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Smile esthetics in orthodontic: A review article

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Abstract

In orthodontic treatment, esthetics has traditionally been associated with profile enhancement. Both the Angle classification of malocclusion and the cephalometric analysis have focused attention on the profile, without considering the frontal view. Even though patients come to us mainly to improve their smiles, the orthodontic literature contains more studies on skeletal structure than on soft-tissue structure, and the smile still receives relatively little attention. An attractive, well-balanced smile is a paramount treatment objective of modern orthodontic therapy. Extensive studies on facial features have resulted in the establishment of norms that orthodontists use as guidelines to evaluate facial forms and to direct therapy. Knowledge of the influence of orthodontic treatment on smile attractiveness is very important, and recently, some smile components such as midline position, axial midline angulation, buccal corridor, and smile arc have received greater attention.

Keywords: esthetic, orthodontic, malocclusion

Introduction

A smile is a curve that sets everything straight". Smile is one of the most important facial expressions and is essential in expressing friendliness, agreement, appreciation. Smile analysis and design have become key element in orthodontic diagnosis and treatment planning over the last decade [1]. Often the demand for esthetics motivates the patient to seek treatment [2]. The discipline of esthetics in orthodontics can be broken down into at least four parts: microesthetics (the elements that make teeth look like teeth), gingival esthetics, macroesthetics (the principles that apply when groupings of individual teeth are considered), and facial esthetic [1].

An attractive, well-balanced smile is a paramount treatment objective of modern orthodontic therapy. Extensive studies on facial features have resulted in the establishment of norms that orthodontists use as guidelines to evaluate facial forms and to direct therapy [3]. For a long time, orthodontic treatment was primarily based on occlusal relationship results. Currently, modern orthodontics also requires a harmonious balance between soft tissues and occlusion. The influence of smile attractiveness components is important because it allows the professional to identify the hierarchy of esthetic preference. Therefore, knowledge of the influence of orthodontic treatment on smile attractiveness is very important, and recently, some smile components such as midline position, axial midline angulation, buccal corridor, and smile arc have received greater attention [4].

The Ideal Smile

A true smile is a complex gesture. It is one of the most effective means by which people convey their emotions [5]. The ideal smile is also associated with perceived good health and success. A dentition free of inflamed gingiva and calculus deposits, together with the absence of discolored unsightly teeth and fractured restorations, portrays an image of good self-care. Ruelkellerman found that people with well-aligned teeth were perceived to be more conscientious, sincere and loyal [6].



Fig 1: Ideal Smile

Anatomy Of Smile: The smile is apparently formed in two stages- The first raising the lip to the nasolabial fold and the second further raising of the lip and the folds by three muscle group [7]. The perioral musculature can be classified into three groups:

- Group I muscles: Buccinator, orbicularis oris, levator anguli oris, depressor anguli oris, risorius, zygomaticus major
- Group II muscles: Levator labii superioris, levator labii superioris alaeque nasi, zygomaticus minor
- Group III muscles: Depressor labii inferioris, mentalis, platysma.

Group I muscles insert into the modiolus, Group II muscles

inserted into the upper-lip, and Group III muscles insert into lower-lip.

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 which insert into the modiolus of the orbicularis oris at each corner of the mouth.

The soft-tissue determinants of the display zone are lip thickness, interlabial gap, intercommissure width, smile index (width/height), gingival architecture [8].

Classification Of Smile: Many authors have classified smile into different types:

e.g. **Ackerman *et al*** classified smile into two basic types:

- **The social smile/posed smile** which is reproducible, voluntary: The lips part due to moderate muscular contraction of the lip elevator muscles, and the teeth and sometimes, the gingival scaffold are displayed.
- **The enjoyment smile/unposed smile/Duchenne smile:** is an involuntary smile and is elicited by laughter or great pleasure and results from maximal contraction of the elevator and depressor muscles causing full expansion of the lips, gingival show, and maximum anterior tooth display [8].



A.



B.

Fig 2: A. Posed smile, B. Unposed smile

Peck and Pecks classified it as

- Stage I-Unforced Smile
- Stage II-Forced Smile [7].

Tjan classified smile into:

- High smile where complete length of incisors is exhibited

along with some amount of gingival display.

- In average smile, 75–100% of upper incisors and interdental papilla is displayed
- In low smile line, <75% of the maxillary incisors in the full smile is displayed [8].



A.



B.



C.

Fig 3: A. High smile, B. Average smile, C. Low smile

Age Related Changes In Smile Dynamics: With age, females were found to undergo a gradual and consistent increase in lip length. Of greater significance are the changes

that the perioral musculature undergoes in the dynamic state, ie, during the process of producing a smile. The change in upper lip length (lip elevation) and upper lip thickness from

rest to smile are measures that give an insight into the inherent activity of the facial muscles involved in raising the perioral musculature when smiling. The upper lip elevation from rest to smile showed marginally significant decrease with age (decreased by 0.74 mm).

The observed pattern of change can be attributed to two factors

- a. Loss of resting tonicity of perioral muscles that support and maintain the length of the upper lip (levator labii superioris alaeque nasi, levator labii superioris, incisus labii superioris, zygomaticus major, and zygomaticus minor), reflected by the lip lengthening at rest and evident at a later age.
- b. Decrease in the muscles' ability to raise the upper lip due to reduced function of lip musculature, as depicted by reduced lip elevation and smiling lip length. Loss of function apparently begins at an early age [9].

The male population exhibited slight variation in the pattern of change in lip length with age. The reduction in resting tonicity and muscle activity present at a later age in males, unlike females, where function is affected early [9]. Loss of function, together with increased resting upper lip length, contributes greatly to the aged look of maxillary anterior teeth hidden by the upper lip during a smile. A comprehensive lip/smile analysis should be undertaken to evaluate the effect on incisor display in the static as well as dynamic state before considering possible treatment options.

Intrusion of anterior teeth for management of deep bite malocclusion in different age groups should be planned with care. Intrusion in the upper arch may be preferred in younger individuals for bite correction. However, for adult patients especially males beyond the third or fourth decade of life, since there is a natural tendency for reduced maxillary incisor display, further intrusion may adversely affect smile esthetics. In such situations, intrusion of mandibular anteriors may be the better treatment option without compromising smile esthetics.

Mandibular incisor display increases non significantly with age for both the sexes, drawing attention toward mandibular midline considerations in adult patients.

For moderate anterior crowding cases, single mandibular incisor extraction may sometimes be the preferred treatment approach. However, in adult patients proximal reduction of incisors should be considered to maintain the mandibular midline for optimizing esthetics.

Apparently, the intrinsic fibers of lip musculature that are responsible for maintaining the thickness of lip must be affected, resulting in thinning of lips. However, females did not show appreciable change in lip thickness, implying that the intrinsic fibers of lip musculature are little affected by the aging process in females [10].



Fig 4: Age changes in vertical incisor display with relaxed lips, demonstrated by female patients aged 25 years (A and C) and 65 years (B and D). Note that the younger woman shows only maxillary incisors, whereas the older woman shows only mandibular incisors.

Measurement of Smile Characteristics: Smile characteristics can be measured in the following way

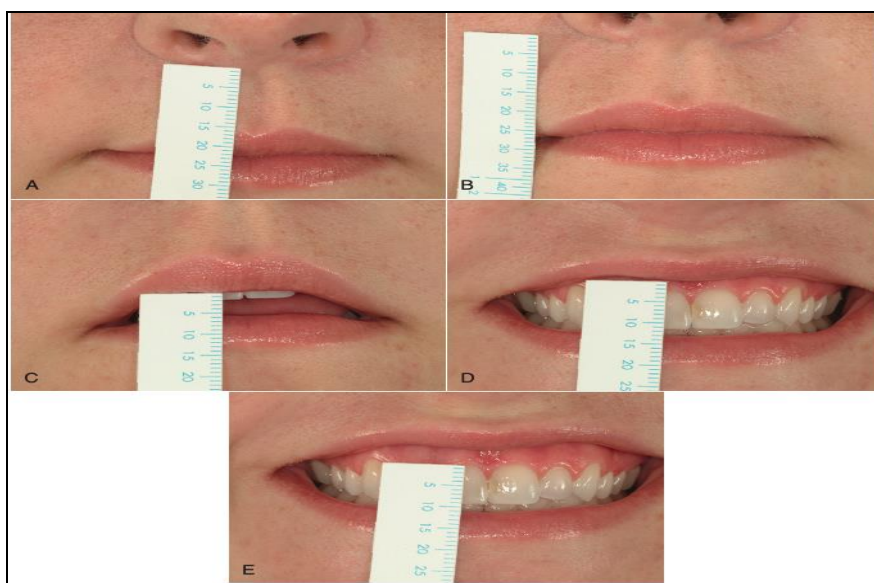


Fig 5: **A:** Philtrum height is measured from the base of the nose to the most inferior portion of the upper lip. **B:** Commissure height is measured from the alar base to the outer commissure of the lips. **C:** Incisor display at rest is an important measurement because it reflects the “relative age” of the patient. **D:** Incisor display and gingival display are recorded within the framework of the smile. In cases of incomplete incisor display on smile, the amount of incisor displayed is measured. In this same patient, crown height is also recorded because the entire crown is visible on smile. **E:** The smile arc, defined as the relationship of the curvature of the incisal edges of the maxillary teeth to the curvature of the lower lip, is evaluated in the posed social smile.[11]

Protection of Smile Arc: In an optimal smile arc described as “consonant”—the curvature of the maxillary incisal edges coincides with or parallels the border of the lower lip in smiling [12]. Smile arcs were found to be flatter in orthodontically treated patients than in an untreated group with normal occlusions, resulting in a “denture mouth” appearance [13].



Fig 6: Flattening of the smile arc after orthodontic treatment

The smile arc can be unintentionally flattened during orthodontic treatment by any or all of the following three techniques:

- **Overintrusion of Maxillary Incisors:** If the maxillary incisors are overintruded to correct an overbite or a gingival smile without considering or monitoring the incisor-lip position at rest, the smile arc may be flattened. Indiscriminate use of utility arches or archwires with accentuated curves can not only flatten the smile arc, but can also result in a low lip line at rest and in smiling, which ages the patient as described above [14]. Indiscriminate use of utility arches or archwires with accentuated curves can not only flatten the smile arc, but can also result in a low lip line at rest and in smiling, which ages the patient as described above [15].
- **Bracket Positioning:** The same bracket heights should not be used for parallel, flat, and reverse smile arcs. If optimal smile arc esthetics are to be achieved, the bracket positions must take into account the relationship of the incisal edges to the lower lip curvature for each individual patient.^[16] In a reverse smile arc, for example, the brackets should be positioned higher than usual on the maxillary central incisors and progressively lower on the lateral incisors and canines [15].
- **Cant of the Occlusal Plane :** Extraoral forces, intermaxillary elastics, and orthognathic surgery can affect the cant of the occlusal plane. If the maxillary occlusal plane is canted upward anteriorly, for instance, the incisal edges will move away from the lower lip, resulting in a nonconsonant smile arc. Conversely, if the occlusal plane has an excessive clockwise tilt, the upper incisal edges will be covered by the lower lip, making the smile arc less attractive. Other factors that can affect the smile arc are attrition due to shortening of the central incisors, habits such as thumb sucking, excessive posterior vertical growth (mostly seen in brachyfacial patterns), and the lower lip musculature [17]. Maxillary incisor inclination affects not only the lip line, but the smile arc as well, when the curvature of the incisal edges does not coincide with the border of the lower lip in smiling. Excessively proclined incisors will be associated

with an everted lower lip, whereas uprighted or retroclined incisors will be partially covered by the lower lip [15].

Clinical Guidelines For Improving Smile Esthetics

Vertical Dimension

The following guidelines are recommended to obtain an optimally esthetic tooth display in normal conversation and on smiling:

- Study the patient's dentition directly from the front to make a reliable esthetic evaluation. With the patient in the dental chair, move the patient's head to the side of the headrest, which allows an "eye-to-eye" perspective.
- Routinely take extraoral photographs with the lips at rest before and after treatment to record the maxillary incisor display. A short video that shows the patient speaking and smiling joyfully is helpful to record the spontaneous gingival display.
- Provide a curve of the maxillary incisors that is parallel to their inner contour of the lower lip on smiling. This is generally achieved by making the maxillary central incisors 0.5-to1.5-mm longer than the lateral incisors.
- Avoid actively intruding the maxillary incisors when the pre-treatment vertical position is normal for the patient's age. Do not over intrude and hide the maxillary incisors behind the upper lip.
- Establish an age-appropriate vertical incisor display in rest position and normal conversation for each orthodontic patient [17].

Midlines

A vertical line from nasion to the base of the philtrum may be the most practical guide to locate the facial midline.

A precise dental midline coincident with the facial midline is not necessary for optimal esthetics. Moderate maxillary midline deviation is acceptable to most persons as long as the central incisor crown angulation is not significantly canted. Securing optimal connector areas between the maxillary anterior teeth according to the 50-40-30 rule is useful for esthetic smile design. The connector area between the two maxillary central incisors should be long (approximately half of their clinical crown lengths), vertical, and parallel to the facial midline. The mandibular midline is less important for esthetics.

Transverse Dimension

The most desirable and esthetic crown inclinations are not evidence-based but the following clinical recommendations are useful: Provide an individualized, esthetic, symmetrical labio- lingual crown inclination of canines and premolars for each patient.

Crown inclination asymmetries between contralateral canines and premolars in the right and left side of the mouth in the same patient are common. They must be (1) recognized early in treatment by studying the dentition from the front and (2) intentionally corrected by archwire torquing (or possibly by custom-made bracket torque prescriptions). Otherwise, the finished result will be asymmetrical with regard to clinical crown inclination. The terminal teeth shown on smiling should be straight to provide smile fullness. In about 90% of cases, the terminal teeth will be the maxillary first or second premolars.

A smooth, gradual front-to-back tooth display curve laterally provides harmony and beauty to the treatment result. Any disruption will reduce the esthetic outcome.

Avoid tipping the mandibular canines, premolars, and molars lingually during the orthodontic treatment. The secret to excellence in orthodontics is to learn to see important details in the dentition as they occur before, during, and after treatment^[17].

Conclusion

The special considerations in orthodontic diagnosis and treatment planning represent the new vistas in orthodontics that reflect the incorporation of artistic elements into our decision-making process. Many of our decisions are now based on proportions, not linear measurements. Shape and form are now important features of contemporary treatment planning, and draw on the talents of the orthodontist to “see” and establish the goals of treatment in terms of health, wellness, and appearance.^[17] An optimal smile is characterized by an upper lip that reaches the gingival margins, with an upward or straight curvature between the philtrum and commissures; an upper incisal line coincident with the border of the lower lip; minimal or no lateral negative space; a commissural line and occlusal frontal plane parallel to the pupillary line; and harmoniously integrated dental and gingival components^[16].

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