



## Contribution of Digital Tools to the Aesthetic Analysis and Rehabilitation of the Smile in Orthodontics: Case Report

Sana Kanoun<sup>1\*</sup>, Wiem Ben Amor<sup>2</sup>, Ines Dallel<sup>3</sup>, Samir Tobji<sup>3</sup> and Adel Ben Amor<sup>3</sup>

<sup>1</sup>Resident, University of Monastir, Faculty of Dental Medicine, Monastir, Tunisia

<sup>2</sup>Assistant Professor, University of Monastir, Faculty of Dental Medicine, Dento-Facial Orthopedics Department of Monastir Dental Clinic, Laboratory of Oral Health and Orofacial Rehabilitation, Monastir, Tunisia

<sup>3</sup>Professors, University of Monastir, Faculty of Dental Medicine, Dento-Facial Orthopedics Department of Monastir Dental Clinic, Laboratory of Oral Health and Orofacial Rehabilitation, Monastir, Tunisia

\*Corresponding Author: Sana Kanoun, Resident, University of Monastir, Faculty of Dental Medicine, Monastir, Tunisia.

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### Abstract

In the last decades, aesthetics continue to become more relevant in our lives, mostly because of social media. Following the pace, patients are becoming increasingly concerned about the treatment's result achieved from a cosmetic point of view. They strive to have the best smile possible. Modern orthodontics deals with the traditional dental and skeletal aspects of the malocclusion, which count among the pillars of a successful treatment. But, it must be kept in mind that a beautiful smile is also an important factor to achieve the patient's satisfaction. With increased digitalization in dentistry, computer-based software of smile analysis and smile design have been proposed. Thanks to these software, high expectation in term of diagnosis and treatment planning can be met. Thus, they participate in accomplishing high aesthetic treatment outcomes. "Smile Design" concept propose facilitated protocols, advanced resources, making procedures simpler, and treatment outcomes easier to visualize before its initiation. Designing smiles has been, until now, largely used in restorative dentistry and prosthodontics. It has been recently introduced in other disciplines such as orthodontics. In complex orthodontic treatment planning, it is useful in improving diagnostic abilities, guiding teeth movement, increasing predictability and facilitating the communication among interdisciplinary team members. This case report aims to illustrate the benefits of digital smile design in the orthodontic treatment planning and to describe the smile design's protocol as complementary tool in orthodontic examination.

**Keywords:** Digital Smile Design; Smile Analysis; Orthodontics; Aesthetics

### Abbreviations

DSD: Digital Smile Design

### Introduction

In common belief, individuals with attractive smiles are happier, successful and more likable in society [1]. For this reason, the aesthetic result remains an important factor in treatment success.

Often in complex orthodontic cases, a multidisciplinary approach is needed to accomplish an aesthetic and functional result. Ideally, engaging all team members from the start is necessary to set treatment process and goals.

A lack of involvement of any of the disciplines in early stages can potentially extend treatment duration [2]. This inconvenience can be easily avoided by efficient communication.

Software have been developed in order to enhance diagnosis, planning and creating an aesthetic smile [3]. An overall analysis is conducted to asses facial, dentogingival and dental esthetics. Therefore, the dynamic relation between teeth, smile and face must be recorded to achieve improved outcomes.

“The digital smile design” is a reproducible protocol based on photographs of the patient. The practitioner is able to trace on them reference lines and define the aesthetic project [4].

This visual representation ease the communication with the patient, thereby, enable him to have a better contribution in the decision making.

This case study aims to assess the benefits of DSD protocol in orthodontics and its role to achieve perfect orthodontic results.

**Case Study**

This 14-year-old-patient presented to the Orthodontic Department at the University of Monastir with a chief concern “spaces between anterior teeth”.

Our team performed a classic orthodontic examination.

Front view in rest position shows no obvious asymmetries and vertical facial midline.

Orthodontic records were taken, which included extraoral and intraoral photographs, maxillary and mandibular impressions, panoramic radiograph and lateral cephalogram.

In full smile front view, she exposed narrow buccal corridors and insufficient exposure of front teeth.



**Figure 1:** Retracted front view\Smile front view.

The intra-oral examination reveals class II subdivision right relation with 2 to 3 mm overjet and 2 to 5 mm overbite. Both maxillary lateral incisors are missing and 3 mm spaces are present between #11 and #21 and between #13 and #14 and a 2mm space is observed between #11 and #13. The maxilla is narrow with an oval palate and no midline deviation is noticed.



**Figure 2:** Intra-oral photographs.

The panoramic radiograph confirmed the maxillary lateral incisors agenesis also the absence of the right maxillary wisdom tooth.



**Figure 3:** Orthopantomogram.

**Treatment plan**

The planning of the case was determined taking into account facial, skeletal and dental aspects. Full upper and lower fixed appliances (0.022\*0.028-in slot) were installed. The levelling was planned according to this sequence of archwires: 0.014NiTi, 0.018 NiTi, 0.018 Stainless steel, 0.017\*0.025 stainless steel, 0.018\*0.025 stainless steel and 0.019\*.025 stainless steel. Space opening for the lateral incisors with nickel-titanium springs was planned. In order

to guide the orthodontist to accomplish the most ideal aesthetic and functional result, a DSD procedure is realized during treatment.

**DSD procedure**

According to C. Coachman’s Digital Smile Design protocol, these photographs were taken:

- Retracted front view
- Smile front view (in the same position as the retracted front view)
- 12 o’clock photo
- Occlusal view of the upper arch



**Figure 4:** DSD photos: front and full smile front view\12 o'clock view\occlusal view of the upper arch.

The measurement of the central incisor helps in the calibration of a digital ruler.

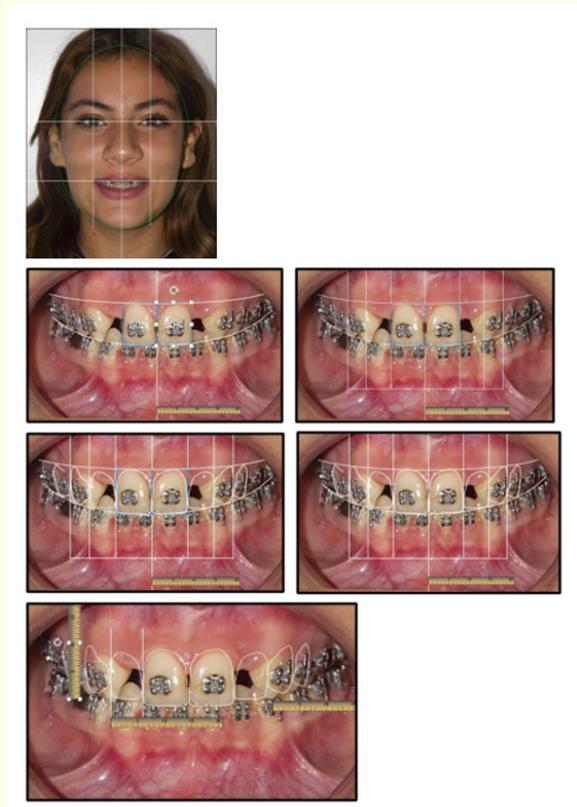
The computer software (PowerPoint, Microsoft) is used to perform DSD steps on photographs.

The DSD results are presented in three different views: Front view, Occlusal view and 12’ O’clock view.

The central vertical line represents the correct midline and the parasagittal lines define the correct size of each tooth.

As the DSD views show, the position of #11 was correct compared to the position of #21 that needs to be mesialized.

The position of #13 and #23 need to be distalized in order to increase space for future rehabilitation of #12 and #22. A posterior gingivectomy should be planned after orthodontic treatment to recreate smile line harmony.



**Figure 5:** Analysis steps.



**Figure 6:** DSD result–occlusal view DSD result–12 o'clock view.

**Discussion**

Complex orthodontic treatment planning is often challenging and require a multidisciplinary coordination. Innovative tools are

required to enhance diagnosis and communication between clinicians, laboratory technician and the patient [5].

Standard orthodontic examinations comprise clinical information, photographs, radiographs and study models. The diagnosis is, undoubtedly, based on this initial data. Whereas, it is incomplete to, effectively, evaluate the relationship of the teeth with the smile and face.

In this case, DSD analysis has brought complimentary information about facial proportion, the smile and its correlation with teeth.

Shapes and reference lines guide the orthodontist to evaluate and correct dental midline as well as teeth shapes and positions. In fact, It has been observed that DSD procedure performed during treatment is helpful to control its progression and compare it with the final project. As a result, diagnosis and treatment predictability are enhanced.

This procedure is also a helpful as a communication tool. In complex treatment planning with multidisciplinary intervention, final goals need to be efficiently communicated between team members.

By sharing DSD results, members can work in perfect accordance. The communication with the patient is also boosted giving him the opportunity to take part in the decision making. These statements were supported by several authors [6,7]. In a recent study, Cervino has assessed 24 articles published until 2018 regarding the use of DSD in different fields of dentistry [8]. He concluded that it guaranteed accurate planning and more predictable results. It also enables the patient to visualize the outcome from first appointments, thus it can have an important medico-legal role.

In daily practice, DSD process is easy to apply after the first appointment and with the adequate photography equipment. Nevertheless, it is only significant to include this analysis in complex treatment planning that requires a multidisciplinary approach. Our work has proved that DSD can be an additional tool for the orthodontist.

It's plausible that a number of limitations are encountered.

The aesthetic analysis is restricted to maxillary front teeth. Furthermore, it is inadequate to capture important orthodontic factors such as Angle, class, Overjet ... Therefore, it must be considered as a complimentary source of information in addition to standard orthodontic examination.

A number of studies demonstrated DSD analysis on static photographs. This approach is not well suited to capture spontaneous smile. More recent reviews used dynamic documentation instead [9]. Videography offers the possibility to record the patient's mimics. All team members can be well aware of the face and smile characteristics without attending the first appointment. Coachman supported this statements and described a modern method of dynamic documentation using smartphone [10].

Given that the analysis is built on static photographs, it is also challenging to precisely evaluate orthodontic displacement. For this reason, Smile Design methods have progressively evaluated towards three dimensional aspect.

Facial scanners have recently emerged making three Dimension aesthetic project possible. Finelle suggested that with digital impressions associated to facial scan and cone beam, it is now possible to perform a 3D analysis from the very first steps of treatment planning [11].

A number of programs work in tandem with orthodontic software to guide digital set up (DSD connect, Hack Dentistry, Bucharest, Romania). The smile design can also be included directly during the virtual orthodontic treatment planning. It is conceivable using software which links 2D design to 3D set up (NemoCast/DSD software, Nemotec). Recent innovative studies have included a fourth dimension to the smile design analysis which is dental movement. Within the next few years, this new generation of smile design is likely to become an important tool of aesthetic analysis [7].

## Conclusion

In the last decades, patients are becoming increasingly concerned about the treatment's result achieved from a cosmetic point of view. However, it must be kept in mind that a beautiful smile is also an important factor to achieve the patient's satisfaction. "Smile Design" concept propose facilitated protocols, advanced resources, making procedures simpler, and treatment outcomes easier to visualize before its initiation. Thus, it participates in accomplishing high aesthetic treatment outcomes. Designing smiles has been recently introduced in orthodontics. In complex orthodontic treatment planning, it is useful in improving diagnostic abilities, guiding teeth movement, increasing predictability and facilitating the communication among interdisciplinary team members.

## Conflict of Interest

Declare if any financial interest or any conflict of interest exists.

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