Source: Tero Rakkolainen

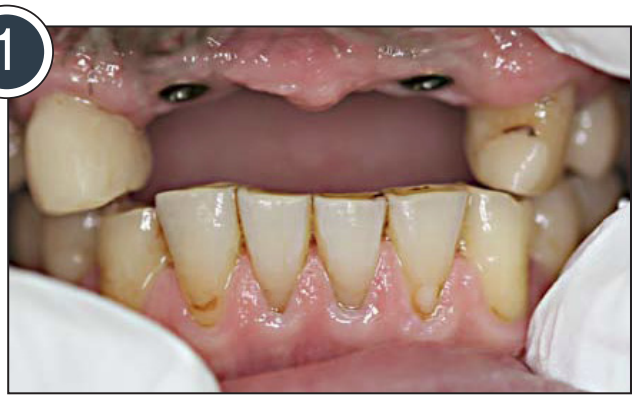
Patient Case

The manufacture of dental implants with CAD/CAM technology raises many questions among laboratory technicians. Unfortunately, if a technician is not familiar with CAD/CAM technology, he/she might have many misconceptions about it. The design and manufacture of fixed prosthetics still requires the professional skills of an experienced denturist/dental laboratory technician. Without input, clicking a button on a computer does nothing. This story is a good example of the multiple phases and challenges present in dental technology work even when CAD/CAM is used in the design and manufacture from start to finish.

The patient is a middle-aged man who had an old fibre-reinforced anterior bridge. The abutment teeth of the old bridge had severe caries and the structures of the bridge had also reached the end of their lifespan. The bridge was removed. Specialist Juha-Pekka Lyytikkä from the dental clinic Hammas-Pulssi extracted the hopeless teeth and placed three Xive 3.8 mm implants for the patient (areas of #14,12, 22). When the healing period was over, the construction of the final prosthesis was started.

A clinical picture of the patient with the implants and healing abutments in place. Since the position and direction of the implants were optimal, screw-retained Zirconium structures were chosen. The fact that screw-retained bridges and crowns can be detached when necessary brings significant benefits for both the patient and the entire dental team.

1



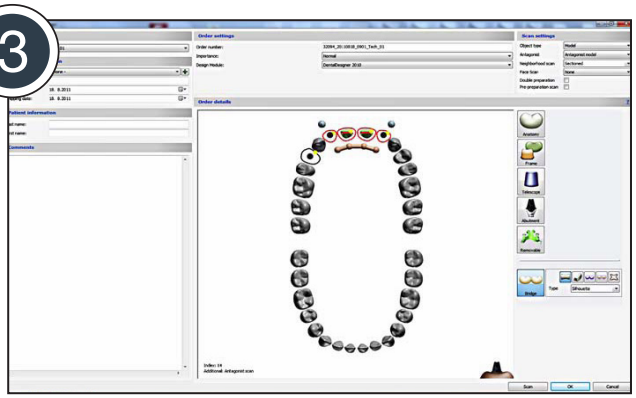
The work models before the actual work was started in the laboratory. It is not necessary to divide the work model into sections when using the 3Shape scanner for implants. A normal gingival mask and high-quality plaster models are sufficient.

2

The starting point for CAD/CAM work is a carefully filled out order form. The order form specifies the work in question and the material to use for manufacturing. The form also specifies the milling centre to use for manufacture as well as the abutment library to use.

Moreover, the order form links the milling centre specific design parameters to the work in question.

3



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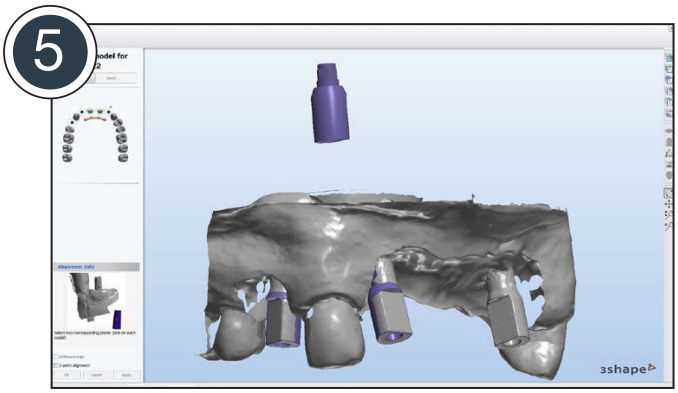
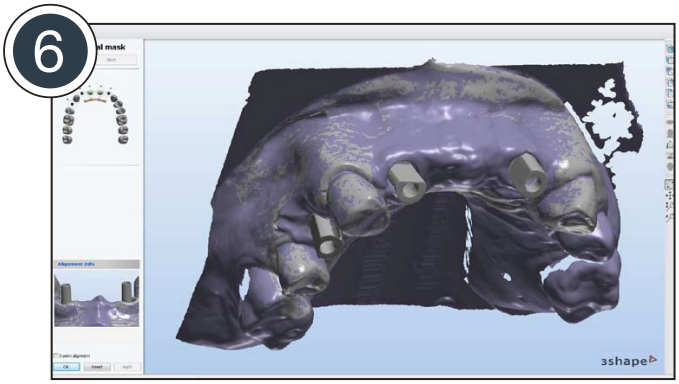
The scanning abutments manufactured by Turun Teknohammas Oy were fixed on the model by screws. This ensures that the position of the implants remains precise during the entire process.

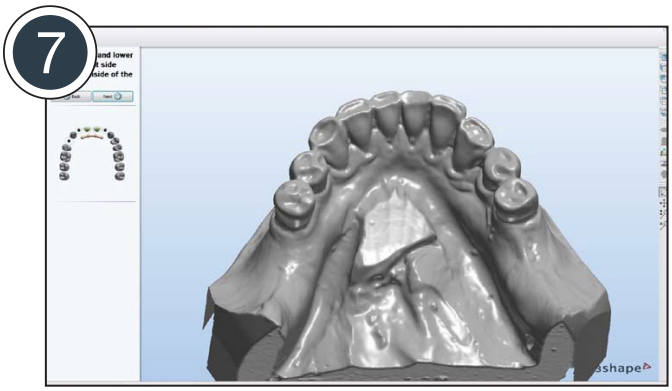
The scanning abutments installed on the model define the position of the implants in 3D space. The software compares the scanning results to the files in the abutment library.



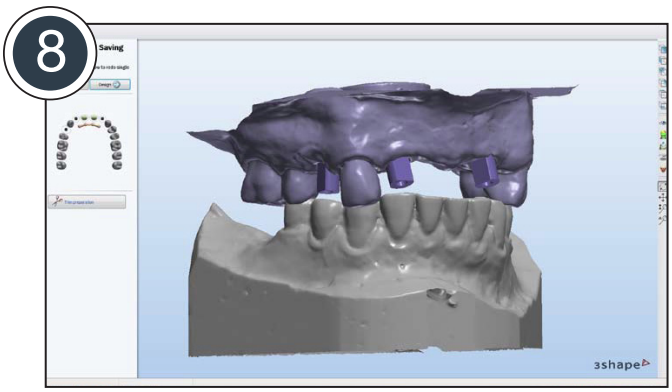
The complete CAD work model with scanning abutments and a separate gingival mask scan.



Opposing arch scan.



The work model and opposing arch scan are combined at the end of the scanning phase. At this stage it is possible to trim away unnecessary data from the scans, such as the base of the plaster model.



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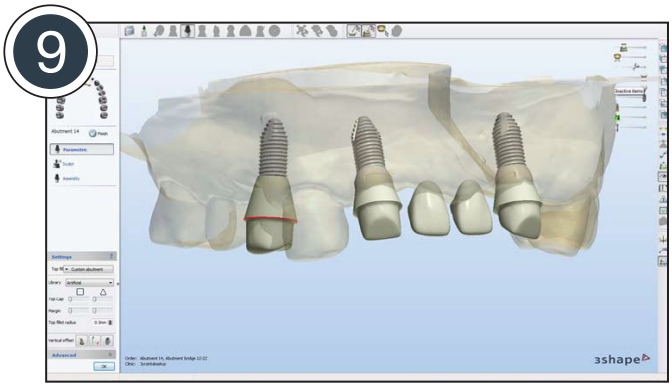
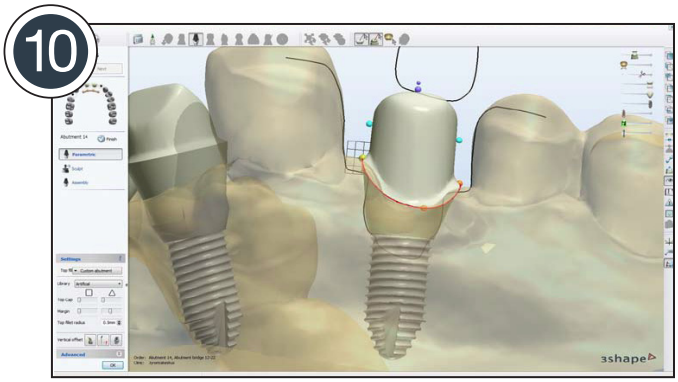
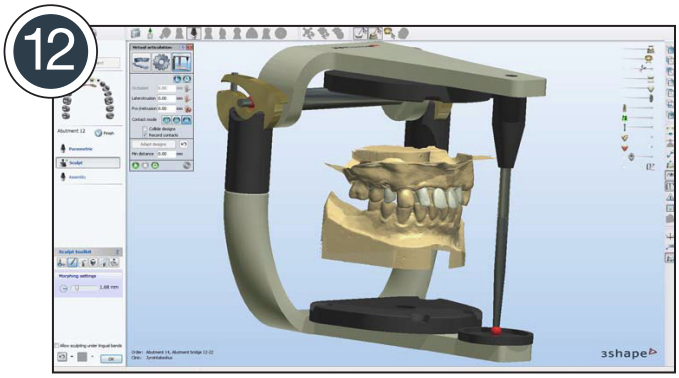
The software closes the scan and opens the DentalDesigner™ program. The 3shape software installs the basic units on their proper places very well. The software also contains many tools for editing the results.



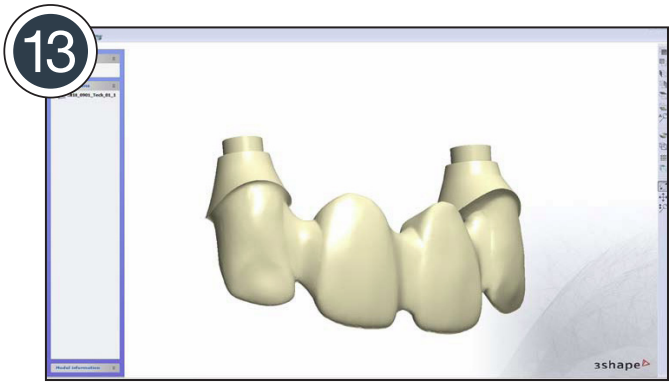
The "preparation limit" of the abutments can be configured by dragging the dots to the desired location. This is where you can also change the shape of the sub-gingival parts of the abutment to e.g. offer support or make more room, depending on the type and volume of the gingiva.



The 3Shape DentalDesigner™ 2010 contains a virtual articulator. The virtual articulator mimics movements the same way as a real articulator does. In addition, you can use the colour-marking feature to detect contact areas. Movements can be simulated automatically or by moving the mouse.



The software contains pre-set values for e.g. configuring the strength of pontics and alerts the user if these pre-sets are changed. The picture shows a completed bridge ready to be sent for milling.



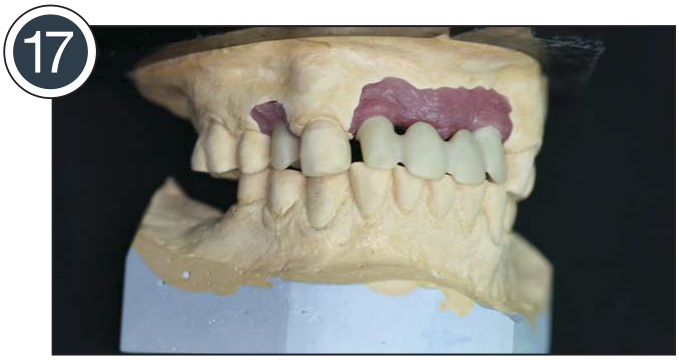
The complete abutment, combining the anatomy from library files and the created plan.

The fact that we can mill custom made abutments and screw-retained bridges from Zirconia is the result of a cross-disciplinary effort between dental technology and engineering. After years of hard work, we are now able to mill parts to tolerances of less than 5 micrometres. The milling of implant bridges requires a 5-axis milling machine. The stl file generated by the CAD system is only one of the pieces required on the way towards the final product.

The complete Zirconium abutment sits completely passively after a correctly executed CAD design, milling and sintering. As part of quality control, the completed abutment is test-tightened to the correct torque in the model. The flexural strength of carefully modified custom made abutments can be up to twice as high as that of commercial zirconium abutments.

Stress tests conducted at the University of Turku strained the abutments at a 45 degree angle using up to 1,500 N of force.

The completed abutments accurately match the design, including opposing arch and the gingival margin. In this particular case, the abutments were coloured using regular colour.

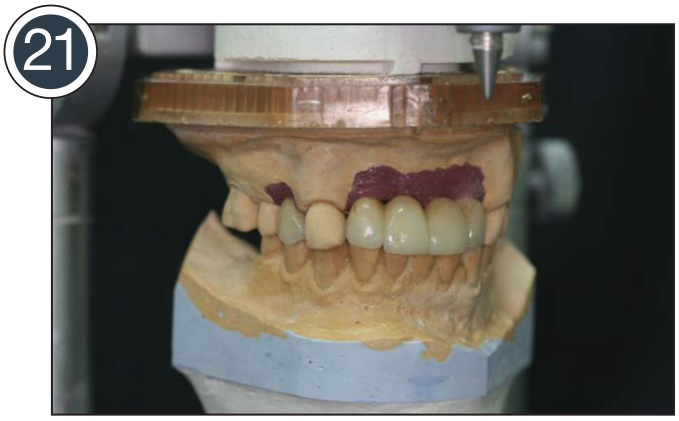


The veneering work was performed at the laboratory of Turun Teknohammas Oy, using traditional methods. The ceramic used was e.max by Ivoclar Vivadent, and the work was performed by Jaakko Siira, the technician in charge.

The completed screw-retained bridge and the abutment on the model.

The screw-retained Zirconium crown.

The completed work ready to be shipped to the clinic.



The final clinical picture of the completed product, tightened to the desired torque. Zirconium-abutment bridges and crowns can be cleaned very well, which is a critical factor in the retention of bone and gingival volume.