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Mini Review

Peak into the Future – with Digital Smile Designing (DSD)

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Abstract

If beauty is power then smile is its sword! And hence to give our patients a beautiful smile todays dental surgeons need to go beyond the boundaries of traditional dentistry and acquire a set of artistic and communicatory skills and vision which helps them to achieve the level of absolute detail and satisfaction. All we need to do to is change our current position and move forwards and take a step in the digitally equipped era. Here is where Digital Smile Designing plays a pivotal role. DSD has basically democratized the way dentistry is performed by making the patient a co-author in his/her own smile designing. Thus, improving communication and predictability with its multidisciplinary approach.

Though, the principles of smile designing followed remain the same but now the approach has become a bit different. Not, only the dentist gets a wider perspective of the treatment plan but also the patient can be well explained about the same through digital mock ups and further physical mock ups. This interdisciplinary approach has made the quality of treatment much better and unique too. This mini review will provide a basic knowledge to the reader about DSD, the software's used and the technical know-how.

Keywords: Digital Smile Designing (DSD); Technology

Introduction

Technology has overpowered almost all our everyday chores be it communication, travel or something uncertain like weather. Almost everything is a click away. So why not dentistry? 21st century era has seen a tremendous growth in dentistry. Technology has transformed the way dentistry is performed today. It has now become important that today's dentists go beyond the boundaries of traditional dentistry and acquire a set of artistic and communication skills and vision to become "smile designers" and this is where digital smile designing (DSD) plays a pivotal role [1].

Dental restoration procedures are commonly performed on patients across the globe. Many patients find themselves in need of restorative services as a result of injury, illness, or other issues that can impact their oral health and the appearance of their smiles. Here, if we can provide with answers like, what will be the final outcome or how close the final smile would be to the original smile, it would confer a greater trust, confidence as well as interest of the patient on the dentist to carry on the procedure further. Thus, making a skeptical patient turn into a more philosophical patient (house classification) and also help us in achieving the De Vans theory, of "meeting the mind of the patient before entering the mouth". A beautiful smile and harmonic facial esthetics are attributes that contribute to the well-being of any patient. 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). Therefore, smile esthetics are related to the form, texture, color, and alignment of the anterior teeth as well as to intraoral soft tissues, lips, and facial esthetics [2]. An important objective of an esthetic treatment is that the final result should be as close as possible to the patient's expectations, improving his/her facial esthetics and smile, thereby making the patient co-author in his/her own smile design.

Digital Smile Design (DSD) has taken the dental world by storm. DSD is a unique dental treatment planning tool that strengthens

a dental provider's diagnostic vision, enhances predictability, and improves communication between dental providers and their patients. A treatment plan is completely based on a thorough analysis of the patient's dental and facial proportions. Through the use of videos, photographs, and temporary mock-ups, DSD providers can get a better sense of the relationship between the lips, gums, and teeth, as well as how they work together to create the patient's smile.

Along with the physical aspects, this approach also looks at the emotional needs of the patient and how they react in certain situations. The mock up is actually a motivational drive which enables the clinician and the patient to evaluate and assess the forthcoming results closely. These factors can impact the treatment plan, as emotions are important to creating the physical way to express those reactions.

History

The search for beauty can be traced to the earliest civilizations; both the Phoenicians (app 800 BC) and Etruscans (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 [3].

Advantages of using DSD

The DSD protocol offers advantages in the following areas

- Esthetic diagnosis
- Communication
- Feedback
- Patient management
- Education

Esthetics

When the dentist first evaluates a new patient with esthetic concerns, many critical factors may be overlooked. A digital photography and digital analysis protocol enables the dentist to visualize and analyze issues that he or she may not notice clinically.

Communication

Successful restorative treatment involves controlling the four dimensions of treatment: esthetics, function, structure, and biology.

In relation to esthetics, there are four main issues that must be controlled to improve predictability and meet patient expectations: the horizontal reference plane, facial midline, smile design (tooth shape and arrangement), and color.

The question is how to precisely transfer this information from the face to the mouth, to the cast, and to the final restoration. The primary goal of the DSD protocol is to facilitate this process.

Feedback

The DSD allows for precise evaluation of the results obtained in every treatment phase. The sequence of treatment is organized on the slides with photographs, videos, notes, graphics, and drawings.

With the digital ruler, drawings, and reference lines, easy comparisons can be made between pre- and posttreatment photographs. These comparisons help determine whether the treatment has successfully followed the original plan or if other adjunctive procedures are necessary to improve the final outcome.

The constant double-checking ensures the excellence of the final result and provides a great learning tool for the entire interdisciplinary team.

Patient management

The DSD can be used as a marketing tool to motivate the patient, an educational tool to help explain issues related to treatment, and an evaluative tool by comparing before and after photographs.

Thereby, patient acceptance by helping them visualize and understand both past and future treatments.

Education

This personal library of clinical cases can also be shared with patients and colleagues, and the most appropriate cases can be transformed into a slideshow for dental presentations and lectures. DSD can increase the visual impact of a lecture by incorporating the slides from clinical cases [4].

DSD in everyday dentistry

Digital Smile Designing can be used in almost all cases where patients esthetic needs are of prime importance. Cases where a multidisciplinary approach is much need DSD can help in giving a good picture of the forthcoming outcome planned.

Few case reports show an important role of DSD in treatment planning and execution of the same.

DSD in esthetic dentistry

In the following case report conducted by MS fan fan., *et al.* A multidisciplinary approach was taken up to rehabilitate a patient suffering from dentinogenesis imperfecta type II Enamel or dentin hypoplasia. DSD assisted and improved the esthetic design of the definitive restoration, communication with the patient, and predictability of the treatment [5].

Figure 1: Pre operative.

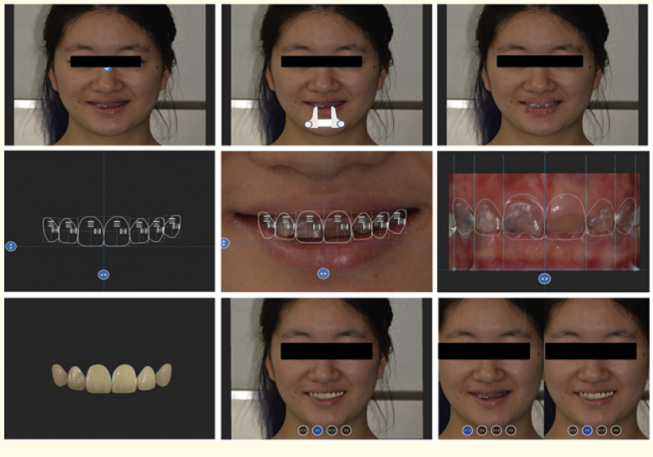
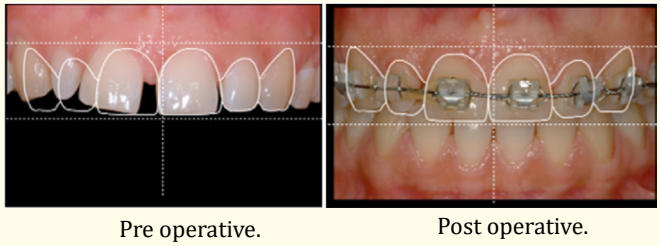


Figure 2: Digital Smile Designing.

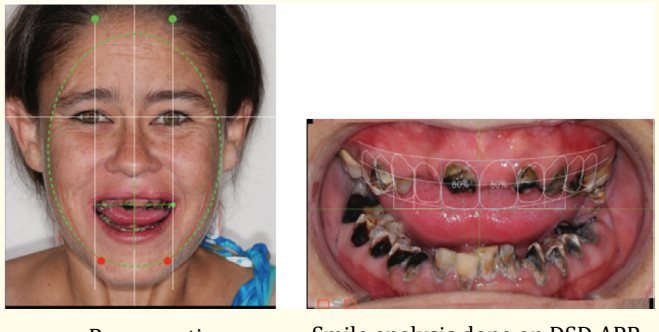
Figure 3: Post operative.



Pre operative. Post operative.

Figure 4

DSD in orthodontia



Pre operative. Smile analysis done on DSD APP

Figure 5

DSD in implantology [6]

Figure 6

Figure 7: Full face digital assessment.

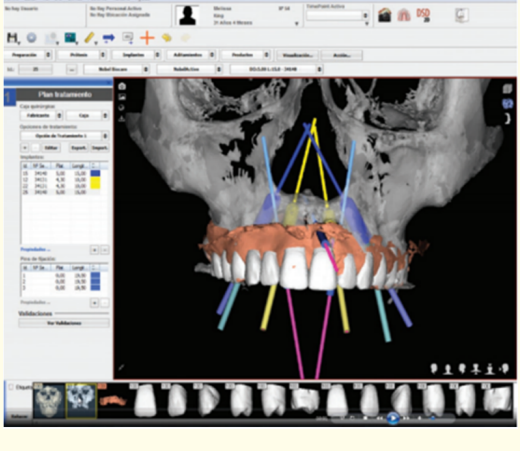


Figure 8: Overlapping the mock up with CBCT.

Final prosthesis

Post operative

Figure 9

Apart, from the above mentioned case reports DSD can be a help in cases requiring Diastemas closure, correction of gummy smiles or the same principles can be applied in designing a complete denture too.

How to go about it??? The DSD workflow

Prime requisites

- Photography and videos

It is recommended to use DSLR with a 100 macro lens to click the following pictures

- Full face with a wide smile and teeth apart
- Full face at rest
- Retracted view of maxillary arch with teeth apart
- All of the above in frontal profile view

These are a minimum set of pictures required. Multiple set of pictures can also be taken.

- Videography of the patient pre-operatively in frontal profile.

Also, a post operative video of the patient, if temporaries are provided.

Software

Software's available for digital smile designing are as follows

- Cerec
- Keynote
- Microsoft Powerpoint
- DSD by Dr Coachman
- Planmeca romnexis
- Visagi smile
- Photoshop C6
- Smile designer pro

Note

- Different software's may have different requirements for number of photos and videos
- The clinician may follow any one of them

In a study conducted by Omar D., *et al* in assessing The application of parameters for comprehensive smile esthetics by digital smile design programs, they inferred that Photoshop scored 20/20 in its ability to fulfil the analysis of facial, dentogingival, and dental esthetic parameters followed by keynote with 19/20 (Culp., *et al*. 2013, Helvey, 2007a, Helvey, 2007b, Helvey, 2007c, McLaren and Culp, 2013) considering many parameters and amongst the different available softwares [7].

Software	Score out of 20
Photoshop CS6	20
Keynote	19
Aesthetic Digital Smile Design	18
Cerec 4.2 software	13
DSD App by Coachman	10
Smile Designer Pro	10
VisagiSMile	10
Planmeca Romexis Smile Design	10

Figure 10

Above table states the total score of facial, dentoginigival and dental analysis features found in the analyzed DSD programs.

But, selection of any DSD program is based on the parameters required and also the level of comfort the clinician has with the software. After all, in the end, it's the clinicians' art to evaluate and assess the condition and provide the patient with a beautiful smile.

The technical know how

- First and the foremost step is selection of an appropriate patient for example a patient with high esthetic needs or replacing a missing tooth in the anterior region etc.
- Thereafter, click pictures of the patient including a full facial, intra oral and lateral profile. A minimum of six pictures are recommended. Rest depend on the software the dentist is using. Clicking pictures is an art, henceforth the dentist has to make sure that the lighting and camera are perfectly suited.
- Since, almost everything depends upon how the pictures are taken the clinician should be very particular about the quality. The shoulders should be maintained in a straight line, ears should be exposed and the eyes should look straight and forward. This step is very much important for establishing the commissural lines, lip line and of course, the interpupillarly line.
- Thereafter a video is made of the patient talking, smiling may be laughing too. Videography is based on the fact that, smile is something natural and dynamic and photography is something very static and may be unnatural at times. So, our treatment plan cannot be just based on pictures and no motion
- Once, this is done the pictures and video are uploaded to the software used by the dentist. It may be simply on power point, keynote or software like DSD by Dr Coachman etc.
- Then the basic lines are drawn, depicting the midline (cross), smile curve and gingival contour.
- A digital ruler is then used to note the dimensions of the changes required. Important point to be noted is that, the first reading is done from the study cast and then the same reading is used to digitalize the ruler.
- After this the smile analysis is done through either the golden proportion by LOMBARDI or Recurring esthetic proportions (RED) by LEVIN or may be the diamond proportion; that is a premolar to premolar smile analysis. Although, many clinicians believe that the golden proportions limits the creativity as the proportion is fixed and RED is a more unique and flexible system, it is completely the choice of the clinician depending upon the case.
- Once this is done the templates are set accordingly. Visagism concept is used to set the perfect shape and size of the teeth considering the sex, age and personality of the patient.
- From this step we can just show the digital mock up on the screen or go about a physical mock up by sending the above details to the technician for temporaries
- Temporaries can also be made by the clinician using materials like tooth coloured self-cure or maybe newer materials like Pro-temp which is nothing but light activated bis-acryl composite.

- The same procedures can also be done using an intra-oral scanner for diagnostic impressions and furthermore, CAD CAM for final prosthesis.
- The use of digital tools offers dentists and technicians a new perspective for diagnosis and treatment plan, facilitating and improving the communication among dentist, technician, and patient.
- The mock-up technique is still regarded as an objective and efficient tool in treatment planning communication and used to confirm the treatment plan before the final preparations and evaluate final restorations within the limitations of biological and functional considerations. The mock-up can also be a clinical confirmation of the digital tool.
- After all of the above is done patient is recalled and a new video is made with the temporaries on.
- Once, this is done, and the patient is motivated enough we can now talk to about all the procedures required to get that beautiful smile. We should always remember DSD is only and only a motivational tool.

Discussion

As Dr Coachman says, performing facially driven smile designs in accordance with the most modern concepts of natural esthetics and orofacial analysis to an interdisciplinary treatment planning has never been so easy. Following the structured digital smile design concepts the simple DSD workflow allows you to offer a chairside solution to improve communication taking dental planning to a new level.

It is important to highlight that spending more time in the diagnosis and planning phase helps to improve treatment predictability and execution efficacy. Improving predictability will support earlier identification of complementary treatments such as orthodontic movement and clinic crown increase [8,9]. Besides, it diminishes clinical errors and frustration by inadequate patient and clinician communication. With the objective of obtaining esthetic and functional rehabilitation, every professional looks for improvement in planning and better predictability support for the clinical treatment [2].

The use of digital tools such as DSD offers dentists a new perspective when combined with the traditional mock-up technique, showing a bigger success rate in relation to the final results. The combination of DSD and mock-up techniques allows for improved esthetic manipulation, therefore, a better predictable model to support the treatment plan.10 Digital imaging allows patients to visualize the expected final result, besides facilitating the presentation of the current condition of his oral health [8,11,12].

DSD is also a powerful marketing tool [13-15]. However, correct digital planning requires a precise photography protocol. The photography obtained following this protocol supplies important information for the esthetic planning. Inadequate photography may distort the reference image and may result in an incorrect diagnosis and planning [9]. Despite studies that show a satisfactory clinical result. this tool should be used cautiously due to these limitations in this protocol [15]. Even though DSD is a simple technique with minimum software and equipment requirements, training is necessary which increases time and cost [13].

The main reasons DSD can improve the way we communicate and plan in dentistry are various. It helps to guide our staff to create a standardized and complete patient documentation. This allows for photo and video documentation and also can be used with outside devices such as scanners and CBCTs, making it very easy to digitalize the patient and bring all the info together in one place. This not only improves team collaboration, visual communication, decision making process but also interdisciplinary treatment planning. It presents the most automated and intuitive 2D smile design process, creating motivational chairside smile simulations and transforming the smile simulation into mock ups and natural restorations.

In addition, a powerful tool commonly used to support digital treatment planning is the mock-up technique; as it gives the patient and dentist, a tridimensional visualization of the final result of the proposed treatment is one of its big advantages [9,14]. While in the diagnostic wax-up, one can only see the desired shape for the teeth, the mock-up allows the visualization of the shape integrated to the gingiva, lips, face, and phonetics [15-17] during the evaluation period. As such, the patient may evaluate, provide opinion, and approve the final shape of the new smile before any irreversible procedures are performed such as dental wearing.

DSD has brought about a paradigm shift in how dentistry is performed today. It has increased communication and predictability to manifolds, thereby increasing patient acceptance and satisfaction. This article explains and examplifies the important feature of DSD and how it can be used for various smile designing cases.

Conclusion

Basically, DSD helps to remove the struggle with miscommunication or unanswered questions due to a lack of clarity. Since, the whole treatment plan is on the screen, it can

be discussed with multiple doctors at the same time giving the treatment plan an interdisciplinary approach. Digital Smile Design is one of the leading forefronts of dental technology, ensuring a dental care treatment that is best for each patient. With DSD, you'll be on your way to creating a treatment plan that is unique to your patients' dental needs and will help you create a smile they deserve.

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