

Digital Smile Designing – ‘A New Era’ In Aesthetic Dentistry – A Review

Digital smile designing

Balashankar Ajay Sathya¹, Suresh Mitthra², Newbegin Selvakumar Gold Pearlin Mary³,
Arunajatesan Subbiya⁴,

¹BDS, First yr post graduate student, Department of conservative Dentistry and Endodontics, Sree Balaji Dental College and Hospital, Bharath institute of Higher Education and Research, Narayanapuram, Pallikarnai, Chennai -600100, Tamilnadu, India.

^{2,3}M.D.S. Reader, Department of conservative Dentistry and Endodontics, Sree Balaji Dental College and Hospital, Bharath institute of Higher Education and Research, Narayanapuram, Pallikarnai, Chennai -600100, Tamilnadu, India.

⁴M.D.S, Professor and Head, Department of conservative Dentistry and Endodontics, Sree Balaji Dental College and Hospital, Bharath institute of Higher Education and Research, Narayanapuram, Pallikarnai, Chennai -600100, Tamilnadu, India

Email: ¹ajaysathya.1011@gmail.com, ²malu.dr2008@yahoo.com.
³n_goldpearlinmary@yahoo.co.in, ⁴drsubbiya@gmail.com

ABSTRACT: *The basic objective of an aesthetic procedure is to satisfy the patient and the outcome of the treatment must meet the patient's expectation of enhancing their facial aesthetics and smile. The digital smile designing technique motivates and educates the patient about the end result of the treatment. Digital Smile Design (DSD) is a technological method that digitally designs and modifies the smile of patients, allowing them to visualise it ahead of time by generating and displaying a digital mock-up of their updated smile design before the physical treatment begins. The aim of this article is to discuss the uses, advantages and limitations of Digital smile Designing.*

Key words: *Digital smile design, Facial aesthetics, digital photography*

1. INTRODUCTION

A bold and beautiful smile is desired by all. The digital smile designing tool is brought up by the clinician when the patient wishes to attain his/her desired smile but is doubtful and not able to visualize the treatment outcome. The concept of digital smile designing aims to favour the clinician by improving the aesthetic picture of the patient's concern thereby educating and motivating them about the benefits of the treatment. The new smile design is created and projected by attaining simulation and pre visualization of the end result of the suggested treatment. The design which is created digitally involves the patients to take part on the self-smile designing process leading to customization as per the desire and needs of the individual thereby complimenting the psychological characteristics of the patient and increasing their confidence in the procedure and better acceptance of the anticipated treatment plan. ^[1]

Digital Smile Design (DSD) was described as a multi-use conceptual tool by Coachman and Calamita which may support diagnostic vision, enhance communication, and improve treatment predictability by allowing careful analysis of the patient's facial and dental features which may have gone unnoticed during by clinical, photographic or diagnostic cast-based evaluation.^[2]

Evolution of DSD

In the last two decades, there is continuous acceleration of smile designing which has evolved from physical analogue to digital designing that has advanced from 2D-3D. In earlier times, there used to be hand drawing on the printed photos of the patient that were used to explain the patients about how the end result of the treatment could be. Now it has completely evolved into a digital drawing on the computer using DSD software. The drawing can be edited or undone anytime to achieve the final design.^[3]

The Evolution in generations were proposed by Christian Coachman in 2017 as follows:^[4]

- a. Generation 1: Analogue drawings over the images and there was no connection to analogue model. This was the period when drawing was carried out on printed copy of photographs to picture the treatment result but there was no co-relation with the study model.
- b. Generation 2: Two dimensional digital drawings and visual connection to the analogue model. With the arrival of digital world, digital drawing was permitted on certain software like Power point. It was more accurate and less time consuming compared to hand drawing. The diagram could be visually connected to the study model but there was still a lack of physical connection.
- c. Generation 3: Digital two-dimensional drawings and analogue connection to the model. This was the commencement of digital analogue connection. Introduction of the very first drawing software that linked 2D digital smile design to 3D wax-up.
- d. Generation 4: Two dimensional digital drawings and connection to the 3D model. There was a transition in digital dentistry from 2D to 3D analysis. 3D digital wax up could be carried out involving facial integration and pre-planned dental aesthetic framework.
- e. Generation 5: Complete 3D work flow was established
- f. Generation 6: 4D concept was introduced.

Requirements of digital smile designing

The digital smile design technique is performed by digital equipment that already exists in current dental practise, such as a computer, smartphone or digital SLR camera.^[5]

A digital intra oral scanner^[6] which is used to obtain a digital impression. 3D printer and CAD/CAM are additional tools for complete digital workflow. An accurate photographic documentation is necessary as complete facial and dental analysis relies on preliminary photographs on which changes and designing is developed. and video documentation is necessary for dynamic analysis of teeth, gingiva, face and lips during smiling.

Photography protocol

The following photographic views are required in fixed head position.^[3]

1. Frontal views: 3 photographic views must be obtained
 - Full face with teeth apart and a wide smile
 - Full face at rest
 - Full maxillary and mandibular arch with teeth apart in a retracted view

2. Profile views
 - Side profile view at rest
 - Side profile with full smile
3. Wide smile and incisal edge of maxillary teeth visible and resting on lower lip. This should be obtained at a 12'o clock view
4. Maxillary arch from second premolar to the contralateral second premolar in an intra occlusal view.

Videography protocol

According to Coachman, Best framing and zoom should be maintained with acceptable exposure and focus adjusted to mouth.^[7] four videos should be taken from specific angles

- 1.A frontal video of the face with retractor and without retractor. The patient should be asked to smile
- 2.A video of facial profile with lips at rest position and wide-E smile
- 3.A video, from above the head at the most coronal angle at 12'o clock view which still allows the visualization of the incisal edge
- 4.Anterior occlusal video recording from premolar to premolar with palatine raphe as a straight line

Along with this, four complementary videos must be taken for facial, phonetic, structural and functional analysis.

Software for DSD

The clinician can have the following software:

Microsoft power point, photoshop CS6, smile designer pro, cerc SW 4.2, DSD app by coachman, Visagi Smile, keynote, Guided positioning system, keynote, DSS, Nemo DSD, Exocad dental CAD2.3

Factors that can influence user's decision are dentofacial aesthetic parameters, ease of use, ability to document the case, systematic digital workflow and organization and compatibility of the program with CAD/CAM system.^[8]

Procedure for digital smile designing

The basic procedures of smile designing remains the same although there is variation of aesthetic parameters in different DSD software. The facial analysis is done using reference lines. uniform parameters are developed from reference lines for frontal view of the face. There are two reference lines which are the horizontal and vertical reference lines. Horizontal reference line contains the interpupillary and inter commissural lines which deliver a complete sense of balance and a horizontal outline in the aesthetically pleasing face. ^[9] The vertical reference line consists of the facial midline, passing the glabella, nose and chin. These two reference lines are crossed against each other in order to measure symmetry and cant of the face.^[10]

Dento gingival analysis is done following the facial analysis. At rest and smile, the length of the upper lip is examined to determine the gingival display. Smile curve is fixed by correlating the curvature of the incisal edges of the maxillary anterior teeth. The dental contour is established according to lower lip proportions and the anteroposterior curvature of the teeth. The intraoral view is shown by cropping the facial photograph. The teeth are marked with 3 reference lines, a straight horizontal line drawn from canine tip to canine tip , another horizontal line is drawn on the incisal edges of central incisors and one more vertical line passing through the interdental papillae. Additional lines such as gingival zenith,

obtained by joining lines of gingival and incisal battlement for a full dental examination. The adequate teeth dimensions can be obtained by any one of the published theories such as Golden proportion^[11], Pound's theory^[12], Recurring aesthetic dental proportion, dentogenic theory^[13].

A digital ruler is used to carry out required changes. Changes can be edited, reduced or adapted to different situations depending upon the aesthetic requirement and individual needs.^[14]

After the new smile design is obtained, it can digitally be presented to the patient to look for feedback and appreciation. The physical mock up can be created after the smile design is approved and can be tested aesthetically in the patient's mouth. The mock up also allows visualization of phonetics during evaluation period.^[15]

Limitations of DSD

- The diagnosis and treatment plan entirely depends on photographic and video documentation therefore even a minor inadequacy may result in incorrect diagnosis and planning.^[16]
- Expensive equipment and software.
- Handling and training for few software are time consuming and costly.^[17]

2. CONCLUSION

The digital smile designing is a great innovative tool in visualizing the aesthetic problems of the patient. It not only helps the patients to preview the treatment outcome ahead of time but also helps clinicians for proper treatment planning. Although it has few limitations like high cost and difficult handling, it has proven to show accurate results.

SOURCE OF FUNDING: Nil

ETHICAL CLEARANCE: Not required for a review manuscript

CONFLICT OF INTEREST: Nil

3. REFERENCES

- [1] Coachman C, Yoshinaga L, Calamita M, Sesma N. Digital smile design concepts. The Technologist. 2014.
- [2] Coachman C, Calamita M. Digital smile design: a tool for treatment planning and communication in esthetic dentistry. Quintessence Dent Technol. 2012 Apr; 35:103-11.
- [3] Jafri Z, Ahmad N, Sawai M, Sultan N, Bhardwaj A. Digital Smile Design-An innovative tool in aesthetic dentistry. J Oral Biol Craniofac Res. 2020 Apr-Jun;10(2):194-98.
- [4] Coachman C, Calamita MA, Sesma N. Dynamic Documentation of the Smile and the 2D/3D Digital Smile Design Process. Int J Periodontics Restorative Dent. 2017 Mar/Apr;37(2):183-93.
- [5] Daher R, Ardu S, Vjero O, Krejci I. 3D Digital Smile Design With a Mobile Phone and Intraoral Optical Scanner. Compend Contin Educ Dent. 2018 Jun;39(6):e5-e8
- [6] Aragón ML, Pontes LF, Bichara LM, Flores-Mir C, Normando D. Validity and reliability of intraoral scanners compared to conventional gypsum models measurements: a systematic review. European journal of orthodontics. 2016 Aug 1;38(4):429-34.

- [7] Omar D, Duarte C. The application of parameters for comprehensive smile esthetics by digital smile design programs: A review of literature. *The Saudi dental journal*. 2018 Jan 1;30(1):7-12.
- [8] Chiche GJ, Pinault A. *Esthetics of anterior fixed prosthodontics*. Quintessence Publishing Company; 1994 Jan.
- [9] Naini FB, Gill DS. Facial aesthetics: 2. Clinical assessment. *Dent Update*. 2008 Apr;35(3):159-62, 164-6, 169-70.
- [10] DP PK, Varma S, Namitha R. Norms for crafting a beautiful smile. *Amrita J Med*. 2013;9:1-44.
- [11] Ward DH. Proportional smile design: using the recurring esthetic dental proportion to correlate the widths and lengths of the maxillary anterior teeth with the size of the face. *Dental Clinics*. 2015 Jul 1;59(3):623-38.
- [12] Farias FD, Ennes JP, Zorzatto JR. Aesthetic value of the relationship between the shapes of the face and permanent upper central incisor. *International journal of dentistry*. 2010;2010.
- [13] Ahmad N, Ahmed M, Jafri Z. Esthetics considerations in the selection of teeth for complete denture patients: A review. *Annals of Dental specialty*. 2013; 1:4-7.
- [14] Lin WS, Zandinejad A, Metz MJ, Harris BT, Morton D. Predictable restorative work flow for computer-aided design/computer-aided manufacture–fabricated ceramic veneers utilizing a virtual smile design principle. *Operative dentistry*. 2015 Jun;40(4):357-63.
- [15] Zanardi PR, Zanardi RL, Stegun RC, Sesma N, Costa BN, Laganá DC. The use of the digital smile design concept as an auxiliary tool in aesthetic rehabilitation: a case report. *The Open Dentistry Journal*. 2016; 10:28.
- [16] Mitthra S, Anuradha B, Pia JC, Subbiya A. Veneers– Diagnostic and Clinical Considerations: A Review. *Indian Journal of Public Health Research & Development*. 2019;10(12):2143-8.
- [17] Meereis CT, De Souza GB, Albino LG, Ogliari FA, Piva E, Lima GS. Digital smile design for computer-assisted esthetic rehabilitation: two-year follow-up. *Operative dentistry*. 2016 Jan;41(1):E13-22.