Fabrication of a long-term prototype to develop and sculpt anterior gingival tissue

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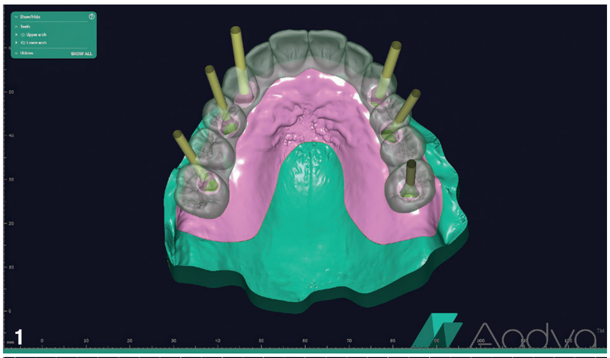
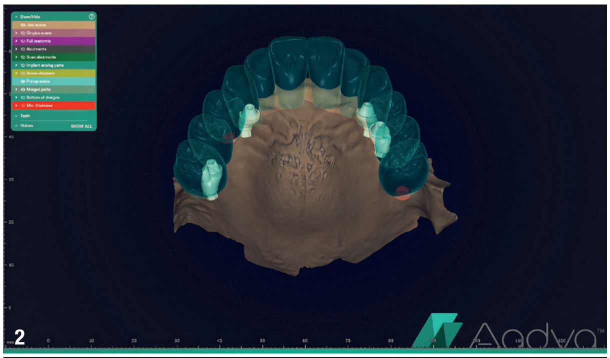
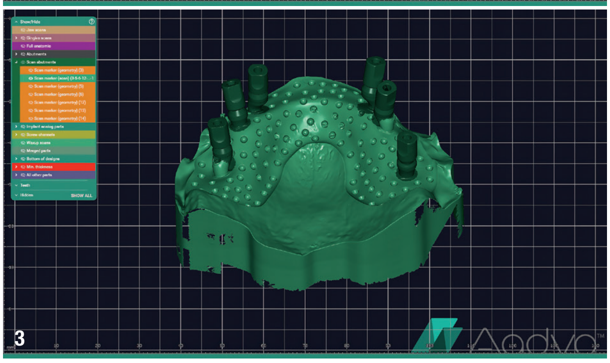
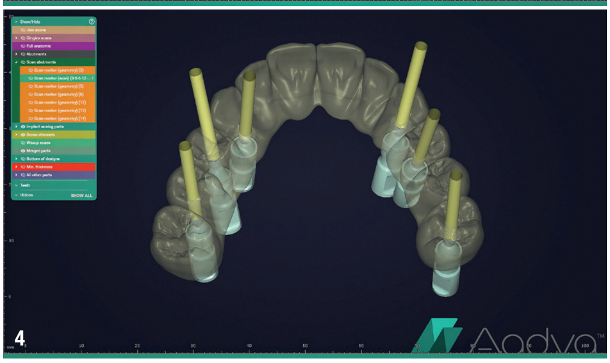


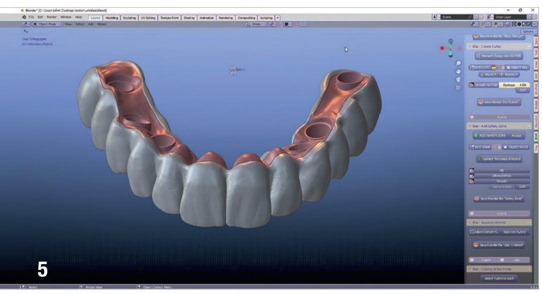


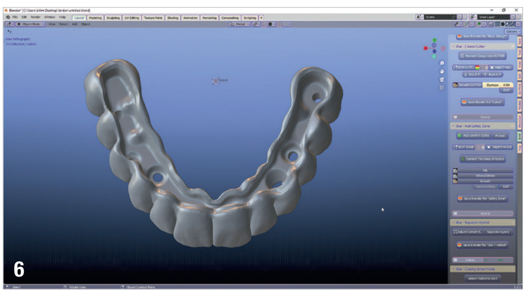


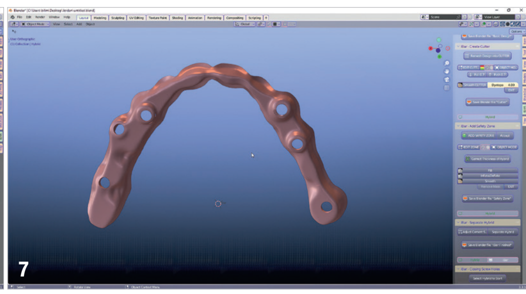


This article shows the step-by-step laboratory production process of a log-term prototype for the development and sculpting of anterior gingival tissue. The design phase began with exocad software, where we observed access hole issues on the maxillary prototype at the level of connection to the implants (Fig. 1). A prototype was 3D-printed with Asiga DentaTRY to assess and resolve these issues. The prototype was then sent to the clinician to review and approve both the vertical and overall aesthetics during the try-in appointment with the patient.

After review with the patient, the printed prototype was returned to the laboratory, and all prosthetic connections were changed from implant level to multi-unit abutment (MUA) level with a combination of straight MUAs and custom MUAs, which were milled at TruAbutment in Irvin



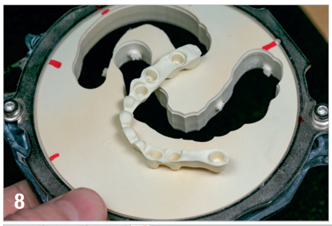




in the US. The implant-level connections were replaced with both MUAs and custom MUAs on the printed model (Fig. 2). After this step, scan bodies (TruAbutment) were added ready for 3D scanning at MUA–implant level using an Aadva scanner (GC; Fig. 3).

A new long-term prototype was designed in exocad to the new MUA–implant level (Fig. 4). The screw access holes were corrected at this stage. This particular case was designed as one solid merged unit, which was then imported into the iBar module (Blenderfordental). Next, a one-piece merged design from exocad was separated into a bar and shell design (Figs. 5–7) using the iBar module. Because of the long span of the edentulous area in the maxillary anterior, the bar was milled (DWX-52D, Roland DGA) out of TriLor techno-polymer (Bioloren), consisting of thermosetting resin reinforced with fiberglass oriented multidirectionally (Fig. 8).

The case was prepared for 3D printing on a MAX UV printer (Asiga; Fig. 9) via the Composer 2.0 software (Asiga). There were a total of three short builds. The shell (Fig. 10) was 3D-printed using Rodin Sculpture nano-hybrid (Pac-Dent; Shade B1; Fig. 11). This 3D-printing resin has been developed for fixed restorations and long-term provisional restorations for both permanent and temporary use. The maxillary implant model (Fig. 12) was 3D-printed using Asiga DentaMODEL (Fig. 13). The gingival mask (Fig. 14) was 3D-printed using Asiga DentaGUM (Fig. 15).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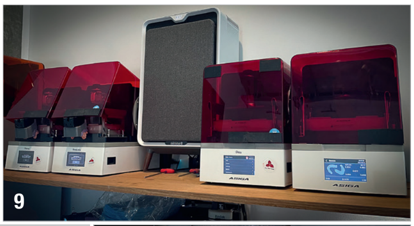
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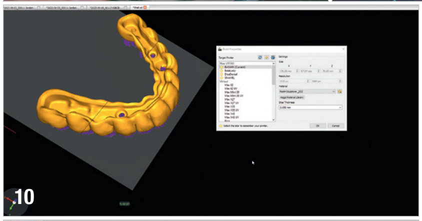
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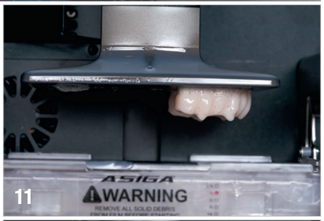

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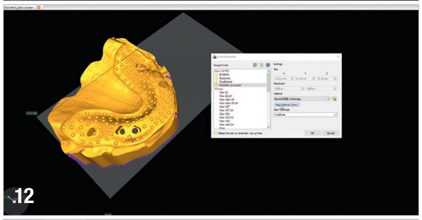
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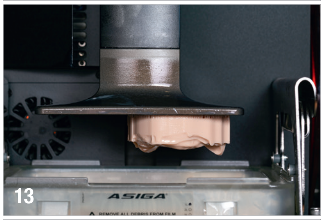

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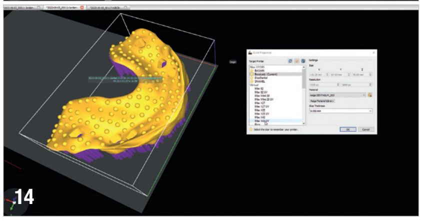
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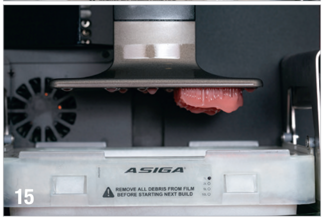

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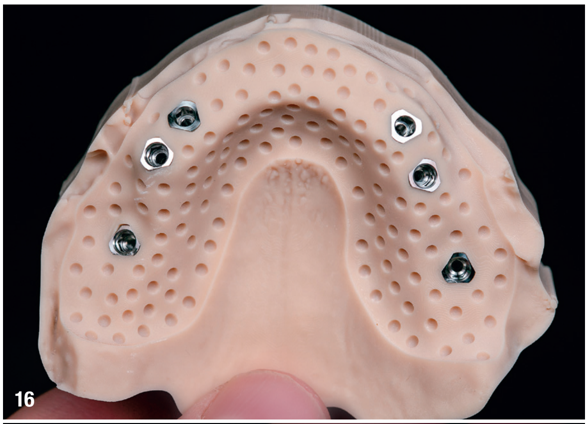
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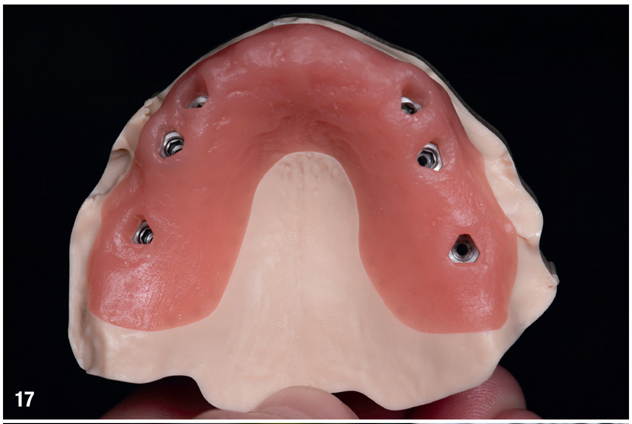
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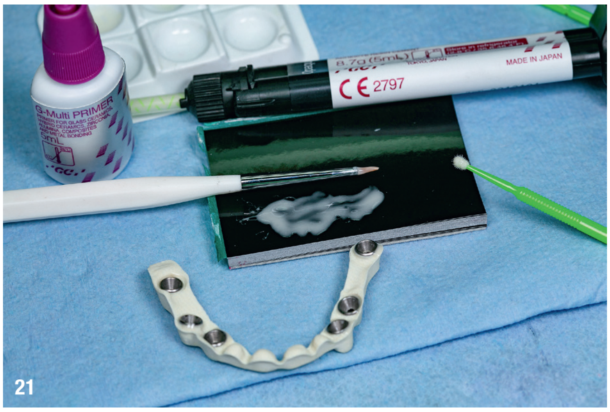

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TruAbutment digital analogues were inserted into the 3D-printed model (Fig. 16). This is where an accurate 3D printer and 3D-printing material combination is essential to allow for such a high degree of fit and precision. Correct material washing and polymerisation are imperative to ensure that the model is ready to accept the analogues. These protocols can be found in the instructions for use for Asiga DentaMODEL on the material manufacturer's website (www.asiga.com). Following these instructions carefully ensures that you achieve optimal mechanical performance and biocompatibility for the 3D-printed device.

Next, the gingival mask was assembled on top of the model (Fig. 17). A visual check was undertaken of the bar and shell before they were cemented together and while the shell was still attached to the supporting structures (Fig. 18). These supporting structures were then removed (Fig. 19). No shaping was necessary at this stage.

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Shaping is best done once the bar and the shell have been cemented together.

The titanium bases and bar insert holes were lightly sandblasted at 300 kPa using 50 μm aluminium oxide. All parts were then thoroughly steam-cleaned and completely air-dried. Finally, all parts were placed in an ultrasonic cleaner in 99% isopropyl alcohol and then air-dried. G-Multi PRIMER (GC) was then applied and allowed to air-dry thoroughly (Fig. 20). It is crucial to ensure that all parts are completely dry before cementing. For cementing the titanium bases into the TriLor bar, G-CEM LinkForce (GC; Shade Opaque) was used (Fig. 21).

Before starting the polymerising process, the cemented titanium bases and the TriLor bar were placed on the implant model, and MUA screws were inserted and hand torqued (Fig. 22). The model with the TriLor bar, titanium bases and screws were then placed in a light polymerisation unit that has dual heat and light polymerisation. The heat allows the dual-polymerising G-CEM LinkForce cement to activate the chemical polymerisation process, as light cannot penetrate the TriLor bar.

In preparation for the cementing of the bar and shell, both were lightly sandblasted at 300 kPa using 50 μm aluminium oxide. Both parts were thoroughly cleaned with steam and completely air-dried. Finally, the bar and shell were placed in an ultrasonic cleaner and submerged in 99% isopropyl alcohol. After washing, the parts were air-dried. The screw access holes on the TriLor base were blocked with wax, and G-Multi PRIMER was applied to both the shell's intaglio surface and the bar (Figs. 23 & 24). Excess cement was removed using brushes soaked in 99% isopropyl alcohol (Fig. 25).

The arch was then shaped and lightly sandblasted at 300 kPa using 50 μm aluminium oxide (titanium bases during this stage should be blocked with wax). The arch was thoroughly steam-cleaned and completely air-dried. It was then placed in the ultrasonic cleaner in 99% isopropyl alcohol and air-dried. G-Multi PRIMER was applied to all surfaces of the arch and air-dried. For both glazing and characterisation, OPTIGLAZE color (GC) was used (Fig. 26). The arch was then polymerised in an Otoflash G171 (NK Optik) using 500 flashes in an inert atmosphere, created using nitrogen. A final glaze was then applied using OPTIGLAZE color (Shades Clear and Clear HV), sealing and protecting the characterisation (Figs. 27–29).

It is vital to use OPTIGLAZE in Shade Clear HV on all intaglio surfaces that will be touching the oral tissue. This seal protects the tissue from the TriLor, and at no time should unsealed TriLor be exposed to the oral environment. Any adjustments to the TriLor bar will require resealing of the bar using OPTIGLAZE in Shade Clear HV.

about the lead author

Bill Marais graduated as a registered dental technician in 1993, after four years of study in dental technology, from the Cape Peninsula University of Technology in Cape Town in South Africa. He later emigrated to the US and, in 1999, opened his own dental laboratory, Disa Dental Studio, a one-man laboratory focusing on high-end, complex, combination cases. He is a key opinion leader for GC America and lectures for the company nationally. He also lectures independently and teaches dental photography classes.

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