Digital Dentistry, From Smile Design to Occlusal Analysis

A case report

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Digital dentistry refers to the application of dental technologies or equipment to perform dental procedures rather than using mechanical and visual tools. The use of digital dentistry can make carrying out dental procedures more efficient than using mechanical tools.

The digital era has brought countless benefits to dentistry. An organized and systematic approach is required to evaluate, diagnose, and resolve aesthetic problems predictably. It is of prime importance that the final result is not dependent on looks alone. Our goal as clinicians should be to achieve a pleasing composition in the smile by creating an arrangement of various aesthetic elements.

Digital dentistry requires that the dentist follow specific protocols in order to obtain a standard and predictable result that corresponds to an optimal clinical result.

Nowadays, many digital technologies have been added to dentistry, but three new innovations in Digital Dentistry have introduced major transformation in clinical practice:

1. Digital Smile Design
2. Digital Occlusion Scanners
3. Digital Occlusion Analysis

The case

The patient was a 26-year-old female, she came complaining of stained restorations and gaps in her upper anterior teeth. After clinical and radiographic examination, the teeth 21 and 22 had large composite restorations with open margins, the teeth 21 and 22 were root canal treated and all the upper anterior teeth required crowns.

Digital Smile Design

The Digital Smile Design is a multi-use tool that can assist in the restorative treatment throughout the treatment, improving their understanding of the aesthetic issues and increasing patient acceptance of final results. The placement of reference lines and ability to draw over extra and introral digital photographs widens the dental team’s diagnostic vision and helps to evaluate the limitations, risk factors, and aesthetic principles of a given case. These critical data will lead to improved results in all phases of treatment.

The greatest challenge of smile design lies in the conversion of 3D photographs into 3D images. Today, the use of 2D and 3D software for photograph editing and digital image editing allows us to process data and customize parameters for each specific clinical and aesthetic requirement of the smile makeover.

Many digital programs and protocols have been introduced to the dental market in the last few years. Some of them focus on the style of imaging and producing a virtual simulation to the patient, helping the patient better visualise imagine what her smile will look like after the planned dental treatment. Others may have lesser virtual results but more precise measurements and tools. It depends on the practitioners’ choice of treatment and the aim of smile design to choose a suitable software for his clinical practice, some clinicians prefer to use more than one software to achieve all treatment goals. Most of companies aim to be the first choice for the dental professional, but some do fail to achieve some critical characteristics in their product.

In this case, we started with designing her smile digitally using “Smile Designer Pro” software. We tried to use other systems but this system showed the easiest mode of transferring for the final result of the design to the CAD system, using the template outline and then trace it to get a similar result. (Fig. 2a, 2b, 2c) Show the steps of smile design.

After presenting the virtual simulation for the patient, she accepted the treatment and we started with replacing old composites and prepared with teeth preparation. (Fig. 3)

Using the technology of optical scanners with Trios from 3Shape, we recorded the digital impression for the prepared teeth. (Fig. 4a, 4b, 4c)

Intraoral Mapping Technology is one of the most exciting new areas in dentistry as 3D scanning of the mouth is essential in almost all clinical practices in every dental office. The first dental digital scanner was introduced in the market in the 1980s with limitations including low precision and high cost. New technologies were then introduced which lead to the creation of enhanced in-office scanners which were considered much more “user-friendly”. The new scanners have become easier to use for the clinician, give more precise digital impressions, and offer technological advances compared to early versions. All systems work to capture 3D virtual images of teeth which can be used to create precise models on which the restorations can be designed in a dental laboratory.

The use of these products is rapidly increasing around the world and presentations of enhanced in-office scanners are made. Several of the leading 3D dental digital scanning systems are presented and discussed in this article.

The greatest challenge in this case during our digital workflow was to convert the 3D smile design that the patient liked and approved to a 3D workable structure. (Fig. 5a, 5b, 5c) We made this by combining and joining the DSD software “Smile Designer Pro” and the digital impression from Trios 3Shape and then completing the CAD design through the dental system from 3Shape. We aligned the 2D to 3D in the same way as suggested to align the patient photo with the 3D jaw. But additional steps were needed for aligning it with the template of the suggested design using the 3D context option and trying to trace the outline of the facial appearance of the teeth design or by uploading the patient photo with the suggested design to the Dental System Software. (Fig. 6a, 6b, 6c)

The crowns were designed using the 3Shape Dental System Software for the CAD step. What is unique about this system is that we could upload the patients’ 3D facial photograph and test our design on the 3D model of the patients’ face. (Fig. 7a, 7b, 7c) In this case, we tried to make it twice; first with the DSD virtual template (Fig. 6a), and second with her natural smile without smile simulation (Fig. 5a) and then we aligned these photos with the 3D digital jaw impression. We aligned it by choosing 3 similar points on each side (right and left) on the 2D photo of the patient’s face and on the 3D digital impression, the system then aligns them together as noticed in photos attached. After this, we started to design a relatively similar design of the suggested DSD by tracing the outline of the simulation template. After making sure of the 3D design outline, labial shape of teeth, width and incisal lengths, and shape, it was adjusted to the marginal finish lines, contact with adjacent teeth was checked along with occlusion while routine lab work took place. Eventually, the final result was shown on the patient’s facial smile in 2D 3D mode. (Fig. 7e) Further adjustments can be easily done per the patients’ functional and aesthetic requirements.

Shade measurements were con-
Digital Occlusal Analysis

The only tool available in the market for digital occlusal analysis is the T-Scan from Tekscan. The T-Scan system is a valuable tool that aids in the diagnostic process of analysing a patient’s bite and showing what is and what is not functioning properly by Digits and Numbers. When a patient bites on the HD sensor, data is transmitted into the T-Scan software, which captures a video of the occluding and non-occluding contact points. T-Scan system provides dynamic occlusal measurement – revealing the level and timing of force on individual teeth and the occlusal stability of the overall bite – bringing articulation paper marks to life.

T-Scan is a digital occlusal analysis system consisting of a patented sensor, USB-based handle, and proprietary software that reveals the level and timing of force on individual teeth and the stability of the patient’s bite. When used in conjunction with articulating paper, T-Scan’s precise and actionable data gives you the ability to diagnose and treat occlusion accurately and with confidence. There is evidence to support that T-Scan system is rapid and accurate in identifying the distribution of the tooth contacts and has shown great promise as a clinical diagnostic screening device for occlusion and for improving the occlusion after various dental treatments.

In the try-in session, we tested the marginal fit, shape, colour, contacts, and correction of occlusion using T-Scan. We noticed almost 50% to 50% occlusal balance with a balanced force distribution between anterior and posterior teeth (Fig 9a, 9b).

No other adjustments were needed at all. Crowns were sent back to the lab to be glazed and then remounted in the patients mouth in the next session (Fig 10a, 10b).

Conclusion

The future of dentistry is digital. Accordingly, dental professionals need to change the way they think, communicate and work to adapt to this new challenging scenario. Wanting to adopt or integrate these new digital technologies will eventually leave them behind.

In the coming months and years there will be further innovations and improvements in this area. Digital technologies will dramatically change the world of dentistry and eventually changing the patients’ expectations towards dental treatment.

References