

# Designing real smiles with digital tools

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Fig. 1

Fig. 2

**\_Dental materials and clinical procedures** have changed dramatically in the last decades. Probably the major advances that have occurred during the last two decades have been in the fields of implantology and adhesive dentistry, but the main revolution is the development of digital dentistry. Although these changes have certainly made diagnostics and certain procedures easier, the basics, such as function and the biological aspects, remain essential. At the same time, we

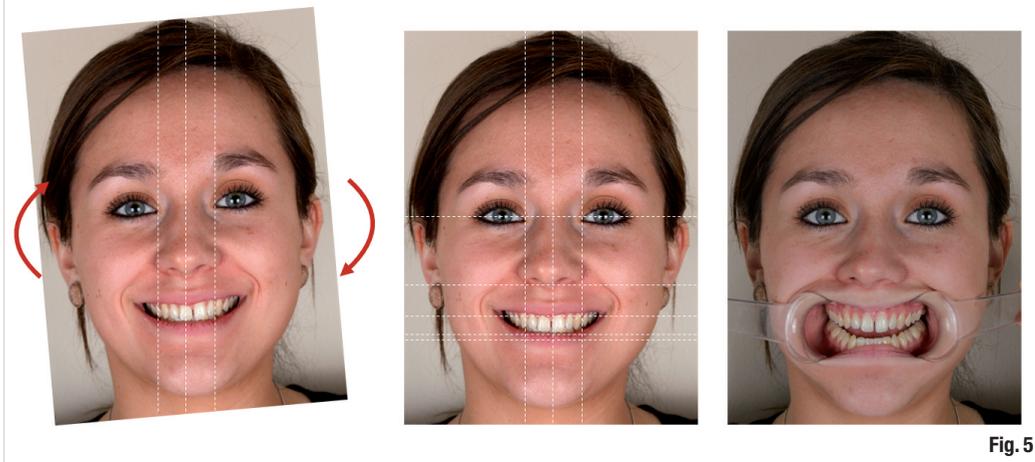
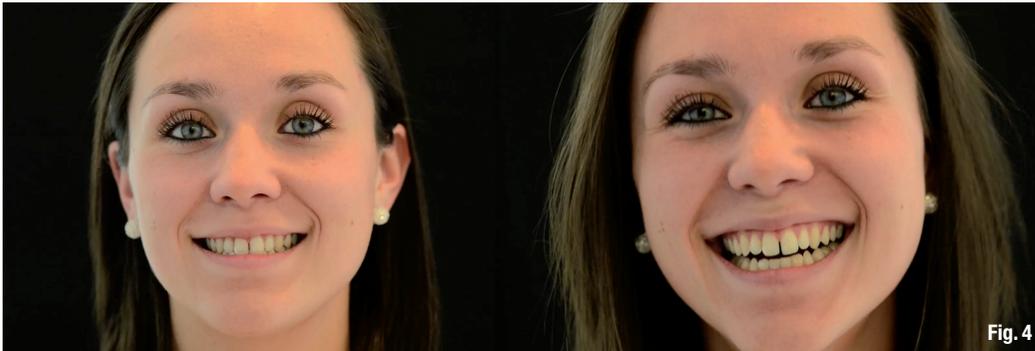
have experienced major improvements in ceramics and composites, helping us to fulfil our patients' aesthetic demands.

A basic prerequisite for these indications is an in-depth understanding of the facial and dental aesthetic parameters. The clinician needs to understand the challenges that each clinical case presents and has to be able to develop an appropriate treatment plan that approaches the case from a multi-disciplinary perspective. Tooth proportions need to be considered in relation to gingival aesthetics and in relation to the facial appearance. It is pointless to make the most beautiful direct veneer if the contours or the texture do not match that of the adjacent teeth or the gingival zeniths are clearly not symmetric and visible. As an example, if we add a tilted occlusal plane or a maxillary tooth midline shift in relation to the facial midline, the results can be frustrating.

Another important aspect is the proper analysis of the patient's smile and display (Figs. 1 & 2). When photographs are taken, people tend to be shy, especially at the beginning and even more so if the person taking the photographs is not a professional photographer and the setting is a dental practice. Figure 3 shows the intra-oral view, where, besides the obvious diastema and the hypomineralised

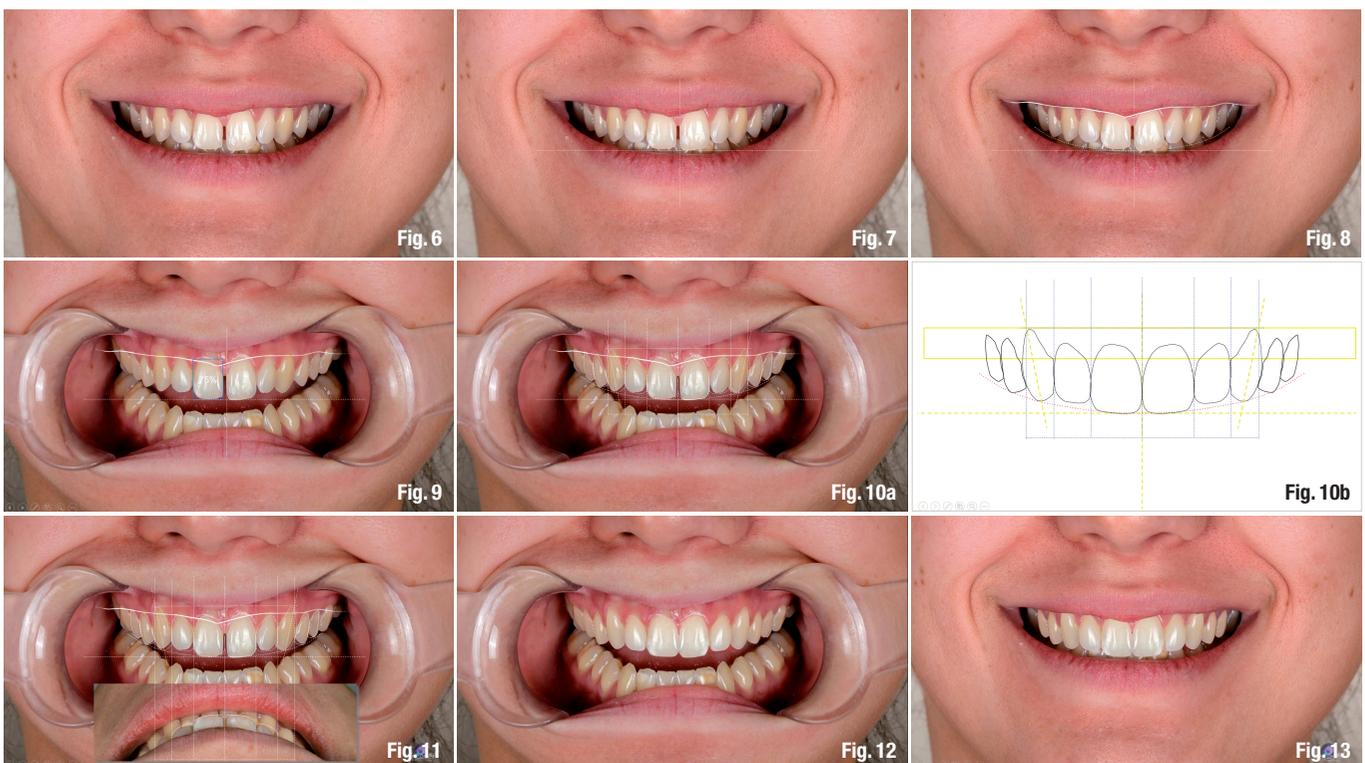


Fig. 3



areas of both central incisors, the major discoloured areas of both mandibular lateral incisors, which were certainly in need of some sort of treatment, are apparent. It is important to try to make a video while conversing with the patient about normal daily issues to avoid overlooking aspects that need

to be considered in the treatment plan. The conversation will relax the patient and evoke natural smiles and laughs in response to something humorous or silly that we might say. Figure 4 shows the differences between the social smile we achieved with our traditional photographs (Figs. 1 & 2) and the





spontaneous smile, which was captured during dynamic recording. In this particular clinical case, had we based our treatment plan on the social smile photograph, we would have failed to visualise the display of the mandibular incisors, which showed unpleasant stains.

The next step was to analyse the patient from the facial perspective based on the details of her teeth. The digital smile design (DSD) concept diagnoses aesthetic problems from a facial perspective and, based on a simplified digital analysis of a few photographs, proposes treatment options and assists with communication between the various specialists in the team.

The first step is to draw a horizontal and a vertical line. The photograph is centred, moved and rotated until the bi-pupillary line is horizontal. The facial midline is subsequently ascertained. Then the same lines are superimposed on to a similar photograph, which has also been centred, but this time taken with lip retractors in place (Figs. 5a–c). The same photographs are then magnified and analysed

(Figs. 6 & 7). The upper lip line is re-created and then superimposed on to the photograph taken with lip retractors in place as reference of its position (Figs. 8 & 9). Then the tooth proportions are measured and their ideal contours are drawn (Figs. 9 & 10a). The isolated situation can be seen in Figure 10b. A photograph taken from the 12 o'clock position is used for the analysis of the labio-palatal position of the teeth and superimposed on to the analysis done previously (Fig. 11).

Once the clinician is clear about the treatment possibilities and limitations, a digitally designed mock-up can be created. This procedure reduces chair time dramatically and increases patient acceptance. Owing to easily accessible software such as Microsoft PowerPoint and Keynote, these effects are easily and quickly created by anyone with minimal training. Recently, new software has been released that simplifies the procedure even more, DSD software for iPads ([www.digitalsmiledesign.com](http://www.digitalsmiledesign.com)). The procedure is based on overlapping certain areas of the teeth in the manner previously described. The result can be seen in detail in Figure 12 and the display in Figure 13. A comparison from the facial perspective between the preoperative situation, the traditional mock-up and the digital mock-up can be seen in Figure 14. Traditional indirect mock-ups are made from a previously created wax-up from the laboratory. First, an impression is taken and a stone cast is then fabricated. Afterwards, the technician waxes the necessary teeth depending on the instructions given by the clinician.

The next step is taking an impression from that wax-up. The excess is removed and a flowable self- or dual-curing composite material (usually bis-acrylic based) is applied to the silicone guide and then placed in the patient's mouth. After a few minutes, the excess is removed and the patient is able to see the changes and the clinician is able to evaluate the proposal directly in the mouth. Generally, photographs are taken of the new situation and analysed. The option of a digital mock-up is much simpler. Once the final forms have been created, a photograph is superimposed on to them, and the texture of the new teeth is created. As seen in Figure 14, the results of the traditional and the digital methods are similar and it is difficult to differentiate between them.





The protocol is based on photographs and videos that are taken during the first appointment. The analysis is performed, and eventually the case is discussed with the team if necessary. Once the presentation is ready, the treatment plan is presented in a visually attractive way to the patient (Fig. 15). Finally, whether to use ceramic or composite restorative materials is considered depending on different factors. Our philosophy is based on the minimally

invasive concept. As long as we can provide the patient with the same aesthetics, durability and predictability of ceramics, we will select composites. In cases in which many teeth are involved, multiple diastemas are present or occlusal imbalances may jeopardise a successful outcome and major changes need to be made, our choice leans towards ceramics. Whatever approach is chosen, it is of paramount importance for the clinician to understand the ceramic





Fig. 23



Fig. 24

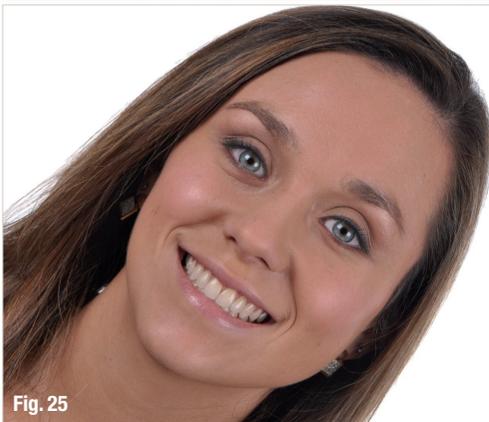


Fig. 25



Fig. 26

and/or composite system he or she is using. In this particular clinical case, the ceramic system used was IPS e.max Press and the composite system was IPS Empress Direct (both Ivoclar Vivadent) because of its simple layering concept, its natural-looking shades and long-lasting gloss. The correspondences between the shades of both systems make them easier to combine.

Once the treatment plan has been accepted by the patient, the treatment begins with preparation and demarcation in order to be as conservative as possible (Fig. 16). Figure 17 shows the detail of the hypomineralised areas of the mandibular lateral incisors. The areas were excavated with a red-coloured bur (Komet Dental) and etched with phosphoric acid. Excite F (Ivoclar Vivadent) was used as a bonding agent, and IPS Empress Direct Dentin A1 and Enamel A1 were placed using a novel instrument called OptraSculpt Pad (Ivoclar Vivadent).

The maxillary teeth were prepared and impressions taken. Figure 20 shows the six veneers fabricated by master dental technician Victor Romero (Santiago, Chile). Then they were tried-in with a specially designed glycerine-based paste, components of the Variolink Esthetic cementation kit (Ivoclar Vivadent). Figure 21 shows how dramatic the change in value can be with this type of cement. This procedure is especially helpful when one or two veneers are seated, and the value needs to be slightly corrected in order to match them to the adjacent

teeth. The veneers were then bonded and the final result can be seen in Figure 22, where the preoperative situation is shown against the similar results achieved with the digital mock-up compared with the final outcome. Figures 23 and 24 show the integration of the six maxillary ceramic veneers and the two direct composite restorations performed on the mandibular lateral incisors at the three-month follow-up. All this work was integrated from the facial perspective, as seen in Figure 25. The satisfied and spontaneous patient can be observed in Figure 26.

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