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International Journal of Current Research
Vol. 7, Issue, 12, pp.24746-24750, December, 2015

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

SMILE DESIGN: ASSESSMENT AND CONCEPT

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ARTICLE INFO

Article History:
Received 24th September, 2015
Received in revised form
10th October, 2015
Accepted 25th November, 2015
Published online 30th December, 2015

Key words:

Ad-hoc connection,
P2P MAC,
Group Owner,
Peer-to-peer connection.

ABSTRACT

Background: The concept of smile design represents complex interaction between skeletal, dental and soft tissue structures of the face. Facial appearance of an individual's smile is net interaction of these components. **Aim:** Purpose of the study is to highlight traditionally accepted smile design concepts with additional newer parameters incorporated in the esthetic treatment of the patients. **Methods:** Literature search was carried out by using various search engines (Pubmed, Google scholar, EBESCO) and articles reporting general facial analysis, dento-facial analysis, dento-labial analysis, dento-gingival analysis and dental analysis were appraised.
Conclusion: Smile design is an individualized concept requiring consideration of many parameters. Therefore, careful diagnosis, analysis of various hard and soft tissue parameters should be part in the treatment of smile design while keeping in mind the esthetics and function. Multi-disciplinary approach towards smile design in consultation with different dental specialties can aid in better designing of smile and facial esthetics

Citation: Abdulrahman Alrizqi, Yahia H. Mohammed and Roula Albounni, 2015. "Smile design: Assessment and concept", *International Journal of Current Research,* 7, (12), 24746-24750.

INTRODUCTION

The concept of smile and dental esthetics represents a complex interaction between skeletal structures, alveolar casing, teeth and the overlying soft tissue covering. Appearance of an individual's smile is net interaction of these components. Smile reflects an individual's capacity to express a range of feelings with the structure and function of the teeth and lips, can regularly decide how well an individual perform in social life. Facial appearance is without a doubt a cornerstone of both past and modem societies.Modern practice of dentistry is not limited to just repair of individual teeth. Now a day's more number of patients demanding an appearance that is physiologically and mechanically sound with esthetically attractive teeth (Spear and Kokich, 2007). Latest dental procedures such as bleaching, bonding and veneering have made it possible not only to restore and restructure the affected dentition but also improve the appearance (Morley, 1999). There have been many publications and courses have been addressed over the years to know how to develop a treatment plan to accomplish an esthetic outcome for the patient (Bowbeer, 1985; Mack, 1996; Ahmad, 1998; Rifkin, 2000; McLaren and Rifkin, 2002). Dental practice in the areas of esthetic or cosmetic dentistry has become increasingly growing since last several years. Although the terms esthetic and cosmetic are very popular and commonly used in dental nomenclature, there exist some differences.

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The term cosmetic denotes superficial coverage of the defect or deficiency to enhance beauty of the body. Second part signifies the cultural component that is beauty is in the eye of the beholder. Hence the term cosmetic refers to enhancement of facial and dental features. Whereas, the term esthetics refers to appreciative of what is pleasurable to the senses" or "pleasing in appearance." Thus, cosmetics and esthetics are somewhat tightly intertwined, but esthetics also encompasses appearances that do not have a "cosmetic appearance." Human esthetics implies asense of beauty, a pleasing impulse, naturalness, and a youthful appearance relative to one's age (McLaren and Cao, 2009).

The objective of the esthetic treatment should be to develop a peaceful and stable masticatory apparatus, in which teeth, tissues, muscles, skeletal structures and joints will function in harmony. Esthetic treatment should result in improved but natural appearance that imparts a lively and realistic appearance to the patient. Thorough knowledge and cognition of the interrelationship between muscles, bones, joints, gingival tissues and occlusion is necessary to obtain successful long lasting healthy and functional esthetic. Moreover, smile design should be integral part of the comprehensive patient care (McLaren and Cao, 2009; Dawson, 1983). This paper will present on traditionally accepted smile design concepts with additional newer parameters incorporated in the esthetic treatment of the patients.

Assessment of smile design

Smile designing should involve sequential assessment of certain vital elements related to tooth components and Soft tissue components.

All these elements are connected with each other any change will definitely affect the other element.

General facial analysis: It mainly involves the assessment of general facial balance. Standard esthetic principles govern the facial attractiveness. These include proper alignment, symmetry and proportion of face. Multidisciplinary approach involving orthodontic, orthognathic surgery, plastic and cosmetic surgery and periodontal therapy may be often required for esthetic assessment and treatment planning to achieve best dental and facial beauty (Goldstein, 1997). Two facial features the interpupillary line and lips play important role in facial esthetics. When interpupillary line is drawn it should remain perpendicular to the midline of the face and should be parallel to the occlusal plane. However, lips create boundaries of smile. Hence any major discrepancy in the above stated two factors definitely affects the facial composition. Sometimes there could be need for correction of the facial configuration before attempting to correct the dental composition (Ahmad, 1998). The horizontal and vertical dimensions for ideal face should be as mentioned below. Horizontally the width of the face should be the width of the five eyes. When measured the distance between the eyebrows, and the chin should equivalent to the width of the face. Vertically facial stature is divided into three equal parts starting from the fore head to eyebrow line, from the eyebrow line to the base of the nose, and from the base of the nose to the base of the chin. Additionally, full face is divided into two parts with eyes being midline. Lower part of the face from the base of the nose to the chin is divided into two parts, the upper lip forms one-third of it and the lower lip and the chin two-thirds of it.By looking from the frontal view four basic shapes of the face can be observed-square, tapering, square tapering or ovoid. Similarly lateral profile of the individual can be classified as straight, convex or concave. Above mentioned factors are essential to guide in determining the size, shape and later profile of the tooth (Lavere, 1992; Bukhary *et al*., 2007).

Dento-facial analysis

Facial and dental Midlines

A note of facial midline is necessary to understand the concept of dental midline. Facial midline has been defined in many ways, Donovan *et al* defined it as vertical line, drawn through the forehead, nose columella, dental midline, and chin (Donovan *et al*., 1985). It also represents an imaginary line that runs vertically from the nasion, subnasal point, interincisal point and the pogonion. Various studies have reported that the facial mid-line is located in the center of the face, and it is perpendicular to the interpupillary line (Cipra and Wall, 1991; Moskowitz and Nayyar, 1995). Dental midline refers to an imaginary vertical line that does not necessarily coincide with the facial mid-line (Heartwell, 1968). It denotes the vertical contact line between two upper central incisors. Midline is considered perfect when it end up with the facial midline. It should be 90 degrees to the incisal plane. Among existing all the esthetic elements dental midline abnormalities are least observed by both patients and dental personnel. Slight inconsistencies between facial and dental midlines are acceptable and without obvious appearance (Fradeani, 2006). It has been reported that the dental midlines off the facial midlines of up to 4 mm were not noticeable by the people, provided that the dental midline is parallel to the long axis of the face. Commonly midline discrepancies of up to 4 mm will not be perceived as unaesthetic. Midline can be assessed by using anatomical guides such as midline of the nose, forehead, chin, philtrum, interpupillary plane (Kokich *et al.,* 2001).

Among all the available anatomic land marks philtrum of the lip is the most precise guide and it is always in the middle of the face except in some conditions such as surgery involving the lip or cleft lip or accidents. The center of the philtrum forms the middle of the cupids bow and should correspond to the papilla between the two central incisors. When center of the philtrum conforms to interdental papilla midline is incorrect then difficulty is in incisal inclination. On contrary, if the philtrum and papilla do not correspond to each other, then problematic true midline shift can be observed. Noticeable midline is the one which does not bisect the papilla rather than the one that does not bisect the philtrum (Bhuvaneswaran, 2010). Useful information about midline inclination and slanted incisal plane can be obtained by using face bow transfer adjusted parallel to the interpupillary plane (Paul, 2001). The best way of imagining dental midline is by noticing smile in real time. The gap between the two upper central incisors looks most attractive when observed from front dentition in smile and it should be centered between right and left sides of the face. However, it does not obligatory that the dental midline should always correspond with other topographies of the face (Renner, 1985). By using philtrum as a reference guide, in 70% of cases maxillary midline coincided with midline of the face. Additionally slight deviances in the central midline did not essentially affect esthetics (Miller *et al*., 1979). It has been reported that the maxillary and mandibular midlines failed to coincide in 75% of cases (Johnston *et al*., 1999). Hence lower midline should not be used as a guide for drawing upper midline. Due to the non-exposure of the lower teeth during smiling, the mismatch of upper and lower midlines does not affect the natural esthetic of teeth. In esthetic dentistry, lower midline is not of incredible significance. The imagining the center point frequently gets to be troublesome, attributable to the restriction and uniform size of the mandibular incisors (Johnston *et al*., 1999).

Dento-Labial Analysis

This step is mainly concerned with the evaluation of the relationship of the teeth to the lips and, mainly focuses on visual display of teeth in static and dynamic conditions. It also includes the assessment of the buccal corridor.

Incisal Length

The incisal edge of the maxillary central incisor is the most vital element in the creation of a smile. When it is set, it serves to decide the best possible tooth proportion and gingival level; hence, setting the incisal edge is particularly imperative. The parameters such as degree of tooth display, phonetics and

patient inputs are used to set up the maxillary incisal edge position. An incisal third of the upper central incisor measuring 3.5 mm should be noticeable when the mouth is relaxed and lips are at rest. However, an increase in age reduces muscle tonus resulting in less tooth display (Vig and Brundo, 1978; Connor and Moshiri, 1985). However, it has been suggested that the for most of the patients who have enhanced esthetics as the main objective of treatment, a 3mm-4mm tooth display at rest are considered esthetically ideal. Phonetics is a noteworthy element of the tooth length. With a specific goal to decide appropriate lip, tongue and incisal backing and tooth position, it is fundamental that the patient sits either erect or stands during the phonetic movements (Bloom and Padayachy, 2006). The various phonetics sounds such as; M sound, E sound, F and V sounds and S sounds were pronounced to adjust the incisal edge positions of maxillary teeth (Heinlein, 1980). Placement of the incisal edge is a matter of subjectivity and the patient feedback is an important factor in the final decision making. Composite resin mock-ups of the desired length, diagnostic waxing, and computer imaging, provisional restorations set-ups should be used as helps and guides for communication with the patient.

Tooth dimensions in esthetics

Facial morphology is critical in deciding correct dental proportion which is intern important in creating an esthetically attractive smile. Central dominance of the central incisors is the main feature central incisors must be dominant in the smile and must display attractive proportions. Central incisors are the key to the smile and proportions must be mathematically and esthetically precise. The ratio of width to length of centrals should be nearly 4:5. Additionally, appearance and placement of the laterals and canines is governed by the shape and location of the central incisors. Several guidelines have been proposed for creating correct proportions in an esthetically attractive smile based on perceived proportions viewed from the facial aspect. These include; golden proportion, recurring esthetic dental proportions, M proportions and Chu's esthetic gauges. Golden proportion (Lombardi): Itis based on apparent width from the frontal view. When noticed from the facial, the width of each front tooth is 60% of the width of the adjacent tooth (mathematical ratio being 1.6:1:0.6). However, application of this concept is difficult due to patient's differing arch form, facial proportions andlip anatomy. Moreover, strict compliance of the golden proportion may hinder the creativity leading to unaesthetic appearance (Levin, 1978). Recurring esthetic dental proportion (Ward): When moved posteriorly from midline, the consecutive width proportion viewed from facial aspect must remain constant. This provides marked flexibility of agreement between tooth properties and facial proportions M proportions (Methot): This method involves the use of computer software program to compare the tooth width with the facial width .Chu's esthetic gauges: This method is based on Levin's RED concept and utilizes a series of gauges to make intraoral analysis. The gauges permit diagnosis of problems associated with tooth width, tooth length and gingival length discrepancies. Factors governing individual tooth dimensions are as below. Maxillary central incisor's estimated length should be 10-11 mm and the computed width should fall within the ratio between 75 - 80%. Incisors are the crucial point of an esthetic smile and produce the central dominance. Maxillary lateral incisors are the lively part of the smile. They render individuality, never symmetrical and impact gender characterization. Maxillary canine play a vital point in making a pleasing smile as they are situated at the junction between the anterior and posterior dental segments; hence, only the mesial half of the canine is visible from the frontal view when the patient smiles. Canine portrays the personality characterization.

Buccal Corridor

It refers to negative (dark) space between the buccal surface of upper posterior teeth and the inside of the cheek (corner of the mouth) visible during smile formation. Lay person perceive broad smile with slight buccal corridor as most esthetic. Conversely a broad smile without a buccal corridor could be perceived as a fake. Buccal corridor is influenced by the various factors such as; the width of the smile and upper arch, tonicity of the facial musculature, placement of the labial surface of the upper premolars, disto-facial line angle canine prominence and incongruity between the value of the premolars and the six anterior teeth (Moore, 2005; Sarver, 2001).

Zenith points

These are the most apical points of the clinical crowns demonstrating height of contour, where most of the gingival scalloping is found. It is positioned slightly distal to the perpendicular line drawn down the center of the tooth. But for the lateral incisor zenith point may be centrally situated, making it an exception (Al-Habahbeh *et al*., 2009). The importance of the zenith points lies while closing diastemas and/or changing the distal or mesial inclination of the teeth.

Tooth inclinations

Axial inclination relates to the vertical alignment of upper teeth, noticeable in the smile line, to central perpendicular midline. From the central incisors to the canine, there should be regular, progressive increase in the mesial inclination of each successive front tooth. Axial inclination of the teeth can be evaluated by using photograph of the anterior teeth in a frontal view. Upper central incisor is placed vertically or somewhat labial. Whereas upper lateral incisor's cervical area is tucked in and incisal edge inclined somewhat labially. Maxillary canine is placed in such a way that the cervical area positioned labially with cusp tip lingually angulated.

Inter-tooth Relationships

Interdental contact area and point

It is defined as the broad area in which two neighboring teeth contact each other. It follows the 50:40:30 rule in reference to the maxillary central incisor. The increasing ICA helps to create the impression of longer wider teeth and also extend apically to remove black triangles.

Interproximal contact point refers to the most incisal aspect of the interdental contact area. Rule of thumb is that interproximal contact point moves apically as one move farther backwards form the midline.

Incisal embrasures

The incisal embrasures should exhibit a natural, gradual increase in depth from the central to the canine. This is due to the anatomic positioning of the contact points as they move apically from central to canine. These contact points in their apical movement should imitate the smile line (Rufenacht, 1990).

Symmetry and balance

Symmetry is the proportionate arrangement of several features with respect to each other. For central incisors balanced length and width is most crucial feature of central incisors. It becomes less concerned as moved further away from the midline. Static symmetry refers to mirror image of the upper central incisors, whereas dynamic symmetry stands for two similar but distinguishable. The right and left sides of the smile are said to be well balanced when the balance is apparent as the eyes move distally from the midline.

The relationship of the teeth to the gingiva

Gingival health is of utmost significance so that the gingival tissues should be in a state of complete health before the start of any treatment. Setting up precise gingival levels for individual tooth is significant in making balanced smile. In the cervical region of the central incisors gingival level should be bilaterally symmetrical and it should match the canine. However, gingival level of lateral incisors should be at cervical to that of centrals and canines.

Cervical embrasure

Embrasures located cervical to the interproximal contact area are referred as cervical embrasures. The darkness of the oral cavity that is visible in the interproximal area between the gingiva and the contact area is known as black triangle. These are noticeably unaesthetic and negatively affects individual's smile. It is always mandatory to avoid black triangles by considering most apical area of restoration of 5mm or less from alveolar crest to encourage the formation of healthy pointed interdental papilla (Tarnow *et al*., 1992).

Smile line

Smile line denotes an imaginary line along the incisal edges of the upper front teeth that should follow the curvature of the upper border of the lower lip when smiling. Smile line advocates that the centrals should look slightly longer, or equals to the canines along the incisal plane. Lip line refers to the location of the inferior border of the upper lip during smiling and thereby defines the display of tooth or gingival interface. Gingival margin and lip line should be corresponding to each other or there can be 1-2mm display of the gum tissue.

Conclusion

It is obvious from the above short discussion that the smile design is an individualized concept requiring consideration of many parameters. Therefore, careful diagnosis, analysis of various hard and soft tissue parameters should be part in the treatment of smile design while keeping in mind the esthetics and function. If needed smile designing approach should include different branches of dentistry to achieve best possible results for the patients.

Acknowledgement

We would like to thank Prof. Mohammad Al Omari, chairman department of restorative dentistry, Dr. Bander Abdulwahab, restorative program director and all other staff members of Restorative department of Riyadh Colleges of Dentistry and Pharmacy for their timely help and support in the preparation of this manuscript.

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