ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 11, Issue, 03, pp.2572-2574, March, 2019

DOI: https://doi.org/10.24941/ijcr.34913.03.2019

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

SMILE DESIGNING PARAMETERS IN ORTHODONTICS

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ARTICLE INFO

Article History:
Received 03rd December, 2018
Received in revised form
20th January, 2019
Accepted 14th February, 2019
Published online 31st March, 2019

Key Words:
Smile Designing, Smile Arc,
Buccal Corridors.

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ABSTRACT

Smile is an important constituent of one's own aesthetics and orthodontist plays a crucial role in enhancing it. Redefining the facial skeleton has been the area of interest among orthodontist from past three decades and achieving an ideal smile is of primary concern in planning any treatment as a beautiful smile not only enhance the beauty of the face but also increase the social acceptance of a well being.

***Citation*: *Dr. Garvita Dubey, Dr. Ashish Gupta, Dr. Gaurav Sharma, Dr. Gaurav Arya and Dr. Suresh Sharma,* 2019.** "Smile designing parameters in orthodontics", *International Journal of Current Research*, 10, (03), 2572-2574.

INTRODUCTION

From the past three decades, interest in esthetics among Orthodontists, Medical Professionals and the general population has increased dramatically and will certainly continue to rise (Nanda, 2005). The 18th century philosopher Alexander Baumgarten coined the term, "esthetics" which is derived from the Greek word, "aesthesis", which connotes sensory perception of beauty and the beautiful (Naini, 2006). Orthodontics plays a crucial role in enhancing facial esthetics of an individual. The contours of the face depict the underlying facial skeleton and inevitably affect the facial soft tissues. There has been a transition in Orthodontic diagnosis and treatment planning towards the soft tissue paradigm in which the primary goal of treatment is to obtain best possible adaptation and proportions of soft tissues of face and mouth and the secondary goal is functional dental occlusion (Proffit, 2007). One of the major goals of Orthodontics is to enhance anterior tooth display during speech and smiling. Mini and Micro Esthetics (Table1) in Orthodontics are the considerations carried out during and at the end of orthodontic treatment to enhance the cosmetic appearance by improving the smile of the patient (Proffit, 2003).

Mini Esthetics Consideration

Smile: attractiveness is defined more by the smile than by the soft tissue relationships at rest. Smile is a very important and positive social behaviour for human beings. Studies have shown that infants moods and responses to the environment can be influenced by parent's smiles. Also recent research with functional magnetic resonance imaging (FMRI) technology suggests that adults actually respond neurologically to an attractive and happy face as if it were a reward stimulus (Duchene De Boulogne). Smile has been classified into many different ways, few are mentioned below: Smile types involving different anatomic presentation of the elements of the display zone can be classified as: Social smile / posed smile and Enjoyment smile / unposed smile. Social smile / posed smile: The social smile is reproducible and is the one that is presented to the world routinely. It is voluntary, unstrained and has static facial expression (Ackerman, 2002). Posed smile does not demonstrate emotions, is highly variable, and is not reproducible. Facial muscles surrounding eyes do not contract in social smile. Enjoyment smile / unposed smile: This is an emotional smile which varies with the emotion being displayed. Involuntary, Dynamic, Natural and expresses authentic human emotions. Unposed smile shows crinkling around eyes as orbicularis oculi contract and corners of the mouth are usually brought upward and backward. Social smile is the focus of orthodontic diagnosis. Smile types depending on Incisor and gingival display has been distinguished into 3 type by Anthony H. Tjan in 1984 (Tjan, 1984).

- Low incisor display
- Average incisor display
- High incisor display

Low→ Less than 75% of maxillary incisor is displayed during a full smile. This type is seen in 20% of the population and is not an attractive characteristic of smile. Average→ Most frequent type of incisor display. Seen in 70% of young adults Population and reveals 75-100% of upper incisors display. More tooth display gives a more feminine and youthful smile (Zarricson, 1998). High (Gummy Smile)→ Reveals the complete cervicoincisal length of upper incisors with a contiguous band of gingiva, seen in 10% of population. Dental professionals consider a "gummy smile" as undesirable, but some gingival display is certainly acceptable, and is even considered a sign of youthful appearance. A gummy smile is often more esthetic than a smile with diminished tooth display. Gummy smile is usually greater with younger age group which lessens as the person grows older thus decreasing the incisor and gingival display during rest and smile. This is because as age advances upper lip coverage tends to increase (Sarver, 2003).

Table 1. Consideration of Mini and Micro Esthetics

Mini Esthetics consideration Includes:	**Micro Esthetics Consideration Includes:**
1. Smile types	1. Tooth proportions
2. Smile arc	2. Connectors area and embrasures
3. Buccal corridors	3. Tooth shade and color
	4. Gingival height, shape and contours

If the tooth display is inadequate, elongating the upper teeth improves the smile, makes patient look younger. This can be achieved by extrusion mechanics with arch wires, judicious use of class II elastics to take advantage of their tendency to rotate the occlusal plane down anteriorly and anterior vertical elastics. In patients with maxillary deficiency rotating the maxilla down in front as it is advanced surgically can improve smile esthetics. The amount of proclination of maxillary incisors can affect how much they are displayed at rest and on smile. Flared max incisors tend to reduce incisor display and upright maxillary incisor tend to increase incisor display. Smile arc (Smile curve): Smile arc is defined as the relationship of the curvature of the incisal edges of maxillary anterior teeth to the curvature of the lower lip during a social smile (Sarver, 2001).

Smile arc can be of 3 types

- Parallel (Consonant) smile arc
- Straight (flat) smile arc
- Reverse smile arc

The parallel smile arc has the curvature of the maxillary incisal edges parallel to the curvature of the lower lip upon smiling and the term consonant (ideal) is used to describe this parallel relationship. Goldstein[11] referred the consonant smile as "youthful smile". A nonconsonant, or flat smile arc is characterised by the maxillary incisal curvature being flatter than the curvature of lower lip during smile. Reverse smile arc is the one where canines are lower than the incisors in the maxillary arch and the arc formed by the maxillary anterior teeth is reverse in relation to lower lip curvature during smile.
The characteristics of the smile arc must be monitored during orthodontic treatment because it is surprisingly easy to flatten during orthodontic treatment procedures. Obtaining and maintaining a proper smile arc requires proper bracket positioning during orthodontic treatment.

The traditional guideline for placing brackets is based on measurements from the incisal edge, so that the central incisor brackets are placed at the middle of the clinical crown, lateral incisor, 0.5mm closer to incisal edge and canine at the same level as central incisors. Flat smile arcand reverse smile arc can be improved by placing the central incisor brackets more gingivally or by giving a step bend in the archwire, to bring about extrusion of maxillary incisors (Sarver, 2001).

Buccal Corridors: Buccal corridors refers to the distance between the maxillary posterior teeth (especially premolar) and the inside of the cheek. This is of interest to Prosthodontists and more recently to Orthodontists. This was first introduced by Frush and Fisher (Frush, 1958), which defines the transverse dimension of the smile and is referred to in terms of "broadness of the smile". Excessively wide buccal corridors have been referred to as "negative space", which can be reduced orthodontically by transverse expansion of the maxilla. Esthetically, a broad smile is considered to be more attractive than a narrow one, but too broad a smile with no buccal corridor is also unesthetic.[12]

Micro esthetic consideration

Tooth Proportions: a) Width relationship: An illustration of golden proportion shows that the ideal tooth width proportions from the frontal view is: 1.618:1.0:0.618. In an attractive smile, the apparent width of the lateral incisor is 62% of the width of Central incisor, width of canine is 62% of the width of lateral incisor and1stpremolar is 62% of the width of canine (Naini, 2006). The apparent width of maxillary anterior teeth on smile and their actual mesio-distal width, differ because of the curvature of dental arch. This recurring 62% proportion also appears in other relationship in human anatomy and is known as Golden Proportions.[2] It is an excellent guideline in day to day practice in finishing cases when lateral incisors are disproportionately small or are missing. b) Height /width relationship: The width of tooth should be 80% of its height. If the height is less or width is more the tooth appears squarish. If the height is more and width is less, tooth appears tapered. Extensive changes in tooth proportions are needed when one tooth is to substitute for another and the most frequent is the substitution of maxillary canine for congenitally missing lateral Incisor (Sarver, 2004).

Connector area and embrasures: Morley and Eubank recently introduced the term connector area as a useful tool and a visual goal to optimize smile esthetics in dental patients.[14] Connector areas are broader, larger areas than the contact points between teeth and can be defined as the zone in which two adjacent teeth appear to touch. The most esthetic relationship of connector area between the maxillary anterior teeth is referred to as the 50-40-30 rule.[13] This rule defines the ideal connector area between the two maxillary central incisors as 50% of their clinical crown length, the ideal connector area between central and lateral is 40% of central incisor clinical crown length and between lateral and canine it is 30% of clinical crown length of central incisor. The most important connector area is the one between two maxillary central incisors and should be maintained in orthodontically treated cases. The embrasures (the triangular spaces incisal and gingival to the contact) ideally are larger in size than the connectors and the gingival embrasures are filled by the interdental papillae. Short interdental papillae leave an open gingival embrasure above the connectors called "black

triangles" which give an unesthetic appearance of the teeth during smile (Sabri Roy, 2005). In adults, they arise due to loss of gingival tissue but when crowded and rotated maxillary incisors are corrected orthodontically, the connectors move incisally and black triangles may appear. Reshaping of teeth by orthodontic root paralleling and flattening of the mesial surfaces of the central incisors, followed by space closure, will lengthen this contact area and move it apically toward the papilla and correct the black triangles (Sabri Roy, 2005).

Tooth Shade and Color: Aging brings about changes in the tooth color and shade. In Young age teeth appear lighter and brighter. As age advances the teeth appear darker and duller. This is due to the formation of secondary dentin as pulp chambers decrease in size and thinning of enamel leads to decrease in its transparency and a greater contribution to darker shade (Sarver, 2005). A normal progression of shade changes from midline posteriorly is an important contributor to an attractive and natural appearing smiles. The maxillary central incisors tend to be the brightest in a smile, lateral incisor less bright and canines the least, 1st and 2nd premolar are lighter and brighter than the canines and closely match lateral incisors.

Gingival height, shape and contours: Proportional gingival height is necessary to produce a normal and attractive dental appearance. The central incisor has the highest gingival level, lateral incisor is 1.5 mm incisal and canine is at the same level as central incisor. A difference of more than 2 mm in the gingival height is obvious. This is important in finishing all orthodontic cases and also when tooth substitutions are planned. Gingival shape refers to curvature of gingiva at the margin of the tooth (Sarver, 2004). According to the criteria for the American academy of Cosmetic Dentistry "The shape of maxilllary lateral Incisor and mandibular incisors is symmetrical and half oval. Shape of maxillary centrals and canines are more elliptical and asymmetric".[15] Gingival Zenith is the most apical point of gingival tissue and should be located distal to the longitudinal axis of maxillary centrals and canines while zenith of maxillary lateral and mandibular incisor should coincide with their long axis (Sarver, 2005). Correcting the gingival contours removes the excess gingival covering the clinical crowns and helps improve display of teeth and improves gingival contours and shape. This is carried out with gingivectomy procedure. Gingival contouring can now be carried out effectively with the use of a diode lasers. These concepts of smile esthetics are not new, but are too often overlooked in orthodontic treatment planning (Bansal, 2015).

In summary, an optimal smile is characterized by an average incisor display, consonant smile arc with minimal lateral negative space and harmoniously integrated dental and gingival components (Bansal *et al.,* 2015).

Conclusion

The major goal of orthodontic treatment for the great majority of patients in recent years is dental and facial esthetics. This goal is not "just cosmetic". It reflects the patients' desire to enhance their social acceptability and eliminate discrimination based on appearance, which greatly affect their quality of life.

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