Utilising smile design software and CAD/CAM for creating a mock-up and final restorations

Summary

Patient: A 32-year-old woman with hypoplastic pitted amelogenesis imperfecta.

Treatment: Patient photos and smile design software were used for treatment planning and creating a digital mock-up. A digital impression was captured with an intraoral scanner. A digital mock-up design was used in CAD software for designing a wax-up. After preparations, a digital impression was taken again and the final veneers were designed with CAD software and created with a milling unit.

Case report by: Aki Lindén (CDT)

Fig. 2

Fig. 7

Fig. 1

Fig. 3

Fig. 4

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Fig. 11

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Fig.17

Fig. 18

Fig. 19

Fig. 20

Treatment planning and smile designing have been performed with traditional techniques for years in aesthetic dentistry. In recent years, various software programs have emerged to offer useful new tools for digital designing. When compared to traditional techniques, the main advantages of digital designing lay in speed, flexibility and improved communication between the patient and the treatment team.

Digital smile designing

During the first patient visit, preoperative face photos were taken with a Canon EOS 6D camera *(Fig. 1)*. Two photos were taken of the patient – one face photo of a smile *(Fig. 2)* and one retractor image *(Fig. 3)*.

The photos were both carefully taken from the same angle using a camera stand. The distal distance between the maxillary central incisors was measured with a calliper for the calibration of the image. The appropriate shade for the new teeth was also determined *(BL3 – Fig. 4, the third colour from the left)*.

Next, the patient's smile photo was imported into a smile design software. The patient's facial proportions were analysed – including the smile line, central line and papillary line *(Fig. 5)*.

The different treatment possibilities were explained to the patient visually with help of the software's silhouette tool *(Fig. 6)*. The patient was able to take part in the treatment planning process by visually expressing their expectations of the final result *(Fig. 7)*. Ultimately, the decision was made to treat eight anterior maxillary teeth instead of the initially planned six, as the patient's wide smile revealed more teeth than average. The more comprehensive treatment was also better in line with the patient's expectation of the result *(Fig. 8)*.

To finalise the design, the patient's retractor image was superimposed on top of the smile image, which enabled viewing and modifying the gingival area *(Fig. 9)*.
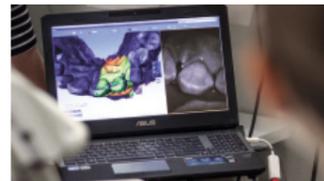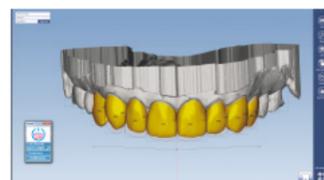
Creating wax-up

A digital impression of the patient's pre-op dentition was taken using an intraoral scanner *(Fig. 10–11)*. Both the upper and lower arches were scanned and the digital impressions were immediately available for wax-up designing.

The smile design silhouette was exported from the smile design software to the CAD software for wax-up designing *(Fig. 12)*. The silhouette was adjusted on top of the digital impression and used as a guideline for creating veneer designs in the software. The tools in the CAD software were used to design and finalise the digital wax-up *(Fig. 13)*.

Next, the digital wax-up was 3D printed for mock-up creation. A silicone key was prepared from the 3D printed model. Using the silicon key and 3M ESPE Protemp™ 4 Temporisation Material, a mock-up was created into the patient's mouth *(Fig. 14)*, with its fit and functionality checked. At this point, the patient had the opportunity to experience the design of her new teeth and understand the altered feel and look *(Fig. 15)*.

Preparations and temporary veneers

After confirming the proper fit, the patient's teeth were prepared *(Fig. 16–17)* and the preparations were scanned, again using an intraoral scanner. Next, temporary veneers were created with the same silicon key and 3M ESPE Protemp™ 4 Temporisation Material. The temporary veneers were tried on the patient and fixed by spot-etching.

Creating final restorations

Once the temporary veneers had been successfully fitted, the final veneers were created from IPS e.max CAD blocks using a milling unit. The restorations were finished by layering ceramics (e.max Ceram) to the labial and incisal parts for maximum aesthetics *(Fig. 18)*.

To conclude a successful treatment process, the final restorations were cemented. A photo of the end result was also taken *(Fig. 19–20)*.

Conclusion

Digital smile designing significantly improves the communication between the patient and the entire treatment team. More predictable results make patients more confident, as they can trust that the outcome will be in accordance with their expectations. Patients are also pleased to be actively involved in their own treatment and that they are able to take part in the design process right from the start. As a result, patient case acceptance is improved.

Digital smile designing provides several benefits compared to the traditional way of smile designing with different wax-ups – it is easier, more comfortable for the patient and more time-efficient.

About the author

CDT Aki Lindén has an extensive history in aesthetic dentistry and fixed prosthetics, as he has worked in his own dental laboratory in Helsinki for over 20 years. Mr. Lindén is a recognised Opinion Leader for Ivoclar Vivadent in Finland, for which he regularly serves as an instructor and lecturer. Mr. Lindén is also a member of several aesthetic dentistry societies, such as the Scandinavian Academy of Esthetic Dentistry (SAED), the American Academy of Cosmetic Dentistry (AACD), and the Society for Color and Appearance in Dentistry (SCAD).

Utilised equipment and software

- Planmeca Romexis Smile Design software
- Planmeca PlanCAD Premium software
- Planmeca PlanScan intraoral scanner
- Planmeca PlanMill 50 milling unit