**Scholars Journal of Medical Case Reports**
Abbreviated Key Title: Sch J Med Case Rep
ISSN 2347-9507 (Print) | ISSN 2347-6559 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

**Dental Anatomy**

# Digital Smile Design Software: An Overview

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**DOI:** https://doi.org/10.36347/sjmcr.2024.v12i11.008 | **Received:** 29.09.2024 | **Accepted:** 01.11.2024 | **Published:** 07.11.2024

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**Abstract** **Review Article**

Digital Smile Design (DSD) software have revolutionized the field of aesthetic dentistry by enabling clinicians to design and visualize patient-specific treatment outcomes. This software integrates digital tools like 2D and 3D imaging, CAD/CAM technology, and simulation algorithms to create comprehensive and highly accurate treatment plans. It facilitates communication between dentists, technicians, and patients by providing a visual representation of potential results, enhancing patient understanding and confidence. This article presents an overview of digital smile design software currently available.

**Keywords**: smile design, digital dentistry, dental esthetics, application.



## INTRODUCTION

Since the presentation in 2012 of the principle of Digital Smile Design by Dr. Christian Coachman (both dentist and prosthetist in Brazil) (Coachman C *et al*., 2012) aesthetic dentistry has experienced a true tidal wave in terms of software and digital suites.

Nowadays several computer software programs for digital smile design (DSD) are available to clinical practice and research. They are multipurpose conceptual tools that allow careful analysis of facial and dental features of patients that may be missed by clinical, photographic, or diagnostic cast assessment procedures.

These types of software allow the patient to be aware of the treatment plan from the beginning. They also allow the dentist to better understand and deal with the patient's needs and expectations.

We shall now briefly describe the main software known and used in Tunisia, which are Appel keynote and PowerPoint, DSD, DSD Connect, Exocad, photoshop, 3Shape and Visagismile.

**1. Appel Keynote and Power Point: (Coachman *et al*., 2012), (Zimmerman *et al*., 2013)**

Brands: Keynote from Apple, Cupertino, California and Power Point from Office Microsoft, Redmond, Washington.

Release Date: Latest releases, 2016.

Country: USA

Required Data: Digital photographs and/or videos.

Working principles: clinical shots, from digital photographs, video clip screenshots are imported into a new project. This software makes it possible to manipulate these images, to carry out an aesthetic analysis, then to create a virtual 2D wax-up.

Compatibility: By associating Keynote, or PowerPoint, with DSD Connect, it is possible to export a project into a CAD/CAM program. This makes it possible to create a 3D wax-up, then to produce the corresponding restorations.

**2. Digital Smile Design DSD**

Brand: DSD app LLC

Country: USA

Release year: 2017

Required Data: three digital photographs and videos.
Working principles: ok the DSD technique consists in using a digital ruler to match three basic photos of different views to complement the lines and drawings and create the frame of the smile, with reference to the video analysis. This framework is a useful additional information that, together with traditional patient documentation (X-rays, models, medical history, clinical examinations, periodograms, etc.), contributes to a better decision-making process, interdisciplinary interaction and development of treatment plans allowing to balance their vision and synchronize their communications.

Compatibility: compatible with ExoCad, InLab et Nemotec

**3. DSD Connect**
Brand: Hack Dentistry

Release date: 2013

Country: Romania

Required Data: 5 Digital photographs and/or videos

Working principles: The DSD Connect makes it possible to transfer all the information of the virtual 2D aesthetic project, produced with Keynote or PowerPoint, into a compatible CAD/CAM software. Thus, the reference lines, the new dental contours, as well as the photographs of the patient, are associated with an arch modeled from optical impressions in CAD /CAM software. This happens in all the planes of space, in which the lines will have been made, (frontal, occlusal, profile view, view at 12 o'clock, etc.). Thus, the aesthetic analysis and the virtual prosthetic project are fully taken into account in the realization of the prosthetic elements. The EPI can be exported to other planning software, such as programs intended for the planning and/or execution of orthodontic treatment and can also be associated with implant planning software, making the association of the P OTI, 0 gulde the surgical aesthetic project with a CBCT examination possible, to guide the surgical act.

Compatibility: Open system, the DSD Connect can combine 2D projects with CAD/CAM software, such as Sirona or 3Shape.

**4. Exocad (Exocad official site), (Tordiglione L *et al*., 2016)**
Brand: Exocad GmbH

Country: Germany

Release year: 2010

Required data: two digital photographs.

Working principles: Combining patient photos, descriptions and 3D representations, aesthetics between teeth, smile and face can be assessed. Patient photos are converted into 3D objects that are then matched to the patient's dental scans. This provides dentists and dental technicians with a realistic view of a treatment plan for restorative procedures.

Compatibility: exocad *DentalCAD* and exocad *ChairsideCAD* can be connected to numerous materials from leading CAD/CAM manufacturers in order to give maximum flexibility and full freedom of choice when selecting materials for all dental applications.

**5. Photoshop Smile design® (MacLaren *et al.*, 2023)**
Brand: Adobe Systems®

Release date: 2013

Country: USA

Required Data: 4Digital photographs.

Working principles: This PSD® (Photoshop Smile Design®) uses tooth-shaped grids with different proportions (proportions of maxillary central incisors: 75%, 80%, etc.). These grids can be saved in a database. The aesthetic analysis process is similar to that of DSD. The software allows you to make edits using its tools. Therefore, the virtual mask is created, and the patient can directly view the result.

Compatibility: Not available

**6. 3Shape Smile Design (3Shape official site)**
Brand: 3Shape

Release date: 2010

Country: Denmark

Required Data: Digital photographs and/or videos, and optical impressions.

Working principles: It is associated with the 3Shape RealView Engine, now sold with the CAD/CAM Dental System 2015 CAD1 software. The project is designed from a portrait photo of the smiling patient, and an optical impression of the maxilla. The software is able to align these two elements in order to make them correspond in the frontal plane, in terms of position and dimension. Then the operator designs the future prostheses with the CAD/CAM software and can integrate the result into the patient's portrait.

Compatibility: This module only works with 3shape products, for the transition from the virtual project,

created with the smile composer, to the design of prostheses.

**7. Visagismile** (Paolucci *et al*., 2012)
Brand: Visagismile Inc.

Release date: 2015

Country: Bulgaria

Required Data: Digital photographs and/or videos.

Working principles: This software is inspired by the visagism of Braulio Paolucci, Marcelo Calamita and Christian Coachman. It proposes from a portrait, where the patient smiles, and a personality questionnaire, to analyze according to the theory of visagism the type of character of the patient, and then generates an aesthetic project in 2D. The tracing produced by the software is adjusted on an X-ray of the maxilla, and a simulation of natural tooth texture is added. Each virtual tooth in the project can be modified. The integration of the new smile within the face is not visible.

Compatibility: Close compatibility, no association possible with CAD software.

## CONCLUSION

The elaboration of a prosthetic project requires numerous working sessions bringing together the practitioner and the prosthetist, as well as the patient. Digital tools, among which photography is the basic element, are nowadays of a real aid allowing a virtual project of the smile.

When the treatment plan includes an aesthetic component, these tools allow a preview of the intended result. This preparatory work, resulting from an analysis then the application of rules and ideal shapes, also called "smile design" guides the prosthetist in his future wax-up work.

Several computer software were proposed to carry out the simulation of the future project. Some of these software programs are very easy to handle, others require more in-depth knowledge but bring additional realism to the project.

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