

How to Cite:

Kaur, U., Sandhu, G., & Kapila, H. (2021). Smile designing: A review. *International Journal of Health Sciences*, 5(S1), 164–171. <https://doi.org/10.53730/ijhs.v5nS1.5436>

Smile designing: A review

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Abstract---Smile, a person's ability to express a range of emotions with the structure and movement of the teeth and lips, can often determine how well a person can function in society. Of course, the importance given to a beautiful smile is not new. It is of prime importance that the final result is not dependent only on the looks alone. Our ultimate goal as clinicians is to achieve pleasing composition in the smile by creating an arrangement of various esthetic elements.

Keywords---smile design, esthetics, beautiful smile.

Introduction

Smile, a person's ability to express a range of emotions with the structure and movement of the teeth and lips, can often determine how well a person can function in society. Of course, the importance given to a beautiful smile is not new. The search for beauty can be traced to the earliest civilizations; both the Phoenicians (app 800 BC) and Etruscians (app 900 BC) carefully carved animal tusks to simulate the shape, form and hue of natural teeth. It was not until the 18th century that dentistry was recognized as a separate discipline and its various branches were established. Pierre Fauchard (1678–1761) of France, the leader of the movement, together with several colleagues modernized and promoted dentistry and also advocated esthetic practices.¹

Goals of smile designing

The goal of an esthetic makeover is to develop a peaceful and stable masticatory system, where the teeth, tissues, muscles, skeletal structures and joints all function in harmony (Peter Dawson). It is very important that when planning treatment for esthetics cases, smile design cannot be isolated from a comprehensive approach to patient care. Achieving a successful, healthy and functional result requires an understanding of the interrelationship among all the supporting oral structures, including the muscles, bones, joints, gingival tissues and occlusion.²

Anatomy of the smile

Smile emanates from the facial movements and is the clear manifestation of the facial structures. 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 scaffold. The main effectors of the smile are the zygomaticus major muscles 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, inter labial gap, inter commissure width, smile index (width/height), gingival architecture.³

Muscular Basis Of Smile

Previous researchers have identified the nasolabial fold as the keystone of the smiling mechanism. They stated that a smile is formed in two stages. In the first stage, the levator muscles contract and raise the upper lip to nasolabial fold. In the second stage, the levator labii superioris, zygomaticus major, and buccinator muscles raise the lips even more superiorly. The final stage is often characterized by appearance of squinting. It represents the contraction of the periocular musculature to support maximum upper-lip elevation through the fold.⁴

Smile Analysis

Smile analysis is traditionally performed in the frontal, oblique, sagittal dimension, and with time. Ackerman and Ackerman developed a ratio called the smile index (inter commissural width/interlabial gap), to visualize and quantify the frontal smile. The ratio is used for comparing smiles among patients. The lower the smile index, the less youthful the smile appears.⁵

In the oblique view, the contour of the maxillary occlusal plane is noted. The maxillary occlusal plane should be in consonance with the curvature of the lower lip on smile. In sagittal dimension, overjet and incisor angulations are best

visualized. Orthodontic correction of overjet involves macro-elements, such as jaw patterns and soft-tissue elements like nasal projection.⁶

According to time, orthodontic patients can be categorized as a preadolescent, adolescent, and adult. The growth, maturation, and aging of the perioral soft-tissues have a profound effect on the appearance of both resting and smiling presentations. Orthodontic cephalometric research indicates that on average, profiles flatten over time.⁷

Digital Smile Designing

A beautiful confident smile is desired by all. When a patient wishes to attain that smile but is skeptical to undertake the treatment procedure, for not being able to visualize his or her treatment outcome, is when, a clinician can use the Digital smile designing (DSD) tool. DSD concept aims to help clinician by improving the aesthetic visualization of the patient's concern, giving understanding of the possible solution therefore educating and motivating them about the benefits of the treatment and increasing the case acceptance. Digital smile design is a digital mode that help us to create and project the new smile design by attaining a simulation and pre visualization of the ultimate result of the proposed treatment. A design created digitally involves participation of the patients on the designing process of their self-smile design, leading to customization of smile design as per individual needs and desires that complements with the morpho psychological characteristics of the patient, relating patient to an emotional level, increasing their confidence in the process and better acceptance of the anticipated treatment.⁸

Advantages of DSD

Digital imaging and designing helps patients to visualize the expected final result before the treatment itself starts which enhances the predictability of the treatment. The clinician can address patients concern by showing digitally the final outcome, motivating and educating them about the benefits of the treatment. It improves clinician diagnosis and treatment plan by aesthetic visualization of patients problem through digital analysis of facial, gingival and dental parameters that will analyze the smile and the face in an objective and standardized manner.⁸ DSD leads to customization of smile design by increasing the participation of patient in their own smile design which result in a more aesthetically driven, humanistic, emotional and confident smile. The patient may evaluate, provide opinion, and approve the final shape of the new smile before any treatment procedures are performed thus enhancing patients satisfaction. It leaves no scope of regret post treatment where the irreversible procedures once carried out cannot be undone. It also helps to evaluate and compare pre and post treatment changes. With the digital ruler, drawings, and reference lines, easy comparisons can be made between pre- and post-treatment photographs. ⁸

It not only improves communication between clinician and patient but also between interdisciplinary team members, between clinicians, clinician and lab technician. All team members can access this information whenever necessary to review, change, or add components during the diagnostic and treatment phases,

without being available in the same place or at the same time. This enhances visual communication, improves transparency, creates a better team work, and interdisciplinary treatment planning. The lab technician also receives feedback of patients expectation related to tooth shape, arrangement, and color to enable any desired modifications. This persistent double-checking ensures the quality of the final result.⁸

A study conducted by Gabriele Cervino et al reviewed as much as 24 articles on DSD published up till the year 2018 with the purpose to evaluate the effectiveness of the use of Digital Smile Design techniques and whether Digital Smile Design is bringing any improvements in the comfort of patients and in their treatments. It took into consideration, the “communicative” utility of the software, the therapeutic planning, and, of aesthetic and functional rehabilitation of the patients. The authors concluded from all of the articles present in the literature regarding Digital Smile Design, that, this tool provides important information to the clinician and patient. Patients can view their rehabilitations even before they start, and this can also have important medico-legal functions.⁸

Anterior Occlusal Plane and Smile Line

The following horizontal reference lines/planes can be used to assess for any horizontal discrepancy:

- Interpupillary line
- Incisal occlusal line
- Gingival margins
- Inter commissure line

The above references can be assessed from good-quality facial images and analysed digitally. Ideally, the plane of the incisal edges of maxillary anterior teeth should be parallel to the interpupillary line and perpendicular to the facial midline, but if the eyes are in different planes, it is more appropriate to use the inter commissure line as a reference. On occasions, neither of the horizontal reference planes is used, and the incisal edges of the maxillary anterior teeth should be aligned with the horizon.⁹

A slanted anterior occlusal plane is an unacceptable treatment outcome and should be avoided at all cost. The use of a facebow, Kois Dento-Facial Analyzer, photographic images and good laboratory communication will help to prevent a slanted occlusal plane. Once the anterior occlusal plane has been set, the orientation of the smile line can be planned. The smile line refers to an imaginary line along the incisal edges of the maxillary anterior teeth, which should mimic the curvature of the upper border of the lower lip while smiling, often following a convex or gull-wing course. A youthful smile line or “gull-wing” shape has the incisal edges of the central incisors below the tips of the canines.¹⁰

A reverse smile line can be observed in the aged or worn dentition, when the tips of the canines or premolars are longer than those of the central incisors. In my experience often patients request a very “flat” smile line, perhaps influenced by smiles they have seen in the media, and communication is required to offer alternatives. The lower third of the face is also known as the “dental zone”, and

has the most important role in evaluating facial beauty, which further emphasises why careful planning is so important in restorative dentistry.¹¹

Width: Length Ratio of Central Incisors

The central incisor position and proportion is all-important, and all the other teeth should be built around them; they should be the dominant teeth in the smile. The width-to-length ratio should fall within 75-85%, depending on facial proportions; these teeth are more dominant at the higher level.¹²

Buccal Corridor

The buccal corridor refers to the dark space (negative space) visible during smile formation between the corners of the mouth and the buccal surfaces of the maxillary teeth. The upper canine defines width of smile and the start of the buccal corridor. A broad smile with a minimal buccal corridor is deemed most aesthetically pleasing by lay people; however, a broad smile without a buccal corridor could also be perceived as fake. If the patient does not have a broad smile then the buccal corridor is of less significance.¹³

Axial Inclination

The long axis of the maxillary anterior teeth follows a progression as the teeth move away from the midline. The teeth incline distally in the inciso-apical direction, with the degree of inclination increasing from central incisor to canine.¹⁴

Embrasures and connectors

Embrasures are the inter-incisal angles, and follow a pattern that develops from the central incisor and progresses laterally. The size and volume of the embrasure space increases away from the midline. The embrasure between the upper central incisors is a narrow inverted "V"; between central and lateral incisors there should be an asymmetrical inverted "V," and between lateral incisor and canine, a wide inverted "V". The connectors are the contact areas where the upper anterior teeth appear to touch.¹⁵

The position of interdental contact tends to progress apically from the incisors toward the posterior dentition. The length of the available contact area is relevant when deciding which material to use in a given restoration; metal ceramic only requires 6mm, zirconia requires 9mm and IPS max requires 16mm. These measurements are important if the crown height is small, or if there is minimal occlusal space.¹⁶

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.¹⁸ 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. Dental midline refers to an imaginary vertical line that does not necessarily coincide with the facial mid-line. It denotes the vertical contact line between two upper central incisors.¹⁹

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. 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.²⁰

Midline can be assessed by using anatomical guides such as midline of the nose, forehead, chin, philtrum, interpupillary plane. 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.²¹ The center of the philtrum forms the middle of the cupid's 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. Useful information about midline inclination and slanted incisal plane can be obtained by using face bow transfer adjusted parallel to the interpupillary plane.²²

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.²³ 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. It has been reported that the maxillary and mandibular midlines failed to coincide in 75% of cases.²⁴

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.²⁵

Conclusion

In our modern competitive society, a charming smile can open doors and knock down barriers that stand between us and a fuller, richer life. It must be

understood that there is no universal “ideal” smile. The most important esthetic goal in orthodontics is to achieve a “balanced” smile. The components of the smile should be considered not as rigid boundaries but as artistic guidelines to help the orthodontist to treat individual patients.

References

1. Aschheim KW, Dale BG. Missouri: Mosby Publications. 2nd ed. Missouri: Mosby Publications; 2001. *Esthetic Dentistry – A clinical approach to techniques and materials*.
2. Dawson PE. Determining the determinants of occlusion. *Int J Periodontics Restorative Dent*. 1983;3:8–21.
3. Kokich VO, Jr, Kiyak HA, Shapiro PA. Comparing the perception of Dentist and Lay people to altered Dental Esthetics. *J Esthet Dent*. 1999;11:311–24.
4. Goldstein RE. Chicago, US: Quintessence Publication; 1997. *Change your smile*.
5. Davis NC. Smile Design. *Dent Clin N Am*. 2007;51:299–318.
6. Ahrberg D., Lauer H.C., Ahrberg M., Weigl P. Evaluation of fit and efficiency of CAD/CAM fabricated all-ceramic restorations based on direct and indirect digitalization: a double-blinded, randomized clinical trial. *Clin Oral Invest*. 2016;20(2):291–300.
7. Cervino G., Fiorillo L., Arzukanyan A.V., Spagnuolo G., Cicciù M. Dental restorative digital workflow: digital smile design from aesthetic to function. *Dent J (Basel)* 2019;7(2):30.
8. Meereis C.T., De Souza G.B., Albino L.G., Ogliari F.A., Piva E., Lima G.S. Digital smile design for computer-assisted aesthetic rehabilitation: two-year follow-up. *Operat Dent*. 2016;41(1):E13–E22.
9. Rubin LR, Mishriki Y, Lee G. Anatomy of the nasolabial fold: The keystone of the smiling mechanism. *Plast Reconstr Surg*. 1989;83:1–8. [PubMed] [Google Scholar]
10. Schabel BJ, Baccetti T, Franchi L, McNamara JA. Clinical photography vs digital video clips for the assessment of smile esthetics. *Angle Orthod*. 2010;80:490–6.
11. Sarver DM, Ackerman MB. Dynamic smile visualization and quantification: Part 1. Evolution of the concept and dynamic records for smile capture. *Am J Orthod Dentofacial Orthop*. 2003;124:4–12.
12. Sarver DM, Ackerman MB. Dynamic smile visualization and quantification: Part 2. Smile analysis and treatment strategies. *Am J Orthod Dentofacial Orthop*. 2003;124:116–27.
13. Sabri R. The eight components of a balanced smile. *J Clin Orthod*. 2005;39:155–67.
14. Mackley RJ. An evaluation of smiles before and after orthodontic treatment. *Angle Orthod*. 1993;63:183–9.
15. Peck S, Peck L, Kataja M. Some vertical lineaments of lip position. *Am J Orthod Dentofacial Orthop*. 1992;101:519–24.
16. Sarver DM. The importance of incisor positioning in the esthetic smile: The smile arc. *Am J Orthod Dentofacial Orthop*. 2001;120:98–111.
17. Chiche G, Pinault A. Artistic and scientific principles applied to esthetic dentistry. In: Chiche G, Pinault A. *Esthetics of Anterior Fixed Prosthodontics*. Quintessence Publishing 1994:13-32.

18. Terry et al, 1976, Components of facial attractiveness Perceptual and Motor Skills. 42:918-11
19. Lombardi RE. The principles of visual perception and their clinical application to dental esthetics. J Prost Dent. 1973;29:358-381
20. Magne P, Gallucci GO, Belser UC. Anatomic crown width/length ratios of unworn and worn maxillary teeth in white subjects. J Prost Dent. 2003;89(5):453-461.
21. Levin EI. Dental esthetics and the golden proportion. JProsthet Dent. 1978;40(3):244-252
22. Rufenacht, C. 1990. Fundamentals of Esthetics. Chicago; US Quintessence publications Co. Sarver, D.M. 2001.
23. The importance of incisor positioning in the esthetic smile: The smile arc. Am. J. Orthod Dentofacial Orthop., 120:98-111.
24. Spear, F.M. and Kokich, V.G. 2007. A multidisciplinary approach to esthetic dentistry in: successful esthetic and cosmetic dentistry for the modern dental practice. Dent Clin North Am., 51:299-318.
25. Tarnow, D.P., Magner, A.W. and Fletcher, P. 1992. The effect of the distance from the contact point to the crest of the bone on the presence or absence of the interproximal papilla. J. Periodontol., 63:995-6.