

Republic of Iraq Nistry of Higher Education and Scientific Research

> University of Maysan College of Dentistry



Digital Smile Design

A Project Submitted to The College of Dentistry, University of Maysan, Department of Conservative Dentistry

> Supervised by: DR. Saad Abd Albaqi PHD in: Conservative Dentistry

By: Fatima Abd Alhakeem, Zahraa Karim Hassan, Zainab Ahmed, Zainab Abdul Hussein, Furqan Nazar

2025

ACKNOWLEGEMENT

First and foremost, I must acknowledge my limitless thanks to Allah ,the Ever-magnificent, the Ever-Thankful, for His help and bless by giving me the opportunity, courage and enough energy to carry out and complete the entire work .

My deep appreciation to my supervisor (**Dr.Saad Abd Albaqi**) his aid, patience and encouragement at all stages of this work .

I would like to thank all the people who contributed in some way to complete

this work.

Introduction

Dental esthetics, sometimes spelled aesthetics, is related to physical beauty, which is the primary component of appearance. As a result, aesthetic dentistry offers advantages that go well beyond tooth health to promote overall wellbeing throughout life .Naturally, aesthetic dentistry has a significant impact on how someone looks, especially when it comes to the relationship between oral aesthetics and physical beauty. As a result, it makes sense to acknowledge aesthetic dentistry as one aspect of the phenomenon of physical attractiveness. It is also logical to consider the reality that results from, or is at least connected to, the phenomenon of physical attractiveness to be highly interconnected. To put it another way, aesthetic dentistry has a great deal of potential, opportunity, and responsibility with regard to the advantages and disadvantages that people encounter throughout their lives. One of the most sought-after areas of dentistry that concentrates on smiles and attractive appearances is aesthetic dentistry. The treatment of individual teeth is not the only aspect of modern dentistry healthy and attractive smile represents an individual's spectrum of feelings and emotions in a positive way. This depends on the arrangement of their teeth and soft tissue structures. An attractive smile is indicative of a high societal feeling and influences their self-confidence, thereby boosting their personality (The smile design is the combination of aesthetic principles that make facial aesthetics compatible with the dentogingival structures. Or, more simply, it can often be described as the aesthetic treatment of anterior teeth in the visible aestheticregion. These aesthetic concepts were created with information gathered from cases, diagnostic moulds, photographic records, scientific dimensions, and fundamental aesthetic beauty principles (In recent decades, smile design has progressively shifted from analog to digital workflows, which have further evolved from 2-dimensional (2D) to 3D tools. The implementation of digital tools and online interaction has improved communication among clinicians, dental technicians, and patient.Newer digital smile design tools can be used to design and modify smiles of patients digitally and visualize the projected outcome before any irreversible procedures are done. Such tools also permit meticulous analysis of the patient's facial and dental characteristics to facilitate the digital design. Patients who prioritize aesthetic results over tooth structure restoration have become more common.In the modern dentistry practice, patients who wish to enhance the appearance of their smiles are increasingly interested in dental aestheticsA person's range of emotions is positively represented by a beautiful and healthy grin. Their tooth and soft tissue structural arrangement determines this. A pleasing grin conveys a strong sense of social status and boosts one's selfesteem, which in turn enhances one's personalityThe combination of aesthetic concepts that make face aesthetics compatible with dentogingival structures is known as the grin design. The aesthetic treatment of anterior teeth in the visible aesthetic region is another common way to

put it. Information from cases, diagnostic molds, photographic records, scientific dimensions, and basicaesthetic beauty principles were used to generate these aesthetic conception Smile design has gradually changed over the past several decades from analog to digital workflows, which in turn have progressed from 2dimensional (2D) to 3D tools.Communication between dental workers, patients, and clinicians has improved with the use of digital technologies and online contact. Combining 2Dimages with 3D digital data enables facially driven digital smile creation and the shift to a fully digital approachBefore any irreversible treatments are carried out, patients can use more recent digital tools for designing and modifying their smiles and seeing the expected results. In order to help the digital design, these tools also allow for the careful examination of the patient's oral and facial featuresThe use of a digital workflow for oral rehabilitation that allows the patient, dentist, and technician to assess and analyze the results is advantageous for. Digital Smile DesignThe team can more accurately assess the aesthetic relationship between the teeth, gingiva, smile, and face by digitally placing reference lines and shapes over the patient's photo in a preset order. The DSD enables a thorough aesthetic examination of the patient's dental and facial characteristics as well as the gradual identification of numerous important elements that would have gone unnoticed during the assessment of the clinical, photographic, or study models. The main goal of the DSD protocol is to simplify communication, transferring key information from the patient's face to the working cast, and to the final restoration.



Review

DSD is a multifunctional digital instrument with benefits that are clinically relevant. It can strengthen aesthetic diagnostic skills, better team communication, establish predictable processes during treatment phases, improve patient education and motivation through visualization, and boost case presentation efficacy. The effort needed to put DSD into practice is valuable since it can improve diagnosis and treatment planning consistency, make the treatment sequence more rational and simple, save time and materials, and record treatment costs

Indication and contraindications of Digital smile design

Indication

1.teeth with discoloration, such as those affected by amelogenesis imperfecta, physiological aging, trauma, fluorosis, or stains caused by tetracycline intake.

2.teeth with extensive caries lesions or fractures, presence of multiple restorations with unsatisfactory shade

3.rotated or inclined teeth.

4.necessity of reduction and closing of diastema.

5.in the cases of developmental anomalies like short teeth which require increasing of its length, misshapen peg-shaped maxillary lateral incisor,

6.microdontia and Hutchinson's incisors. aesthetic transformation (canines into lateral incisors and lateral into central incisors) in orthodontic treatment for closure the space duo toloss of upper lateral incisor



A 24-year-old Kenyan male with poor anterior esthetics due to fluorotic discoloration, staining, chipping, and asymmetry

contraindications of smile design

- 1.patients with bruxism or parafunctional oral habit.
- 2.edge-to-edge occlusion of the anterior teeth.
- 3.anterior teeth with large destruction of the crown.
- 4. when there is not enough remaining tooth structure to support the veneer.
- 5.high caries disease activity associated with bad oral hygiene.
- 6. Presence of periodontal disease.
- 7.teeth with excessive labial inclination.



Presence of periodontal disease.



patients with bruxism

The Principles

The Principles of Smile Design govern how naturally attractive your smileis –or isn't! When art, science, form and function are blended optimally bynature or an experienced cosmetic dentist, the results can be simply amazing!Experienced cosmetic dentists understand and use these principles to transform dull average smiles into successful confident smiles.There are many elements other than having whiter teeth that make for a radiant or confident smile. Each principle is illustrated with a drawing and with pho- tographs showing good and/or bad examples. While most unattractive smiles have multiple flaws, each example illustrates one principle.You can use this guide as a reference to compare or evaluate your own smile.You may find it helpful to use a mirror or a close-up photograph of your smile as you go through these principles.

1- Central Incisor Width / Height Ratio

Do your front incisor teeth appear taller than they are wide like an up-right rectangle, not a square? The width/height ratio should be 75-80%. For example, if the width were 8.0 mm and the height 10 mm, the ratio (8/10) would equal 80%.





2- Mesial Inclination

Are your teeth angled properly? Each upper tooth visible in the smile should have a slight inclination or tilt that is toward the midline (mesial) of the mouth. If these imaginary lines were extended downward they would meet or converge at or near the navel point over the stomach.





3- Midline Placement and Cant

Is your smile centered on your face and in your mouth? The position of the mid-line between the central incisors should be on a line drawn from between the eyes and down through the nose, lips and chin. The angle of the mid-line should not be canted or tilted to the left or right, but should be straight up and down.





4- Color, Shading, Stains, and Markings

Are the teeth a uniform bright color or shade? Is one tooth darker than the rest?

Are there white or dark spots or markings on the enamel?





5- Smile at Rest

Evaluate the amount of teeth showing at rest or with a slight smile. Middleaged adults should show 2-4 mm of their upper teeth. This amount decreases with age as the "window" of the mouth begins to sag downward showing more of the lower teeth.







6- Gum Line Symmetry

The gum tissue frames the teeth and forms a "curtain" for the teeth. Is the height and scalloping of the gum line symmetrical or matched evenly between the left and right sides? Balance and symmetry are important parts of what makes an attractive smile.





7- Gum Line Margin Heights

Is the level of the gum line over the lateral incisor lower than the central incisor? The height of the gum line margin over the lateral incisors should be slightly lower than the height of the gums over the adjacent central incisor and canine teeth.



8- Gaps or Diastema

A "diastema" is a gap between the teeth. Is there a space between your front







9- Gummy Smile

A "gummy smile" is when too much gum tissue shows above your front teeth when you smile. How much gum tissue shows with a full happy smile? Ideally there should be only a slight amount (1 to 3 mm) of gum tissue showing above the front teeth when you smile.







10- Gingival Zenith

What is the location of the uppermost height of the gum line over each tooth? The height of the gum line across the face of each tooth varies from tooth to tooth. It should be centered over each lateral incisor, and it should be 2/3rds of



the way across the face of the tooth for the central incisors and canine teeth.



11-Smile Line Follows Lip

Does your smile line generally follow your lower lip line? The incisal or biting edge of the upper teeth should parallel or follow the contour of the lower lip line in a relaxed or slight smile.





Convex smile arc



Flat smile arc



Reverse smile arc

12- Horizontal Plane

Are your teeth on a parallel horizontal plane with your eyes or with the floor? The left to right horizontal biting plane of the mouth should parallel the floor or the horizon when standing. It should also parallel a line drawn between the eyes (the inter-pupillary line).



Requirements for DSD

Conditions for DSD Digital tools that are already common in dentistry offices today, such as a computer running DSD software, a digital SLR camera, or even a smartphone, are used to perform the DSD procedure.4. Additional tools for a full digital 3D workflow include a 3D printer, CAD/CAM, and a digital intraoral scanner5 for digital impressions. Since thorough face and dental analysis depends on preliminary photos from which adjustments and designs are created, precise photographic documentation is crucial.

DSD WORKFLOW

The DSD workflow begins with digital scanning of the patient's dentition using an intraoral scanner, which is then imported to the respective DSD software. Using the various different shapes and forms available in the digital repository, we can overlap the teeth for a given esthetic procedure. The DSD

workflow then proceeds as follows.

1- After uploading the facial photographs, two baselines are drawn on the center of the slide so that it forms a + sign, in a way that it appears to be placed between the upper and lower anterior with the teeth apart Horizontal reference lines are achieved through the interpupillary line creating a digital facebow.



.2- Soft tissue features (gingiva, lips, facial lines) and their association with other components are evaluated by grouping and transferring them to the facial photograph.

3- A template tooth that is set to be standard and exact in dimensions is placed over the original photograph so that axial inclinations, proportion in relation to adjacent teeth, and soft tissue silhouette are established. The retracted view is engaged in order to evaluate whether the intraoral photograph is concurrentwith facial baseline data, where three lines are drawn .



Line 1: Intercanine width measured from the tip.

Line 2: The middle third of the central incisor to the occlusal edge of the adjacent central incisor.

Line 3: From the philtrum of the upper lip to the interdental papilla and the incisal embrasure.



4- Rectangular crop mode is then chosen and placed over the region of both central incisors to measure the width/length proportion of the central incisors .



5- Using editing tools, the template tooth can be placed over the photographed tooth, and pasted and morphed according to the best esthetic outcome. The patient's preferences and inputs can also be gathered and included during this step .



6- A digital ruler available in the software can be used to calibrate the real-time dimensions of the tooth by recording the measurement on the 3D model and then incorporating it into the software. Gingival contour and the proportion to attached gingiva width and incisal edges can also be calibrated.



7- Transferring the + sign to the cast: The measurement of baseline point till the free gingival margin is recorded and then transferred to the 3D cast with the aid of a caliper. Horizontal lines above the teeth which predict the gingival margin are marked on the cast using a pencil mark. The vertical lines are then marked using the interval between the incisal embrasures along with the facial component, which is then marked in the 3D model.



8- Wax up of the procedure to be performed for establishing a smile and then carried

out on the cast and evaluated using DSD, after which it is tried on the patient.







9- Once the approval of the wax-up has been sought, minor corrections, if deemed necessary, are performed.

10- Minimal intervention should be prioritized such as minimal reduction of tooth surfaces, and giving proper clearance for crowns, if required Attention to detail in each step in DSD usually results in an outcome that goes beyond the patient's expectations.

11. Restoration Fabrication (CAM)

After finalizing the design, the data is transferred to CAM (Computer-Aided Manufacturing) software. This software generates the necessary instructions for a milling machine or 3D printer to fabricate the restoration from a block of material, such as ceramic or composite resin. The fabrication process is highly automated, resulting in restorations that are both precise and consistent.



12. Finishing and Polishing

Following fabrication, the restoration undergoes finishing procedures, which may include polishing, glazing, or staining, to achieve the desired appearance and ensure biocompatibility. These steps are crucial for the restoration's longevity and integration with the natural dentition.

13. 5. Final Fitting and Bonding

The completed restoration is then fitted into the patient's mouth to ensure proper alignment and occlusion. Once satisfied with the fit, the restoration is bonded securely to the prepared tooth using dental adhesives. This final step restores the tooth's function and appearance, often in a single visit.





Advantages of Digital Smile Design

Accurate esthetic analysis The DSD allows a careful esthetic analysis of the patient's facial and dental features and a gradual discovery of many critical factors that might have been overlooked during the clinical ,photographic, or study models evaluation. The drawing of reference lines and shapes over extra-and intraoral digital photographs performed in presentation software such as Keynote (Apple iWork) or MS Powerpoint (Microsoft Office ,)following a predetermined sequence, will enhance the diagnostic vision. It also helps the team to assess and understand limitations and risk factors such as asymmetries, disharmonies ,and violations of esthetic principles, adding critical data to the process of treatment planning.

1 Choosing the appropriate technique is easier once the problem has been identified and the solution clearly visualized .Increased communication amongthe interdisciplinary team The main goal of the DSD protocol is to simplify communication, transferring key information from the patient's face to the working cast, and to the final restoration .The DSD protocol provides effective communication between the interdisciplinary team members, including the dental technician. Team members can identify and highlight discrepancies in soft- or hard-tissue morphology, discussing over high-quality images on the computer screen the best possible solutions for the case. Every team membercan add information directly on the slides, in writing or using voice-over ,simplifying the process even more. All team members can access this information whenever necessary-"in the cloud -"changing or adding new elements during the diagnostic and treatment phases .Traditionally, the dental technician has implemented the smile design with the restorative wax-up. He or she creates shapes and arrangements in accordance with restricted information, following instructions and guidelines provided by the dentist in writing or by phone. In many cases the technician is not given enough information to utilize his or her skills to their maximum potential and the opportunity to produce a restoration that will truly satisfy the patient is missed.

DISADVANTAGES OF DSD

Although DSD presents with an attractive treatment planning tool for the patients, it has certain limitations. It poses as an expensive set-up as the costs for purchase and repair are considerably high. It cannot be operated by any person; rigorous training is

required to learn the tool.Sometimes, the patient disagrees with the pertaining outcome of the treatment even though the software had predicted a better outcome. In such cases, the software blame might seem illogical. This scenario has already been advertised by the manufacturers which often state "the enhanced image does not always match the original image". It is important to watermark the clinician's respective work so as to eliminate unauthorized reproduction of the images. It is recommended that copies of the original images be stored on the computer or network server.

DISCUSSION

In order to establish an esthetic rehabilitative treatment plan, a correct diagnosis is necessary, which identifies and quantifies which elements of the smile need to be corrected or improved, and which must be maintained. Clinical information, data from images, study models and photographs have been used for this purpose. Although these sources of guidance provide relevant data for diagnosis, they do not offer all the information necessary for analyzing the smile .Dynamic records of the smile on video are fast, easy and allow a more precise analysis of esthetics, phonetics and function .It's is very difficult to capture a photo on the exact ideal moment for smile analysis. Usually when the dentist asks the patient to give a full smile, the patient shows less than the real maximum height of the smile. The same can occur on the rest position analysis. On a photo we cannot guarantee that the moment captured is the realistic rest position .

Dentist are usually not professional photographers and patients are not usually professional models so make ideal protracts is also a big challenge in dentistry. Through video documentation the patient can feel less uncomfortable and give more natural poses. The photo camera is emotional barrier for normal people that commonly feel uncomfortable on smiling in front of a camera for somebody that they just met. Even more difficult, when the patient is not Lcomfortable with their own smile. When the photo camera is in front of the photographers face, it increases this barrier and the patient freezes or has difficulty to perform a natural smile. Usually when the photographer brings the camera down the patient will give the best smiles that unfortunately one will miss with the camera. When filming with a smartphone the camera holder can move himself from behind the camera and make direct eye contact with the patient create a much easier environment for natural poses. With proper illumination, a good smartphone camera can become a very decent camera that can generate enough quality for the smile design and treatment planning process and also for patient communication .Facial analysis based only on photograph may give incomplete and/or ncorrect information. Tjan & Miller9

evaluated static photographs of posed smile and reported 11% of the patients in his study presented a high smile, as opposed to 21% of patients with an anterior high smile in a study with video recording.18 Tarantili et al 17 .also evaluated the smile on video and observed the duration of a spontaneous smile was 500 milliseconds on an average, which reinforces the difficulty of recording this moment in photographs. These data have contributed to understanding the findings of Maulik & Nanda18 who reported greater exposure of the posterior teeth and a gingival strip characterizing a high posterior smile in 42% of the patients evaluated on video. This high exposure of teeth and number of teeth visible in the smile tend to diminish with age, a fact confirmed both in photographic,12 and dynamic20 evaluations, however, many other esthetic parameters that have been established in photographs have not yet been defined in videos .Creating

a photo protocol from videos can save a huge amount of time for the photographer (dentist/staff) and also for the patient. An efficient and fast initial photo session will generate a positive feeling on the patient and it's much more simple to train the staff to take photos with smartphones that to train them to use sophisticated DSLR cameras and studios with their complex settings and possibilities .Another great utilization for videos is to help the technician to become a better smile designer by increasing their learning by watching their own work in the patients' mouth on videos. The suggestion is to always film the patient when trying in the work and send these videos to the technician. By looking at facial videos of the patient with their work in the mouth (mock-ups, provisionals, denture setup ,restoration try-ins, etc) the technician will understand better what really works and what doesn't and will improve their smile design decisions becoming a better smile designer even when they don't work inside the clinic and can see these things live .

All the photographic facial documentation taken from videos allows the creation of a 2D smile frame completely integrated into the face. Interdisciplinary treatments have increasingly been necessary for the esthetic and functional resolution of clinical cases in Dentistry. Photographs, videos and drawings of the DSD protocol shared online, have allowed members of the team to access this set of information, at any time, discuss, present

proposals, re-evaluate decisions, compare before and after treatments, making communication and treatment plans really multidisciplinary

CONCLUSION

The DSD is an innovative tool that helps the clinician to create esthetically pleasing smiles.Previsualization drastically increases the patient's acceptance rate. The technology also makes the patient a part of the decision-making process by including their preferences. Although caution should be exercised that ideal case selection is

always necessary in order to have a successful outcome. Patients should be enlightened about the potential ups and downs that they might face if the results are not up to their expectations. Further research into this area will definitely address and solve the issue and make this technology central to esthetic dentistry The use of dynamic smile documentation associated with the DSD protocol may make diagnosis more efficient, and treatment plans more consistent, leading to more logical and direct treatment sequences, with reduction in risks and improved final results.

reference

1- Egr Solomon: Esthetic consideration of smile; Med Dent; 41-47

2- Virtual articulators and virtual mounting procedures: where do we stand ?

Prosthodont;30(2021) ;PP.24-35

3- Bruno MA. 256 Shades of gray: Uncertainty and diagnostic error in

radiology Diagnosis (Berl). 2017

4- Gupta C, Mittal A. Role of digital technology in prosthodontics: A step

toward improving dental care Indian J Oral Health Res. 2018

5- Coachman C, Van Dooren E, Gürel G, Landsberg CJ, Calamita MA,

Bichacho N. Smile design: From digital treatment planning to clinical

reality. In: Cohen M (ed). Interdisciplinary Treatment Planning.

6- Ronald E. Goldstein: Esthetics In Dentistry; third Edition; Volume 1;

Principles, Communications And Treatment Methods.

7-Advance dental export Posted June 27, 2024 by Haresh Savani