
Clinical implication -

a. Children show more tooth at rest and have more gingival display on smile than adults.

b. In patients with excessive gingival display main treatment, the objective is to reduce the gummyes in the smile. It can be done by intruding the maxillary incisors which in turn may improve the gingival display on smile. Ideally, Gingival margins should be coincident with the upper lip in social smile.

iii) Smile arc - This is the relationship between curvature of the incisal edges of the maxillary incisors, canines and lower lip. Ideally maxillary incisal edge curvature is parallel to the curvature of the lower lip creating a more youthful smile.

Clinical implication - Normally, orthodontic alignment of maxillary and mandibular arches may result in loss of curvature of maxillary incisors relative to lower lip curvature. Smile arc were found to be flatter in orthodontically treated patients than in an untreated group with normal occlusions, resulting in a denture mouth appearance.

So, it is very important to assess and visualize the incisor smile arc relationships and place brackets so as to extrude the maxillary incisors in flat smiles and to maintain the smile arc where it is appropriate. A set of formula for bracket placement based on tooth measurements is not appropriate for maximum esthetics.

The smile arc can get flatter during orthodontic treatment by any of the following methods (Figure 12) -

a) Overinclusion of maxillary incisors - To correct deep bite cases, if maxillary incisors are intruded without considering the incisor lip position at rest, the smile arc may be flattened which will increase the age of the patient.

b) Bracket positioning - The same bracket heights should not be used for parallel, flat and reverse smile arcs. In reverse smile arc, the bracket positioning on maxillary central incisors will be higher followed by progressive lowering on lateral incisors and canines.

II) Transverse dimension - The four transverse characteristics of the smile arc:

a) ARCH FORM
b) Buccal CORRIDOR
c) FRONTAL OCCLUSAL PLANE
d) DENTAL MIDLINE

Clinical implication - Generally exists in three forms narrow, ovoid and broad. Archform mainly affects the transverse dimension of the smile. A broad arch is more likely to fill the buccal corridors than narrow and constricted arch and so it is preferred by orthodontists.

Orthodontic expansion and widening of a collapsed archform can dramatically improve the smile by decreasing the size of buccal corridors and improve the transverse smile dimension. It is mainly related to the lateral projection of premolars and molars into the buccal corridors. When we achieve wider archform in premolar area, buccal corridor area gets filled but this arch expansion has two undesirable side effects - Obliterated buccal corridors leading to a denture like smile and smile arc may be flattened.

b) Buccal corridors - It is measured from the mesial line angle of the maxillary first premolars to the interior portion of the commissure of the lips. It is the lateral negative space between the posterior teeth and the corner of the mouth on smiling. Orthodontists refer buccal corridor as negative spaces to be corrected by transverse expansion of the arches.

Clinical implication -

(i) In adolescents, it is often desirable to increase arch width by RME to create space. Initially, these arch forms appear broader and might be considered excessive but with further maturation the transverse smile characteristics fit nicely and appear normal with the face. In adults, non extraction treatment with maxillary expansion does not necessarily improves the attractiveness of smile.

(ii) Buccal corridors are also influenced by the anteroposterior positioning of maxilla.

(c) Frontal maxillary occlusal plane- This can be due to

- Differential eruption - More vertical growth in the posterior maxilla than in the anterior could result in a different relationship between occlusal plane and the curvature of the lower lip during smile. So high pull headgear therapy keeps the maxillary posterior teeth superior to incisors. Thereby, maintaining or improving the smile arc.

- Skeletal asymmetry of the mandible resulting in a compensatory cant of the maxilla. With good visualization and documentation of tooth lip relationships, the orthodontist can make appropriate adaptations in appliance placement or make a decision.
as to the need for differential growth or dental eruption modification of maxilla in adolescents or surgical correction in the adults.

**Asymmetrical smile curtain** (Figure 14) -
Differential elevation of the upper lip during smile, gives the illusion of a transverse cant of maxilla. Smile asymmetry can also be assessed by the parallelism of the commissural and papillary lines. A large differential elevation of the upper lip in an asymmetric smile may be due to deficiency of musculature tonus on one side of face. Myofunctional exercises have been recommended to help overcome this deficiency and restore smile symmetry.

(d) **Dental midline** - Dental midline is an important focal point in an esthetic smile. The parallelism between the dental midline and facial midline is more important than coincidence between both dental midlines.

**II) SAGITTAL DIMENSION**-
(a) **OVERJET** - It is the amount of anterior maxillary projection. It is greatly influence smile characteristic both in sagittal and frontod dimension. In frontal dimension, excessive positive overjet is not as perceived as in sagittal dimension.

(i) **INCISOR PROCLINATION** - Flared maxillary incisors tend to reduce incisor display whereas upright incisors tend to increase it.

**Clinical implication** - Transverse smile dimension is a function of both arch width and anteroposterior position of the maxillary and mandibular arches.

When maxilla is retrusive wide portion of dental arch is positioned more posteriorly as related to anterior oral commissure, creating the illusion of greater buccal corridor in the frontal dimension. So after orthodontic compensation, as maxilla is advanced in to the buccal corridors, the negative space was reduced by the wider portion of the maxilla coming forward in to the static commissure width leading to decreased buccal corridor visibility.

III) **OBLIQUE DIMENSION - SMILE ARC** (Figure 15) -
This is the relationship between the curvature of the incisal edges of the maxillary incisors and canines and the lower lip. While recording the smile arc occlusal plane should be constant.

This view expands the definition of the smile arc to include the premolars and molars.

Ideally, maxillary incisal edge curvatures parallel to the curvature of the lower lip and create a more youthful smile.

**IV) TIME** -
Growth maturation and ageing of the perioral soft tissue have a profound effect on the appearance of smile. In preadolescents, soft tissue is still in growing phase, so treatment decision pertaining to profile must take growth into account. Adolescents have experienced the maximum velocity in growth and have roughly achieved their “adult look”. In adults, ageing of perioral and facial soft tissues becomes important.

From adolescents to adults there is:

- i) Lengthening of resting philtrum and commissure height.
- ii) Decrease in incisor display at rest and during smile.
- iii) Decrease in gingival display during smile.

**SMILE DESIGN** (Figure 16) - While designing a smile we the orthodontists must take the following points into consideration:

- Good lip support
- Proper arch width
- Well aligned and levelled beautiful individual teeth.
- Well levelled gingival tissue line.
- Optimal gingival exposure.

**Clinical implication** - In cases with high labial ectopic maxillary canines, when a continuous archwire is placed it will intrude the maxillary central and lateral incisors flattening the smile arc. So, one should plan segmental archwire technique to preserve the sweep of the smile arc.

**CONCLUSION:**
Designing a smile needs interdisciplinary approach (Periodontics, Restorative Dentistry, and Orthodontics) considering shape, size, color, position and degree of gingival display of anterior teeth. Smile analysis (Figure 16) and smile design generally involve a compromise between two factors that are often contradictory:

- i) The esthetic desire of the patient and orthodontist.
- ii) Patient’s anatomic and physiologic limitations.

Using digital video and computer technology, the clinician can evaluate the patients dynamic anterior tooth display and incorporate smile analysis into routine planning. This will help the orthodontist to assess various treatment options and select the most appropriate mechanism for optimal smile design. Some important points to be taken into consideration while planning a balanced and esthetic smile are:
i) Treating the occlusal plane in preadolescents with growth modifications (headgears etc).

ii) In adults surgical modification of the maxillary occlusal plane is often indicated.

iii) Bracket positioning is crucial to either maintain or modify the smile arc. At least 1-1.5 mm difference between central and lateral incisor bracket slot is needed to preserve or create consonant smile arc in contrast to the conventional bracket positioning in which 0.5 mm difference between central and lateral incisor bracket slot will create flattened smile arc. So careful bracket placement should also be done as related to the gingival margins will result in good alignment of gingival margins to the upper lip on smile.

Tooth morphology and enamel odontoplasty should also be taken into consideration.

Therefore for designing the optimal smile, treatment must be individualised so that patient's unique esthetic preferences can be incorporated.

**BIBLIOGRAPHY**


LEGENDS FOR FIGURES:

FIGURE 1: POSED SMILE

FIGURE 2: SPONTANEOUS SMILE

FIGURE 3: CUSPID SMILE

FIGURE 4: COMPLEX SMILE

FIGURE 5: MONALISA SMILE
FIGURE 6: CONSONANT SMILE

FIGURE 7: NON-CONSONANT SMILE

FIGURE 8: SMILE DIMENSIONS
UPPER LIP CURVATURE

LIP LINE

FIGURE 9: LIP LINE

FIGURE 10: LIP LENGTH

FIGURE 11: CROWN HEIGHT/ GINGIVAL DISPLAY

FIGURE 12: BRACKET POSITIONING AND CHANGE IN SMILE ARC
Table 1

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<tr>
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