

SMILE ESTHETICS-A REVIEW

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ABSTRACT

Physical attractiveness is an important social issue and the face is one of its key features. An attractive smile in modern society is often considered an asset in interviews, work settings, social interactions and even the quest to attract a mate. Improvement in facial esthetics is also a powerful motivation for seeking treatment; therefore, orthodontic treatment should carefully consider a patient's facial appearance and particularly his or her smile. The esthetic considerations are paramount in treatment planning; however rigid rules cannot be applied to this process because of an infinite variety of faces could be esthetically pleasing. There are two forms of smiles—the enjoyment or Duchenne smile and the posed or social smile. The posed smile is voluntary and not elicited by an emotion. In other words, it is reliably reproducible and can be sustained. The various aspects of smile anatomy are the degree of maxillary anterior tooth display (Morley's ratio), upper lip drape and gingival display, buccal corridor, smile arc etc. In a youthful smile, most of the maxillary central incisors should be positioned below an imaginary line drawn between the commissural lines. A perusal of the literature reveals that various vertical skeletal patterns present with their characteristic dento-skeletal and soft tissue features. A few studies reported that smile characteristics change with changing vertical skeletal dimensions. This article presents the concepts of various smile parameters and how they relates to orthodontics—from the recognition of their importance and their impacts on orthodontic treatment planning, to how procedures and mechanics are adapted to optimize the appearance of the smile.

Keywords: Maxillary incisor display, Buccal corridor, Gingival Exposure, Smile arc

INTRODUCTION

Facial esthetics has been an objective of orthodontic treatment planning since the beginning of this specialty. The period of cephalometric dominance continued in which esthetics was defined primarily in terms of the profile as measured on a lateral cephalogram and clinical examination was secondary¹.

By the end of the 20th century the soft tissue paradigm continued to expand and resulted in a paradigm shift in the field of orthodontics, placing greater emphasis on the clinical examination of soft tissue pattern, function and esthetics².

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Improvement in facial esthetics is also a powerful motivation for seeking treatment. Therefore, orthodontic treatment should carefully consider a patient's facial appearance and particularly his or her smile⁴

There are two forms of smiles—the enjoyment or Duchenne smile and the posed or social smile⁵. The posed smile is voluntary and not elicited by an emotion. In other words, it is reliably reproducible and can be sustained⁶. Posed smiles, therefore have importance in orthodontic diagnosis and treatment planning. The vertical aspects of smile anatomy are the degree of maxillary anterior tooth display (Morley's ratio), upper lip drape and gingival display. In a youthful smile, most of the maxillary central incisors should be positioned below an imaginary line drawn between the commissural lines.⁷

Racial, regional and cultural variations play a significant role in influencing any study on facial form and smile analysis⁸, and at present there are very few studies of the same on the Indian population^{9,10}.

The smile plays an important role in orthodontic diagnosis and treatment planning. Smile is a representation of the dynamic relationship of peri-oral soft tissue with underlying skeletal and dental components. Many studies have reported age related variations as well as sexual dimorphism in smile characteristics.

There are some important parameters to evaluate smile characteristics.

MAXILLARY INCISOR DISPLAY: Leonardo da Vinci described the importance of the strongly movable section of the face around the mouth and chin in determining facial expression emphasizing the importance of observing the face in animation as well as in the static state. One of the most important facial aesthetic parameters is maxillary incisor display (the amount of vertical display of the maxillary right central incisor on posed smile). The vertical exposure of the maxillary incisors in relation to the upper lip at rest should be 2 – 4 mm, and on a youthful smile most of the maxillary central incisors should be positioned below an imaginary line drawn between the commissural lines¹¹



Figure 1 maxillary incisor display

Bhavna Singh et al.¹², Balani et al.¹³ & peck et al.¹⁴ showed that a significant sexual dimorphism was found in the vertical lip-tooth-jaw relationship with higher prevalence of maxillary incisal display on smiling in female individuals.

Whereas, Grover et al.⁹ & P.Tandon et al.¹⁰ found that maxillary incisor display on posed smile was more in males in comparison to females in normo & hyper-divergent groups, Weeden et al.¹⁵ demonstrated that males had greater facial movement than females thus increasing inter-labial gap on smiling.

In a study done by Mc Namara et al.¹⁶ found that the maxillary right central incisal display on smiling could not be correlated to the skeletal vertical dimension, whereas the vertical thickness of the upper lip had a significant positive correlation with the position of the maxillary incisor.

BUCCAL CORRIDOR:

The buccal corridor or 'negative space' is the space revealed between the buccal surface of the posterior teeth and the commissures of the lips when a person smiles. The presence of dark buccal corridors (excessive lateral negativespace) may be due to the following causes:

1. Transverse narrowing of the maxilla, especially in the premolar region
2. Palatal inclination of the maxillary posterior dentition
3. Retropositioned maxilla



Figure 2 Right & left buccal corridor

Normal values for inter - commissure distance (i.e. mouth width) in repose have been provided by Farkas: Male: 55 ± 3 mm, Female: 50 ± 3 mm. Rigsbee et al.¹⁷ demonstrated that, in an 'attractive' smile, the mouth increased to 130% of its original width. There is likely to be considerable individual variation in the degree of increase in inter - commissure distance in smiling. The greater this increase, the greater the potential for lateral negative space in smiling.

Grover et al.⁹ and Maulik and Nanda¹⁸ who found that females had less buccal corridor space than males.

Buccal corridor was found to be higher in hypo-divergent growth pattern and least in hyper-divergent growth pattern group for both male & female subjects. Yang et al.¹⁹ showed that FMA & lower anterior facial height was negatively correlated with buccal corridor space. Tripti et al.²⁰ showed buccal corridor is influenced by dental structures & soft tissue structures rather than underlying skeletal hard tissues. Srinivas et al.²¹ found that the percentage of the buccal corridor width and the total smile width does not change along with change in the facial form.

AMOUNT OF GINGIVAL EXPOSURE:



Figure 3. Amount of gingival exposure

Gingival display and the relative relationship of the upper and lower anterior teeth have an absolute effects on smile esthetics.²² It has been stated that the esthetically ideal amount of visible gingiva during smiling is about 1 mm, although 2 to 3 mm of gingival display might be esthetically acceptable.²³ The amount of esthetically acceptable gingival display during smiling can vary widely, but the relationship between gingival display and incisor show at rest is important.²⁴

Excessive gingival display (more than 3 mm) with smiling is often more esthetic than a smile with less tooth display.²⁵ A high smile line have been attributed to short philtrum height, short incisor crown height, and mild vertical maxillary excess. Several investigators reported that female patient had greater gingival display with smiling compared to male patients,²⁶ this can be because males generally have longer upper lips than females.⁶

Miron H et al.²⁷, Osama Al-Jabrah, et al.²⁸ & Peck et al.¹⁴ in their study showed that women were more prone to display gingiva in smiling. peck et al.²⁹ in their study showed that the biologic mechanism underlying the gingival smile line was related to anterior maxillary height and the muscular ability to raise the lip on smile.

SMILE ARC:

The *smile arc* is defined as the relationship of the curvature of the incisal edges of the maxillary incisors and canines to the curvature of the lower lip in the posed smile. The ideal smile arc has the maxillary incisal edge curvature parallel to the curvature of the lower lip.

Evaluation of anterior smile esthetics must include both static and dynamic evaluations of profile, frontal, and 45° views to optimize both dental and facial appearance in orthodontic planning and treatment.



Figure 4. Consonant Smile arc

Determination of smile arc highly depended on head posture³⁰ thus every attempt was made to keep the subjects apparent occlusal plane parallel to the floor and camera. P.Tandon et al.¹⁰, in their study they showed a flat smile arc was more frequently observed in the horizontal pattern with males (66.7%) and females (60%). Rajesh Balani et al.¹³ & Nanda et al.³⁰ showed that consonant smile arc was noted more frequently in females, while males displayed flat smile arc commonly.

A high frequency of flat smile arcs in the hypo-divergent skeletal pattern group may be attributed to inherent brachycephalic growth patterns that may lead to flat smile arcs. Patients with this skeletal pattern might, theoretically, have a tendency for the anterior maxilla to lack the clockwise tilt needed for an ideal smile arc; in some cases it might even exhibit a counterclockwise tilt that results in a flat smile arc⁶

In a study Ackerman and Ackerman³¹ concluded that two factors that contribute to the appearance of the smile arc are the arch form and sagittal cant of the maxillary occlusal plane. The broader the arch form, the less the curvature will be of the anterior segment and the greater the likelihood of a flat smile arc, which may explain the greater frequency of flat smile arcs in hypo-divergent group seen in various studies.

According to various studies, Orthodontically treated patients show a greater frequency of smile arc flattening³² due to over intrusion of maxillary incisors³³, use of same brackets height for all patients⁶ or the cant of occlusal plane, which in-turn can be caused by use of extra-oral forces, inter-maxillary elastics and orthognathic surgery. Therefore the treatment plans should be accommodates with varying facial patterns. Studies have shown that patients with a horizontal skeletal pattern are more prone to smile arc flattening^{3,31} therefore the clinician needs to be extra-cautious during incisor intrusion in such patients. An increase in the cant of the maxillary occlusal plane to Frankfort horizontal plane in clock wise direction will increase the maxillary anterior teeth display, and it improves the consonance of the smile arc. Sufficient efforts should be given to create consonant smile arcs, such as careful planning of incisor intrusion, individualized bracket positioning and controlling the cant of the occlusal plane by the appropriate use of extra oral forces.

SUMMARY AND CONCLUSION:

The smile plays an important role in orthodontic diagnosis and treatment planning. From a clinical standpoint it is important to evaluate a smile in three dimensions during diagnosis and treatment planning for the individuals, as smile is a three dimensional facial expression. Thus it can be concluded that different facial patterns exhibit different characteristics of the smile.

Vertical facial pattern have increased vertical dimensions (incisal exposure & gingival exposure), decreased transverse smile dimension (buccal corridor) and an opposite trend is seen in hypo divergent facial patterns on smiling. Vertical smile parameters (incisal exposure & gingival exposure) exhibited greater values in females,

The consonant smile arc was more prevalent in normo and hyper-divergent group for both genders and flat smile arc was more prevalent in hypo-divergent group for both sexes. Therefore, the clinician needs to be extra-cautious while formulating the treatment plan for such hypo-divergent facial pattern.

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