

VIRTUAL

Esthetic Smile Design

Driving the Restorative Plan

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The digital *JCD* version features a preview and link to an educational DentalXP video about this article.

Editor's Note: This article is adapted from "*Digital Smile Design: A Tool for Treatment Planning and Communication in Esthetic Dentistry*" (QDT 2012, vol. 35, p. 103). Adapted with permission from Quintessence Publishing.

Abstract

Digital Smile Design is a multipurpose digital tool with clinically relevant advantages: It can strengthen esthetic diagnostic abilities, improve communication between team members, help organize treatment planning, create predictable systems throughout treatment phases, enhance patients' education and motivation, and increase the effectiveness of case presentation. This article describes the main steps of introducing this practical tool to the clinician's esthetic restorative practice.

Key Words: Digital Smile Design, esthetics, treatment planning, communication, presentation



“ Excellence will never be achieved by chance; rather, it comes from a consistent, systematic approach to diagnosis, communication, treatment planning, and implementation. ”



Introduction

Excellence will never be achieved by chance; rather, it comes from a consistent, systematic approach to diagnosis, communication, treatment planning, and implementation. The incorporation of protocols and checklists¹⁻⁷ for quality control and information management help to guarantee that every critical point is performed effectively, is double-checked, and is communicated correctly.

To obtain predictable and consistent outcomes, the practitioner should define the design of the restorative treatment at an early stage. The data must guide the succeeding phases of the rehabilitation,⁸ scientifically integrating all of the patient's needs and desires and the patient's functional, structural, and biological issues into the esthetic treatment design. The data serve as a frame of reference for the treatment that will be performed.^{9,10} However, many of these pieces of information may not be taken into consideration if their real meaning is not transferred in an adequate way to the design of the restorations.

Digital Smile Design is a multipurpose digital tool with clinically relevant advantages. It can strengthen esthetic diagnostic abilities, improve communication among team members, create predictable systems throughout the treatment phases, enhance patients' education and motivation through visualization, and increase the effectiveness of case presentation. Because using DSD can make diagnosis more effective and treatment planning more consistent, the effort required to implement it is worthwhile and will make the treatment sequence more logical and straightforward, saving time and materials and reducing the cost of treatment.

Clinically Relevant Advantages

The advantages of using DSD are as follows:

- esthetic diagnosis
- treatment planning and communication
- feedback
- patient care
- case presentation
- education.

Esthetic Diagnosis

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 model evaluation. Drawing reference lines and shapes over extra- and intraoral digital photographs in presentation software (such as Keynote [Apple; Cupertino,



Figure 1: Preoperative extraoral view 20 years before first appointment showing ankylosed teeth #21 and #22.



Figure 2: Preoperative extraoral view at first appointment.

CA]; PowerPoint [Microsoft; Redmond, WA]; DSD software; or Smile Designer Pro [TastyTech; Toronto, Ontario, CA]), following a predetermined sequence, helps widen the diagnostic vision. This visualization process also helps the team to assess and understand limitations and risk factors such as asymmetries, disharmonies, and esthetic principle violations, adding critical data to the process of treatment planning.¹ Choosing the appropriate technique is easier once problems have been identified and the solution clearly visualized. The main steps related to diagnosis are shown in **Figures 1-11**.



Figure 3: Profile issues: Skeletal Angle Class II.



Figure 4: Digital facebow in DSD software.



Figure 5: Facial lines overlapping the smile in DSD. The facial cross and digital wax rim (red curve) is visible.



Figure 6: Calibrating the intraoral photograph to the facial photograph.

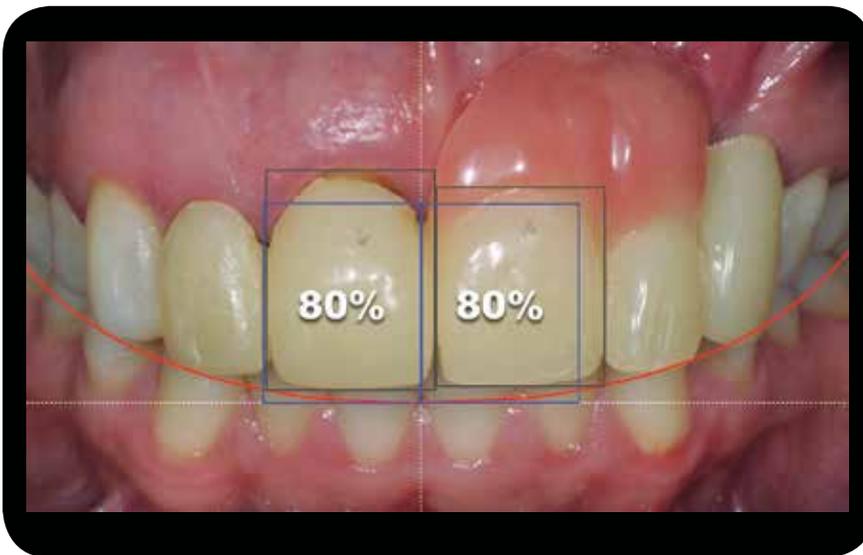


Figure 7: Central incisor tooth proportion analysis.

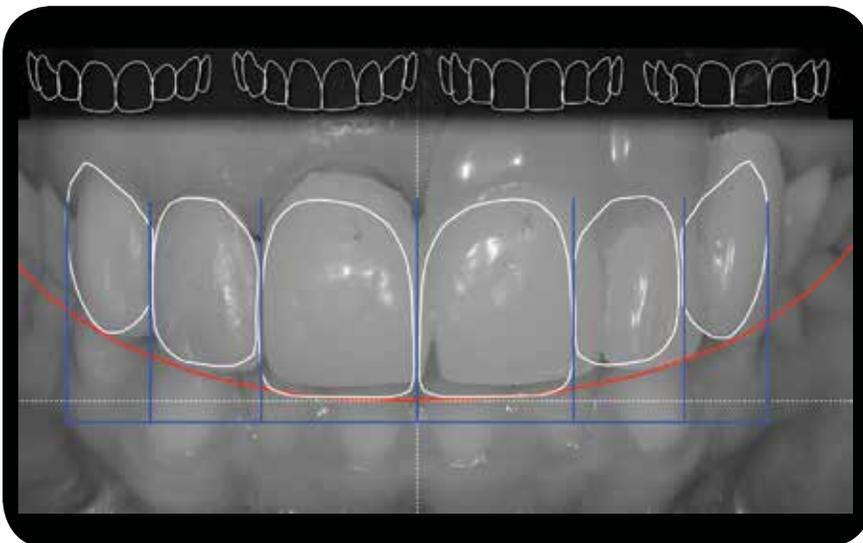


Figure 8: Interdenture proportion guide and tooth outline according to morphopsychology.

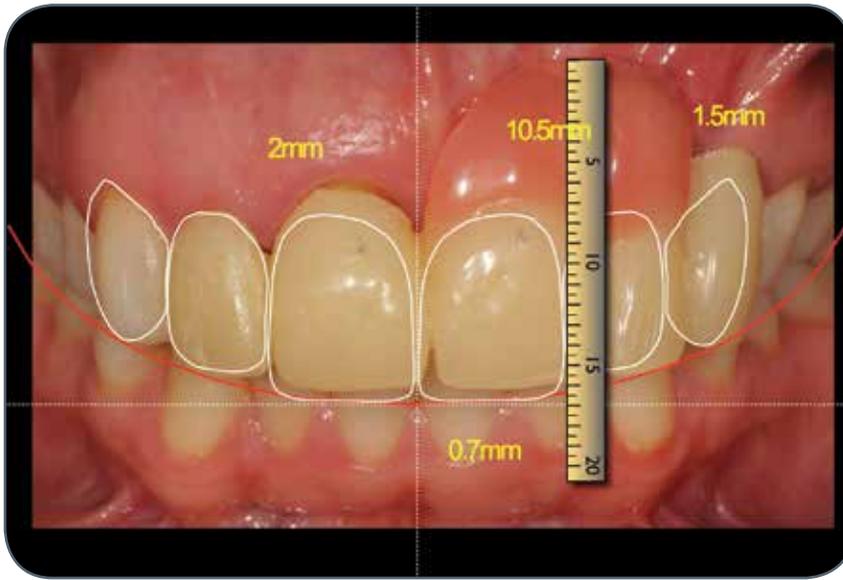


Figure 9: The digital ruler, measuring the gingival and incisal discrepancies for treatment planning and for guiding the wax-up.

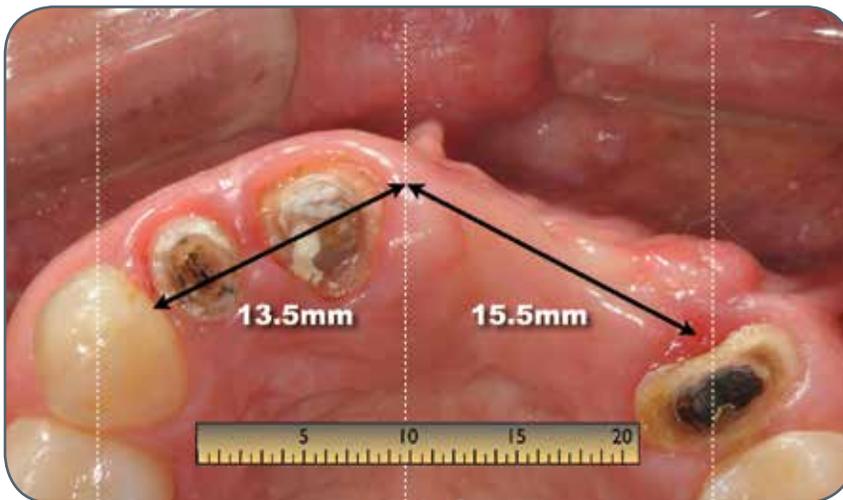


Figure 10: Occlusal analysis in DSD, detecting a mesiodistal space discrepancy anteriorly.



Figure 11: DSD drawings for better understanding the space management possibilities, implant position, and horizontal ridge reconstruction.

Treatment Planning and Communication

The main goal of the DSD protocol is to simplify communication, transferring key information from the patient's face to the working cast and then to the final restoration. The DSD protocol allows for effective communication between the interdisciplinary team members, including the dental technician. Team members can identify and highlight discrepancies in soft- or hard-tissue morphology and use high-quality images on a computer screen to discuss the best possible solutions for the case. Every team member can add information directly on the slides, either in writing or by using a voice-over function, thus simplifying the process even more. All team members can access this information whenever necessary by using shared files and changing or adding new elements during the diagnostic and treatment phases.

Traditionally, the dental technician has implemented the smile design with a restorative wax-up. The dental technician 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 use his or her skills to their maximum potential, and the opportunity to produce a restoration that will truly satisfy the patient is missed.

When the treatment coordinator or another member of the restorative team who has developed a personal relationship with the patient takes responsibility for the smile design, the results are likely to be superior. This team member has the ability to communicate the patient's personal preferences and morpho-psychological features to the laboratory technician, providing information that can elevate the quality of the restoration from one that the patient sees as merely adequate to one that the patient sees as exceptional.^{7,8,11}

With this valuable information in hand and from the two-dimensional DSD, the dental technician can develop a three-dimensional wax-up more efficiently, focusing on developing anatomical features within the parameters provided, such as planes of reference, facial and dental midlines, recommended incisal edge position, lip dynamics, basic tooth arrangement, and the incisal plane. Transferring this information from the wax-up to the "test-drive" phase is achieved through a mock-up or a provisional restoration.^{4,6,12} The design of the definitive esthetic restorations should be developed and tested as soon as possible, guiding the treatment sequence to a predetermined esthetic result.¹³ Efficient treatment planning results in the entire treatment team being able to do a bet-

ter job of identifying the challenges they will face and helps expedite the time to initiate and ultimately complete treatment.^{8,14} The steps related to the treatment planning and the sequence performed are shown in **Figures 12-31**.

Feedback

DSD allows precise evaluation of the results obtained during every phase of treatment. The treatment sequence is organized on the slides with the photographs, videos, reports, graphics, and drawings, making this analysis simple and effective. Any team member can access the slide presentation at any time and check what was done until that moment. With the digital ruler, drawings and reference lines can be created so that it is possible to perform simple comparisons between the "before" and "after" images, determining whether they are in accordance with the original planning or whether any other adjunctive procedures are necessary to improve the outcome. The dental technician also gains feedback related to tooth shape, arrangement, and color so that final refinements can be made. This constant double-checking of information ensures that a higher-quality product will be delivered from the laboratory and also provides a great learning tool for the entire interdisciplinary team.

This process also becomes a useful library of treatment procedures that can be used in many different ways. Going back to old cases and understanding visually how they were treated is effective as a learning experience.

Patient Care

DSD can serve as a marketing tool to motivate patients so that they can better understand the issues and treatment options, compare "before" and "after" images, and understand all the work that was involved. Moreover, creating slides of treatments performed generates a personal library of clinical cases that can be shared with other patients and colleagues, and the most appropriate cases can be transformed further into interesting slide shows of one's work.

Case Presentation

DSD is designed to make treatment-planning presentation more effective and clear because it allows patients to see and better understand the combined multiple factors responsible for their dental and facial issues. Case presentation will be more effective and dynamic for these patients because the problems will be superimposed over their own photographs, increasing patient understanding, trust, and acceptance of the proposed plan. The clinician can express the severity of the case, introduce treatment strategies, discuss the prognosis, and make case management recommendations.¹ The case presentation also can be used for medico-legal purposes, registering the improvements that were achieved and the reasons for each decision made during the treatment.

Education

DSD aims to improve academic presentations by adding visual elements to the slides to make what the presenter says more clear in visual terms. This allows the audience to better understand and see what is being taught, because all of the information is presented in a clear, concise, and visual format.

Digital Smile Design Workflow

The DSD protocol was performed by the authors using Keynote or PowerPoint, but specially developed software such as Smile Designer Pro or DSD software is highly recommended. This type of software allows simple manipulation of digital images, as well as the addition of lines, shapes, drawings, and measurements over the clinical and laboratory images. In this article, the main steps for using DSD are described and illustrated by showing the resolution of a complex case (Figs 12-31). It is important to emphasize that DSD was used from treatment inception and helped the patient to visualize all her clinical issues, understand potential solutions, and choose the option that best fit her needs and wishes.

“Choosing the appropriate technique is easier once problems have been identified and the solution clearly visualized.”

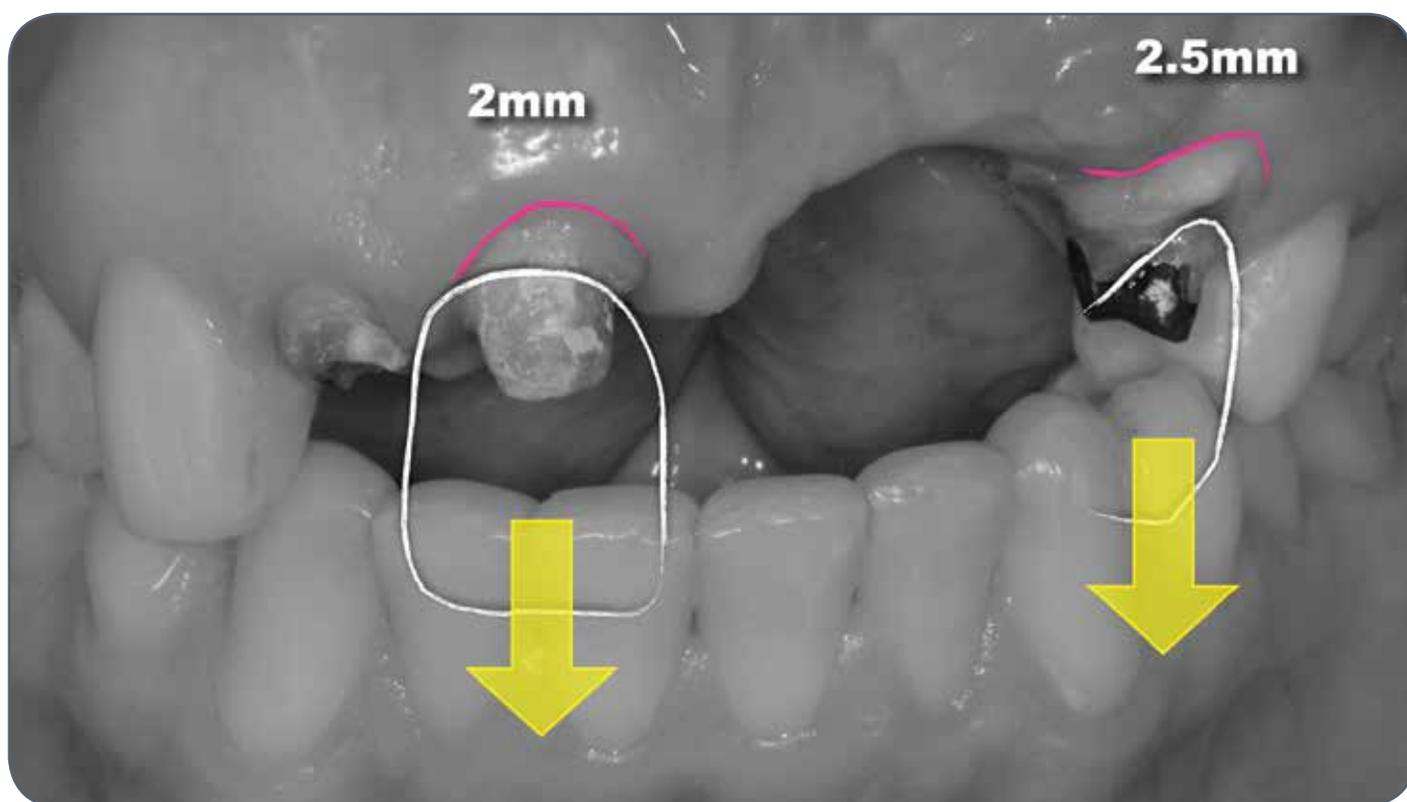


Figure 12: The plan: Orthodontic extrusion of #11 for bone and soft-tissue repositioning according to the DSD analysis. Tooth #23 would be extracted because of lack of bone support and esthetic limitations.



Figure 13: Orthodontic extrusion of #11.



Figure 14: The bridge design after extracting the structurally compromised canine. There was an esthetic improvement because of the artificial gingiva extension over #23, leveling the pink esthetics and placing the interface between natural and artificial gingiva in a less esthetically demanding area, distally behind the canine.



Figure 15: Final position for lithium disilicate restorations over natural abutments.



Figure 16: Try in and analysis of white esthetic integration with the face.



Figure 17: The patient returned one week after seating for the improvement of the artificial pink interface. The tissue was ideally healed and adapted to the new emergence profile, so there was an ideal environment in which to bond the pink composite to the pink ceramics intraorally.



Figure 18: The bridge was unscrewed and prepared for bonding. The first step was to roughen the surface for better retention.



Figure 19: Acid etching.



Figure 20: Applying the silane.



Figure 21: Applying the bonding agent.



Figure 22: Applying the first layer of flowable pink composite chairside to guarantee better bonding without interference of the saliva.

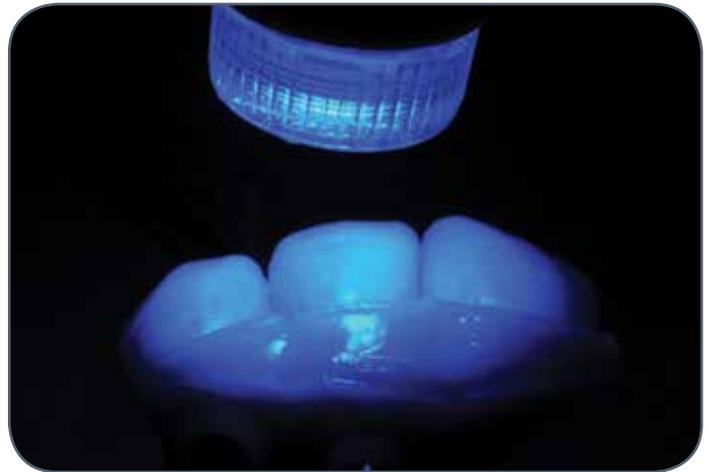


Figure 23: Light-curing before inserting the bridge in the mouth to proceed with the direct composite buildup.



Figures 24 & 25: Intraoral pink composite buildup produced by using a micro brush and thin-tip stain brushes. Different colors and pigments were used to better match the natural gingiva.

“The design of the definitive esthetic restorations should be developed and tested as soon as possible, guiding the treatment sequence to a predetermined esthetic result.”



Figures 26a-26c: Finishing and polishing the restoration outside the mouth.



Figure 27: Final seating after testing hygiene procedures; floss should be able to go all the way around and underneath the artificial gingiva.



Figures 28a-28c: Final outcome.



Figure 29: The positive emotional response of the patient reflects a successful treatment.



Figure 30: Genioplasty was performed to improve the profile; a significant difference achieved with a relatively simple procedure. The ideal facial integration was achieved with an interdisciplinary approach.



Figure 31: Postoperative extraoral view after two years.

Summary

DSD is a practical multi-use tool with clinically relevant advantages. It can strengthen esthetic diagnostic abilities, improve communication among team members, create predictable systems throughout the treatment phases, enhance patients' education and motivation, and increase the effectiveness of case presentation. The drawing of reference lines and shapes over the patient's photograph, following a predetermined sequence, allows the team to better evaluate the esthetic relation among the teeth, the gingiva, the smile, and the face.

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References

1. Coachman C, Van Dooren E, Gürel G, Landsberg CJ, Calamita MA, Bichacho N. Digital smile design: from digital treatment planning to clinical reality. In: Cohen M, editor. Interdisciplinary treatment planning, Vol. II: comprehensive case studies. Hanover Park (IL): Quintessence; 2011.
2. Goldstein RE. Esthetics in dentistry: principles, communication, treatment methods. Hamilton (ONT): Decker; 1998.
3. Chiche GJ, Pinault A. Esthetics of anterior fixed prosthodontics. Hanover Park (IL): Quintessence; 1996.
4. Magne P, Belser U. Bonded porcelain restorations in the anterior dentition: a biomimetic approach. Hanover Park (IL): Quintessence; 2002.
5. Fradeani M. Esthetic rehabilitation in fixed prosthodontics: esthetic analysis—a systematic approach to prosthetic treatment. Hanover Park (IL): Quintessence; 2004.
6. Gürel G. The science and art of porcelain laminate veneers. Berlin: Quintessence; 2003.
7. Rufenacht CR. Fundamentals of esthetics. Hanover Park (IL): Quintessence; 1990.
8. Dawson PE. Functional occlusion: from TMJ to smile design. St. Louis: Mosby; 2007.
9. Spear FM. The maxillary central incisor edge: a key to esthetic and functional treatment planning. *Compend Contin Educ Dent*. 1999 Jun;20(6):512-6.
10. Kois JC. Diagnostically driven interdisciplinary treatment planning. *Seattle Study Club J*. 2002;6(4):28-34.
11. Paolucci B. Visagismo e Odontologia [Hair and makeup: and dentistry]. In: Hallawell P, editor. Visagismo integrado: identidade, estilo, beleza [Hair and makeup: integrated: identity, style, beauty]. São Paulo: Senac; 2009: p. 243-50. Portuguese.
12. Gürel G, Bichacho N. Permanent diagnostic provisional restorations for predictable results when redesigning smiles. *Pract Proced Aesthet Dent*. 2006 Jun;18(5):281-6.
13. Paolucci B, Hallawell P, Sauer C, Coachman C, Ricci A, Calamita M, Yoshinaga LG, Gürel G. Visagismo: a arte de personalizar o desenho do sorriso [Hair and makeup: the art of customizing the design of the smile]. São Paulo: VM Cultural; 2011. Portuguese. Available from: http://www.fineartdental.com.br/downloads/visagismo_braulio-paolucci.pdf
14. Coachman C, Calamita MA. Digital Smile Design: a tool for treatment planning and communication in esthetic dentistry. Hanover Park (IL): Quintessence; 2012. **JCD**

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Dr. Coachman is the owner of Well Clinic Esthetic Dentistry, Digital Smile Design Center in São Paulo.

Disclosure: Dr. Coachman is the developer of Digital Smile Design.