

## Smile Design Software: A Virtual Avenue To Treatment Planning

Research Article

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### Abstract

The ever-evolving field of dentistry with its advancements has provided room for elective, minimally invasive dental treatment. Aesthetic dentistry is one such field that has benefitted greatly from the evolution of smile design software. Virtual Smile Design is a concept that enables the clinician to customize the smile for the patient in accordance with the facial and dental structures. The software provides visualization of this outcome, before the initiation of any treatment, to the clinician, patient and the technician. There are numerous smile design software available, many of which are mobile app-based, stand-alone software or integrated into a CAD module. This article reviews the basics of virtual smile design and currently available software.

**Keywords:** Cosmetic Dentistry; Virtual; Digital; Smile Design; Software.

### Introduction

The demand for elective, aesthetically driven dentistry has increased manifold and the modern patient frequently seeks smile transformations [1]. The dentist must identify the primary problem, visualize the custom 3-dimensional solution, and choose the appropriate technique [2]. A history, evolution of the patient's aesthetic concerns, and assessment of the expectations and desires of the patient are the preliminary prerequisites. The clinical examination includes analysis and evaluation of the intraoral structures, occlusion [3], existing restorations, and the surrounding soft tissues. Koirala et al. recommended the evaluation of the facial, dentofacial, and dentalelements [4]. Along with radiographs, diagnostic casts, and interocclusal records, with high-quality photographs and videography of the patient are recommended [5]. Videography offers a unique and dynamic view which aids in gauging phonetics by controlling their playback speed [2]. Screenshots can be captured from the video frames and can be exported [6]. Additionally, intraoral scans, 3D printers and CAD/CAM enable a 3-dimensional workflow.[7]

Aesthetic dentistry has always been faced with important challenges like correlating the face with the working models, multidisciplinary communication, and treatment planning and communication to the patient [8]. To overcome these challenges, clinicians are shifting focus to the virtual method of diagnosis and treatment planning in which dedicated software enable them to conceptualize the model, solidify diagnostic vision, communication, and make the treatment more predictable. The dental and facial features along with other critical factors can be minutely analyzed using the software. Diagnostic visualization can be improved with drawing reference lines and shapes over digital images in a predefined order. The clinicians can have a better understanding of the shortcomings and risks such as asymmetries and disharmonies [9].

The workflow of digitally designing the smile is summarised in Figure 1 based on the guidelines developed by Coachman, 2018 [10].

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With the aesthetic goal in place, the treatment is planned with the design as a guide to performing the restorative and if required the periodontal, orthodontic, and endodontic treatment. Recently, there has been a shift towards cross-disciplinary treatment for better outcomes in the smile design.

Numerous software are currently available to aid the clinicians for effective enhancement of smile (Fig. 2.). These have various advantages and disadvantages which are often unclear to novice dentists. Hence, we aimed to critically appraise the commonly available smile designing software.

**Digital Smile DesignApp**

Requirements: DSDApp, Photographs, intraoral scan  
 Compatibility:

- iTero Connection - enabling direct upload from iTero scanner to the app [11]
- TScan Connection
- 3D Smile Design
- IOScan

**Available Platforms:**

- Apple iPhone Application
- Apple iPad Application

**Features:**

- Smile simulation based on Facial Flow [12] and artificial intelligence
- 3D templates can be grouped and moved together. Example-mirror 3D design to adjust the position, size and rotation
- Mix 3D shapes: Minor shapes can be changed within the same smile design giving three or four different versions of the same smile design.
- 2D / 3D slider gives the option to check the 2D to 3D accuracy
- Analysis with all measurements and percentage calculation for the smile proportion
- Currently does not offer treatment planning of the lower arch in the app.
- The app has monthly or yearly subscriptions and unlimited iCloud storage

**Need for further training:**

- Two levels of Residency are offered.
- Level 1 of 3-4 days and Level 2 of two weeks.
- Certification of a DSD Master is required to open a DSD Clinic.

**Lite Dentistry**

Requirements: iTero intraoral scan, DSDApp Photographs

**Figure 1. Basic steps in the digital smile design software.**

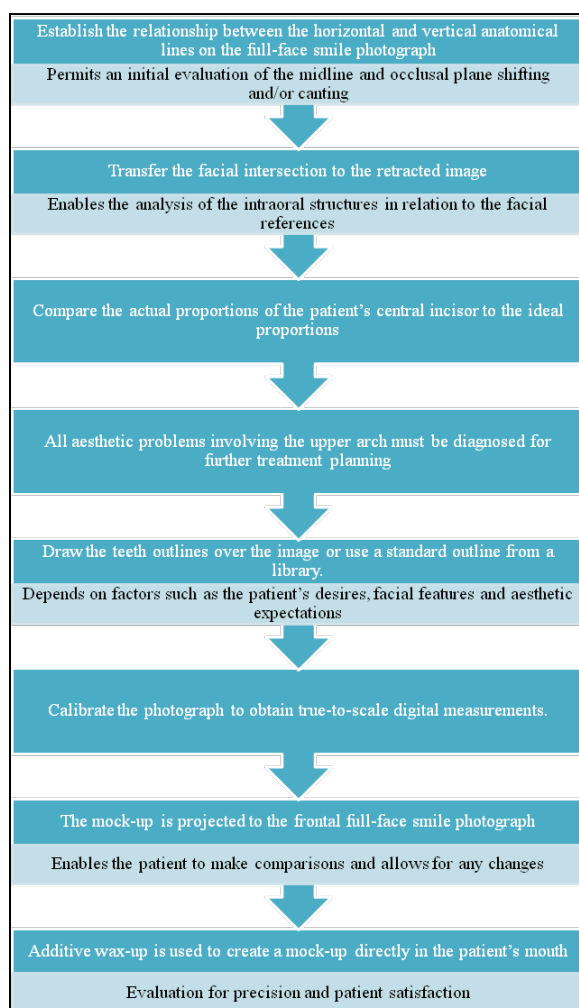
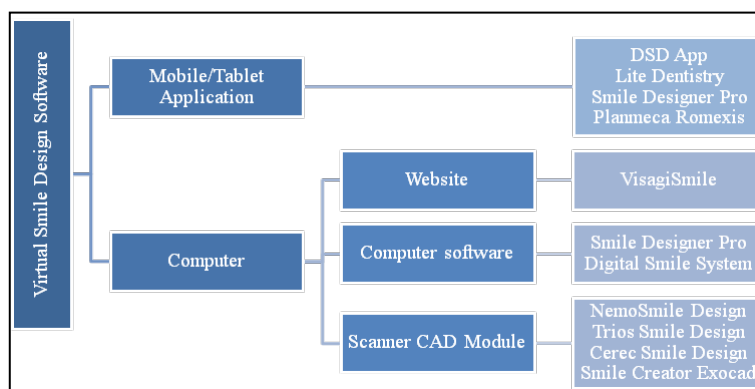


Figure 2. Classification of Virtual Smile Design Software.



Compatibility: Works in conjunction with Invisalign GO software

**Available Platforms:**

- Mobile phone application
- Tablet application

**Features:**

- Offers a combination of simple orthodontic movement and direct restoration in the same protocol.[13]
- Tooth movement is performed by using clear aligners by Invisalign GO
- The final restoration is performed by DSD Direct Technique which uses injectable composite to fabricate direct composite veneers using a clear custom-fabricated mould according to the smile design
- Due to automation at every step of the procedure, the results are precise and replicate the initial smile design to perfection.
- No sophisticated skills are required by the dentist as the direct composite bonding is performed with injectable composites in a mould
- It offers an excellent marketing tool as it offers more comfortable and affordable treatment options to the patient relative to porcelain veneers.

**VisagiSmile**

**Requirements:**

- Full face picture with a maximum smile and visible dentition
- Picture of the maxillary arch with retracted lips and a black contrast.
- Patient interview via questionnaire in the software.

**Available Platforms:** Cloud-based web application.

**Features:**

- The software performs auto-analysis of the facial structure and the classification of facial shape.
- The optimal tooth shape is determined with the questionnaire embedded in the software and it algorithmically computes the temperament.
- The software can compute the main parameters of the smile frame: incisal projection, tooth shapes, tooth inclination, dominance, etc.[14]

- The software amalgamates the data from the questionnaire with the facial analysis and the patient’s choice considering aesthetic rules to give the final smile design [15]
- The free version of the software while does not expire, only allows the smile analysis and offers a proposed smile design for the patient.
- The paid version of the software permits the operator to upload intraoral pictures and make modifications in the design.
- Free software has lifetime validity while the paid version must be renewed every year.

**Smile Designer Pro**

**Requirements:** Frontal full-face smile photograph and additional views, eg. the 12 o’clock view.

**Available Platforms:** Standalone software available on mobile phone application, tablet application and computer software.

**Features:**

- The photographs create 2D smile frames.
  - It includes five prefabricated templates for tooth shapes.
  - Similar to photoshop, it provides a “Smudge Brush” to simulate gingival recession.
  - A brightening tool is used to simulate tooth whitening.
  - The Pro version can generate a classic see-through template that can be positioned over the 3D model
  - Provides an auto-assist feature to optimize the workflow
- Training:** Premium plan includes an optional online training session

**Storage:** Cloud Storage available

**Digital Smile System**

**Requirements:** Full Frontal photographs taken in an exaggerated smile, with full lip retraction and teeth in maximum intercuspal position [16] while wearing special eyewear.

**Available Platforms:** Standalone computer software.

**Features:**

- Photographs are taken while wearing special eyewear to automatically superimpose the images [16]
- Selection of tooth moulds from virtual tooth libraries that can

be applied directly on the patient's facial images and serves as an effective 2D previsualization tool

- Virtual tooth libraries that can be applied directly on the patient's facial images and served as an effective 2D previsualization tool.

### NemoSmile Design 2D/3D

**Requirements:** 2D Photographs and intraoral scans

NemoStudio Suite [17]:

- NemoCast –orthodontics software
- NemoFAB – orthognathic surgery software
- NemoScan implantology software

**Available Platforms:** Standalone computer software.

#### Features:

- Records are imported into a series of images to view them in presentation layouts based on the type of series.
- Perfect calibration is essential when working with photographs and 3D models.
- Transformation of 2D into digital 3D mock-up
- Model the Smile Frame in 3D from 2D or another image using:

- Curved lines (Smile Frame DSD)
- Dental proportion
- Occlusion analysis with virtual articulator

- Facial prediction of the planning in real-time with a preview of the different prosthesis galleries
- Superposition of the mock-up to measure veneers and/or prostheses
- Library of aesthetic prostheses and creation on demand of custom esthetic prosthesis libraries
- Creation of a digital wax-up

- Mockup biomodel print (from digital design to physical design) for smile design, orthodontic treatments and final prostheses

Trios Smile Design (3Shape)

Requirements:

- The frontal picture with a wide smile
- Intraoral scan

**Compatibility:** It is a part of the Trios Dental System and is compatible with third-party intraoral scanners, mills and 3D printers.

#### Features:

- The intraoral scan and the photograph are aligned by using blue bullet points as matching references that are placed on the photograph and scanned simultaneously.
- A black outline that contours the scan is overlapped over the photograph with reduced opacity
- The suggested restoration directly on the patient's 2D image using the app.
- Using Dental System's RealView engine, the 2D picture is combined with 3D digital impressions to facilitate functional restora-

tions[18]

- A 3D printed trial restoration can be fabricated
- Available on TRIOS 3 and 4 Scanners, but it is not available on the TRIOS 3 Basic version.

### Cerec Smile Design

**Requirements:**

- Frontal full-size photograph
- Intraoral scan
- Intercanthal width measured with a calliper [19]

**Compatibility:** Cerec Chairside software- InLab Software 4.2 onwards

**Available Platforms:** As a part of InLab software

#### Features:

- 16 feature points project the photograph on a 3D Avatar
- Dimensionally accurate calibration is performed by determining the intercanthal width measured by a caliper [19].
- The Cerec Smile Design tool can be activated during the CAD design process. This makes it possible to achieve the direct 3D design of aesthetic anterior restorations
- The BioCopy CAD design mode allows the user to perform direct intraoral scanning of a mock-up, which can then be used as a 1:1 reference guide for designing the final restoration
- A Gingival Design option is given in the software for restorations with a gingival component.

### Romexis (Planmeca)

Requirements: Frontal full-face photographs with the patient smiling naturally and with the lips retracted.

**Compatibility:** Compatible with any CAD/CAM Software

**Available Platforms:**

- Standalone software
- Within the Romexis module
- Available on Mac or Windows
- Mobile application- mRomexis

#### Features:

- The software automatically generates a silhouette of teeth with automatically determined width: length ratio, automatic golden proportion measurements
- The editable template can be expanded to a maximum of 14 teeth, and for five different character types.
- VITA Classical and VITA 3D-Master tooth shades (Vita) are stored in its smile libraries, a Colour Picker tool enables selection of colours from the existing teeth
- A slider can be used to adjust the shade and translucency of teeth in the 2D Smile Frame.
- Colour can be selected from an existing tooth or shade guide
- Crown lengthening, clone brush and warp brush tools are offered for editing gingival margins
- It is possible to work with retracted and smile images simultane-

ously [20].

**Storage:** Cloud storage available on Planmeca Romexis Cloud Smile Creator ExoCad

**Requirements:** Facial photographs, intraoral scan or digitized stone cast

#### Available platforms:

- Standalone software
- As a module of DentalCad by ExoCad

#### Classical Features

- Exocad's proven wizard-based user interface guides through every step of the smile design process – from image loading, face analysis to tooth setup.
- Facial analysis with help lines and proportional guides enable the user to design the perfect smile for the patient's anatomy
- Smile templates from the extensive tooth library can be easily individualized using 2D outline editing tools, while the resulting shape is displayed simultaneously in 3D from various angles.
- Maximum predictability of outcome is guaranteed as the feasibility can be assessed quickly and reliably at an early stage.
- Diagnostic wax-ups are easily realized with exocad's Model Creator.[21]

#### Other Softwares

- There are other software which may not be dedicated smile design software, but can still be used to achieve similar results. Although not specifically digital smile design software, Photoshop CS6 and Keynote [22] have been used by dentists as smile design tools and are presented in the literature supporting their credibility to be used in aesthetic dentistry.

#### Conclusion

Numerous dedicated software are currently available in the market. Clinicians need to carefully choose the best software keeping given the ease of operation, cost, support and compatibility with other software. The available virtual smile design software can improve the dental team's understanding of the aesthetic issues and patient acceptance.

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