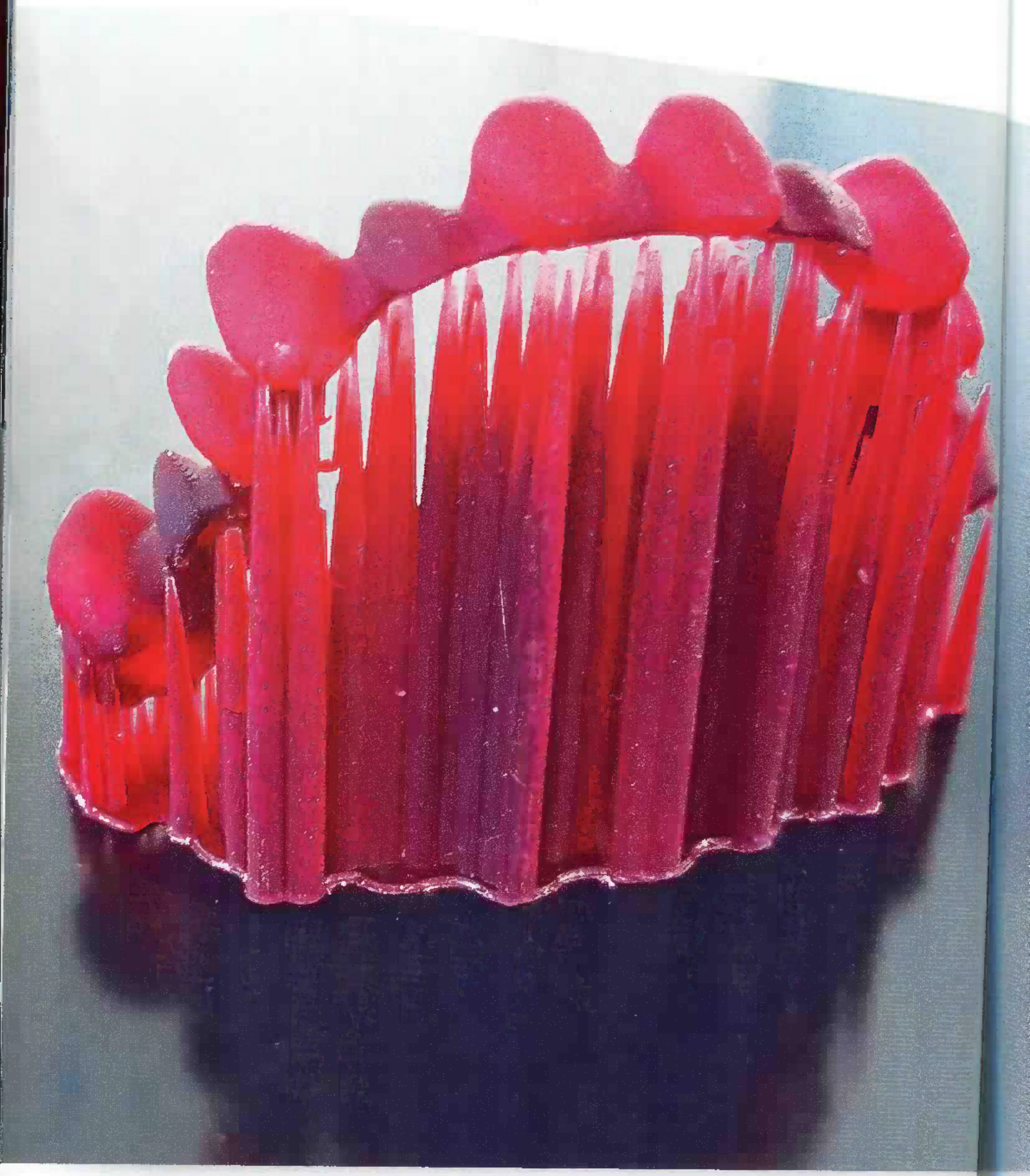
USER REVIEW



By Uwe Aupperlen Dental Technician

Free the Print

Exploring 3D Print Applications in the lab

Digitalisation in dental technology has advanced at an enormous pace over recent years, so that it is now difficult for lab owners to keep up with developments.

For this reason, it is important to assess which options make sense in the lab. The wrong choice or a bad investment can have devastating implications.

We established our lab in 1989, and have been producing dental restorations for around 28 years. The first scanner arrived in our lab in 2007 and ushered in a new era. Over the years our CAD/CAM equipment has been expanded with various scanners and milling systems. As a means of relieving the burden on our milling systems and to take care of further workflows in digital fabrication, we decided to take advantage of the possibilities offered by a 3D printer. We opted for the open FREEFORM PRO 2 3D printer from Asiga, which uses UV LED light for curing materials. The materials from the company Detax, as approved and accepted by Asiga, meet the requirements of the German Medical Devices Act (MPG) and round off the production line.

The materials used:

- Freeprint ortho UV, for fabrication of splints, various templates and various other applications
- Freeprint tray UV, for fabrication of individual trays and bases for bite registration.
- Freeprint cast UV, for fabrication of a wide range of cast objects.
- Freeprint temp UV, for fabrication of temporary crowns & bridges.
- Freeprint model UV, for fabrication of dental models.

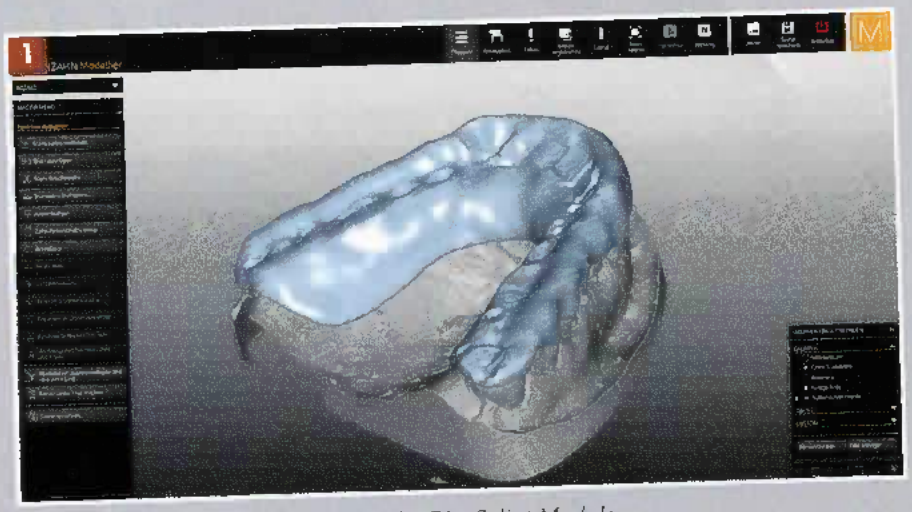
The Otoflash G171 xenon photoflash unit from NK-Optik with an inert gas atmosphere is used for final curing of objects cleaned with pure isopropanol in an ultrasonic bath.

As previously, the different STL files for the respective 3D printing jobs are generated with our open 3Shape and Zirkozahn systems with the associated software.

In order to obtain the Class IIa medical device classification for drilling, X-ray and bite splints, it is absolutely necessary for all those involved to adhere to the prescribed procedure. The following pictures and explanations present the various ways in which 3D printing is used in our lab.

Bite splints

An occlusally adjusted splint, designed using the Zirkonzahn Bite Splint Module, was generated in 20 - 40 minutes (Fig. 1). The splint was positioned on screen using the Asiga Composer CAM Software, then transmitted via the network to the 3D printer and printed.
The Asiga Composer Software allows for the positioning of individual or multiple objects or splints.
The size of our printer platform allows us to positon up to six parallel aligned bite splints.
The number of splints will depend on the height of the splints and the angle at which they are placed in relation to the printer platform (fig. 2). The more acute the chosen angle is to the platform, the thicker the polymerised layers through the printed object, and the shorter the printing time.
The finished printed Freeprint ortho UV (Detax) splints were removed from the printer together with the printing plate and the splints were detached (fig. 3). They were easy to separate from the printing plate with a spatula.



The splint is designed in the Zirkonzahn Bite Splint Module

The splints were then cleaned with isopropanol twice for three minutes in an ultrasonic bath. Cleaning detaches the sticky, shiny layer and the splints became matt (Fig. 4).

After the final curing in the Otoflash G171 unit (Fig. 5), the support structures were removed.

The splints were then positioned back on the models, finely ground and polished to a high gloss, which took 25 - 40 mins.

Further adjustments were made with the modelling resin Freeform (Detax).
Standard rotary instruments, such as mills, round burs, rubber polishers etc., were used to finish the splints.

N.B: the more precisely the preparatory work is carried out, the easier it is to obtain a high gloss using rotary brushes with pumice powder and then to polish the splints on high gloss buffing wheels.

The splint height and angle at which they are placed determines the number printed.

The splints are removed still attached to the printing plate and detached by spatula.

The splints have a matt aspect once cleaned with isopropanol.

X-ray /

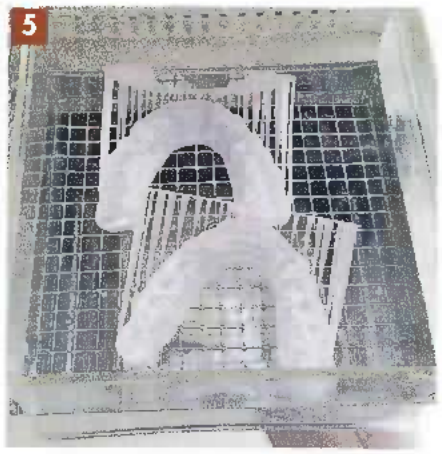
drilling templates and guided drilling templates

Here we have used the 3Shape Implant Studio Software to design an upper and lower x-ray and drilling templat using digital volume tomography (DVT) (figs. 6 and 7). Drill guides allow for the precise placement of planned implants.

Once designed, the maxillary and mandibular drill guides are positioned on the print plate on-screen prior to printing using the Asiga Composer CAM Software, then printed in the printer using Freeprint ortho UV material (Detax) (Fig. 8).
Once printed the drill templates are removed from the printing plate and cleaned. Finishing to a high gloss is not required in this case.
After final curing and removal of the print support structures, the drill guides are checked on the upper and lower models: the fit is precise.

The appropriate X-ray inserts can now be positioned in the mandibular X-ray template (Fig. 9) and a Digital Volume Tomography of this is taken. This is then used as the basis for producing a drilling template.
The appropriate guide drilling inserts are next positioned in the maxillary drilling template (Fig. 10).

Guided placement of the implants can be planned from this.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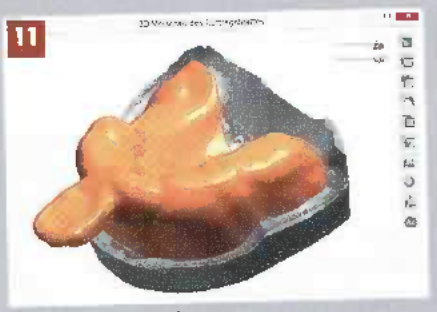
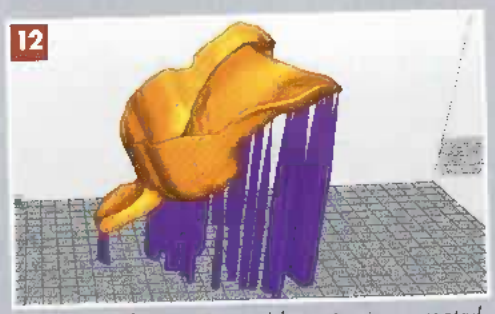
Trays and bases
for bite registration

We designed an individual tray using the 3Shape Dental Designer software (Fig. 11) in approximately ten minutes. This was transferred to the Asiga Composer Software and positioned for printing with supports generated (Fig. 12), then sent to the 3D printer via the network. The trays were printed in Freeprint tray UV material (Detax). Once the trays had been printed, the platform moved up and the printing plate with the trays was removed (Fig. 13). The trays were detached and cleaned with isopropanol in an ultrasonic bath twice for two minutes each time. Next, the print support structures were removed and the trays were cured in the flash curing device with 2000 light flashes. The trays were then polished.



Individual tray design



Positioned for printing with supports generated

The trays on the printing platform

Duplicate
denture

We scanned a maxillary denture using the Zirkonzahn System (Fig. 14) and reproduced it using our 3D printer (Fig. 15).
This technique allows for an implant impression to be taken while simultaneously adopting the existing bite position (Fig. 16). At the same time, all information from the patient's existing denture, which has been worn for years, is acquired for the new job. Figure 17 shows the process - from the edentulous maxillary, to a duplicated printed denture for the DVT, through to the guided drilling template with guide inserts positioned for implantation.

The patient's existing denture was scanned...

...And reproduced with out printer for implant planning

This was used to produce a drilling template

Edentulous maxillary - duplicated denture - drill guide

Prototypes

To produce a protoype, we first reproduced the original denture in the 3D printer prior to milling the final appliance (Figs. 18 & 19), and was tried-in. This allowed for adjustments to be made as required, patient wishes observed, and any errors spotted and rectified. This technique ensured that the finished final denture met the patient's aesthetic requests and met all functional requirements (Fig. 20).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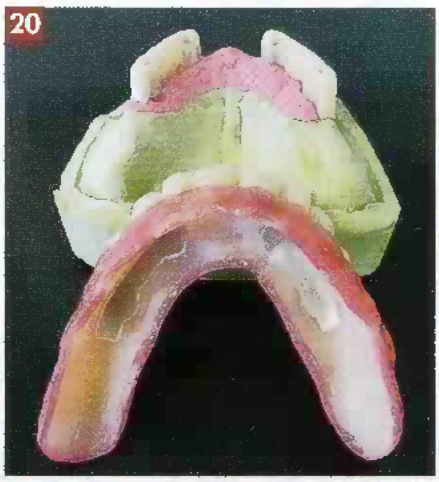
The original denture was scanned...


19

...and printed...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To ensure aesthetic and functional adjustments were made prior to milling the final restoration

Crowns,
bridges, cast frameworks

The burnout frameworks for casting were designed in the 3Shape System and Zirkonzahn System, and STL files were generated.
A 12-unit bridge was designed in the CAD software (Fig. 21). The resulting STL file was transferred and the burnout framework was printed using the residue-free, castable resin, Freeprint cast (Detax) (Fig. 22). The burnout coping for the bridge framework was then cleaned as previously described (Fig. 23). It was then invested and cast in the conventional manner. The framework was tried on the model - the fit was perfect.
After finishing, it was oxidised and


21

Framework design for a single piece, 12 unit bridge

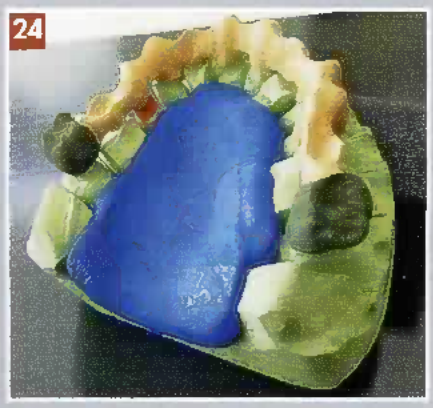

22

This was printed in Freeprint Cast material


23

Ready for investment and casting

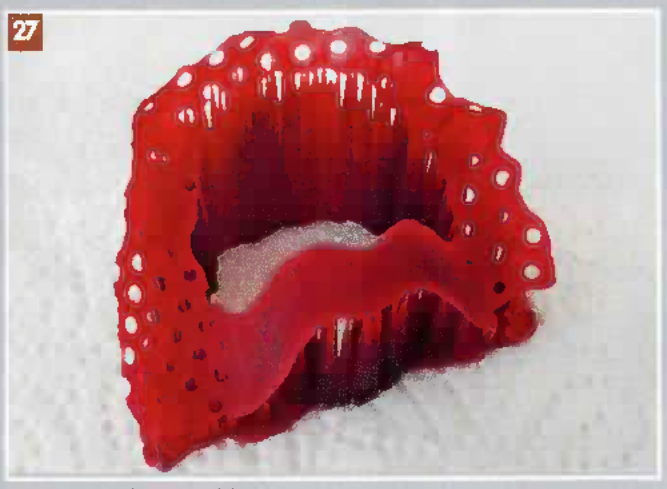
cleaned with acid, primed with opaquer and prepared for porcelain layering (Fig. 24).
Denture plates can also be created this way. A denture plate was designed in the 3Shape model casting module (Figs. 25 & 26). Once the STL file had been printed in residue-free, castable resin (Freeprint cast UV, Detax), the denture plate was ready for investing and casting (Figs. 27 & 28).



Cast framework ready for porcelain build-up

A denture plate was designed...

... In the 3Shape denture module

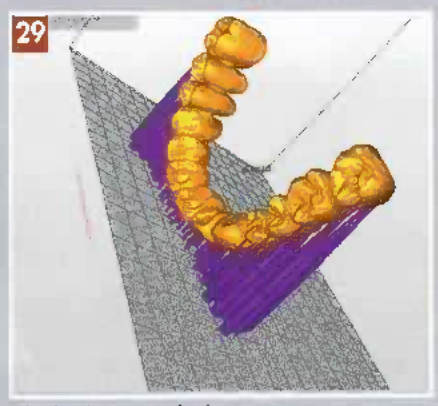


Once printed in castable resin...

... The print supports are sectioned and the denture plate is ready for casting

Temporary crowns & bridges

A 13-unit bridge was designed using the Bridge Modelling Programme (Fig. 29) and a temporary of this bridge was printed in the Asiga Freeform printer using Freeprint temp UV (Detax) (Fig. 30). Freeprint temp UV is a Class IIa medical device material.
The printed temporary bridge was then cleaned as previously described. Once free from residual resin, the temporary bridge had a matt aspect. The print supports were removed and the bridge was checked for fit on the model (fig. 31).



The bridge is ready for printing

Printed in Class IIa compatible material

The fit is perfect

The bridge was processed following the standard procedure.

The smartrepair sytem (Detax) allows for characterisation prior to polishing, if this is required.

Once polished the temporary bridge has a glossy finish, and is ready for fitting (Fig. 32).

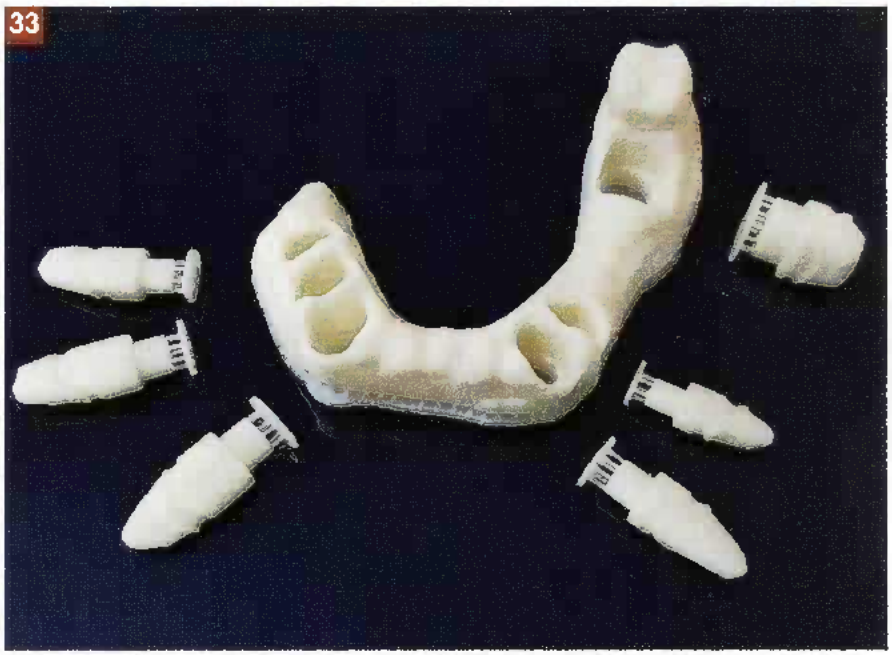
On the model, after finishing

Models
and working / master models

A model with removable dies can be produced digitally from a digital impression using the Modellbuilder from Zirkonzahn.

The digital file was transferred to the printer for processing, and was printed with Freeprint model UV (Detax). The fully printed dental arch with associated dies was removed from the plate, cleaned and light cured (Fig. 33).

Here we used the Zirkonzahn Modellbuilder software to create a model with removable dies for printing at the same time as designing a bridge for milling in zirconia (Fig. 34), model and bridge separated (Fig. 35). ◆



Dental model with removable dies

34 & 35 Model and bridge

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n° 129

Dental TECHNOLOGIES

Ti-bases

How, why and when?

Free the Print

What can you do with your 3D printer?

Pressable ZLS

The next generation of pressable ceramic material: Celtra Press

Just Print it!

Surgical drill guides

Now with verifiable CPD

Dental TECHNOLOGIES

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