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INTERVIEW

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THE
SMILE**

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**CAD/CAM PRETTAU®
BRIDGES FOR AN
EDENTULOUS PATIENT**

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**IMPERFECTION
MAKES
PERFECTION**



CAD/CAM PRETTAU[®] BRIDGES FOR AN EDENTULOUS PATIENT

**Occlusally Screw-Retained Mandibular and
Maxillary Prettau[®] Bridge Restorations on
Titanium Bases and Custom Zirconia Abutments**

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DT. Manfred Pörnbacher

DENTIST:
Dr. Wael Att



If all the teeth of one jaw are extracted, the alveolar bone will atrophy very quickly. While resorption is more pronounced in the mandible, it is the implant-supported reconstruction of the edentulous maxilla that poses the greater aesthetic challenge. Thanks to new CAD/CAM technology and the result of increasingly complex digital workflow, which transcends the laboratory to find its continuation in the dental office – and vice versa – this challenge can now be met not just satisfactorily, but brilliantly.

Intraoral implant positions have a direct influence on the biomechanical, functional, aesthetic and phonetic properties of a dental restoration. Maximum precision in planning implants and their positions is therefore a prerequisite for treatment success and the implementation of a functional and aesthetically pleasing implant-supported restoration.

Baseline situation and treatment plan



A 55-year-old female patient presented to her dentist, Professor Wael Att of the Department of Prosthodontics, School of Dentistry of the University of Freiburg, Germany, with complaints about the unfavourable appearance of their malpositioned teeth and about gingival bleeding. She also had chewing difficulties due to missing teeth. What she wanted was a natural, harmonious smile and straight teeth. Following a thorough analysis, the dentist described the patient situation as follows:

“The unsatisfactory aesthetics was mainly due to the inappropriate intra-tooth proportions, tooth-to-tooth proportions and misalignment of the anterior teeth. All of these teeth appeared too long and too thin in shape [...] The assessment of the dental status showed that nearly all of the residual dentition was restored with crowns or fixed dental prostheses. All restorations were deficient [...]. The gingival tissues exhibited a thin biotype and appeared irritated and unharmoniously shaped [...]. A distal occlusion with few tooth contacts in maximal intercuspation was revealed. The overjet and overbite were 4 and –2 mm, respectively. [...] Due to generalized secondary or root caries, insufficient root canal treatments, existing periapical radiolucencies and significantly compromised periodontal support, the prognosis of all remaining teeth was considered hopeless.”

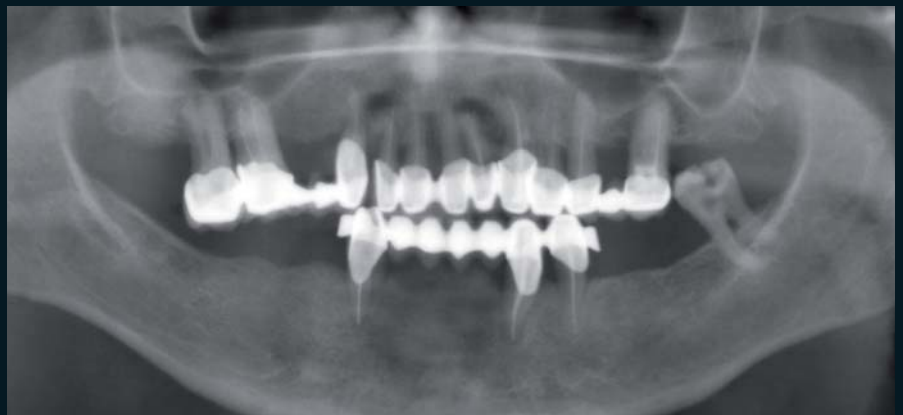
The treatment plan therefore provided for

“[...] fixed rehabilitations in both jaws to reestablish of proper pink and white aesthetics, contributing to the overall enhancement of facial and smile aesthetics and improved patient comfort, self-confidence and quality of life. The definitive treatment plan called for implant-supported fixed dental prostheses in the upper and lower jaws.”

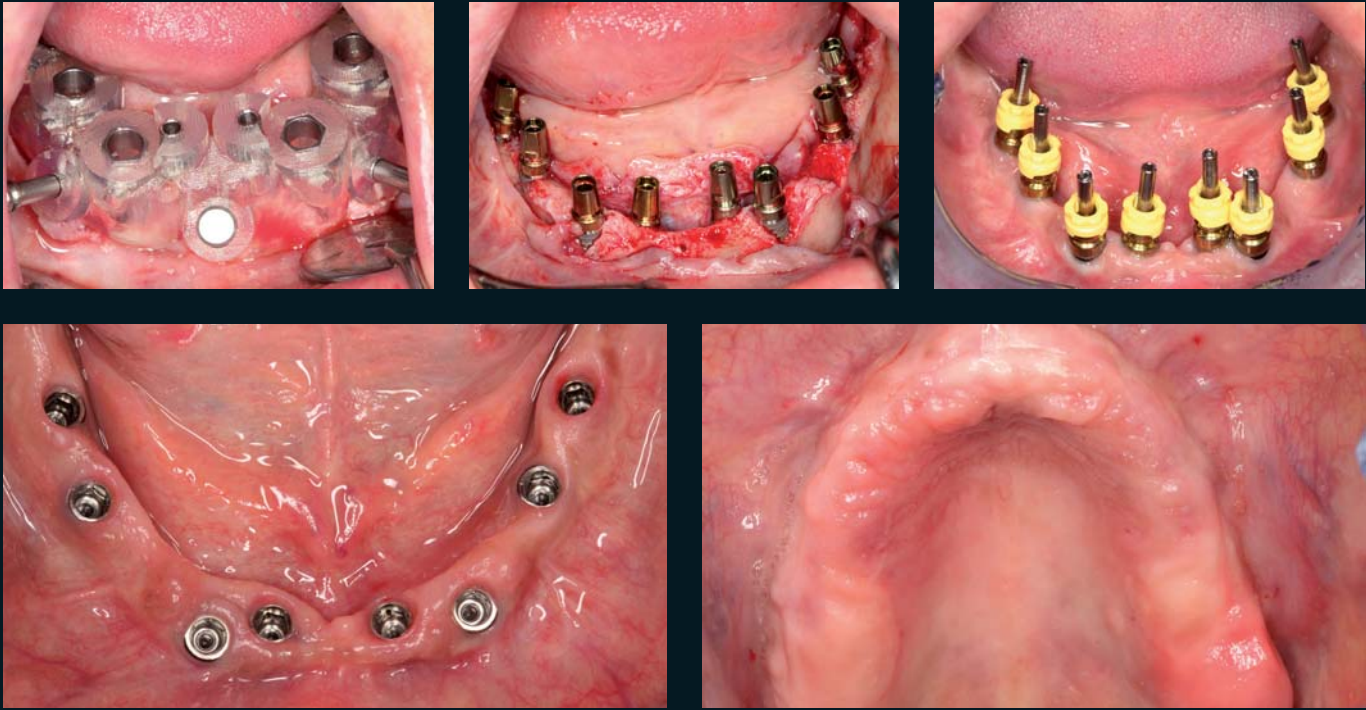


Clinical baseline situation.

As a first step of the treatment, the dentist extracted the remaining maxillary teeth to obtain sufficient time for the healing process. He then proceeded with implant planning. Preoperative diagnostic tools such as study casts, diagnostic way-ups and x-ray and CT data help to identify the optimal implant position; the data can also be used to guide implant surgery.



Baseline X-ray.



Insertion of implants in the mandible.

As a result of the design phase and the subsequent preparatory surgery (extraction of remaining mandibular teeth and mandibular implant placement and dental prosthesis insertion), eight implants were now present in the mandible (sites 36, 35, 33, 32, 42, 43, 45 and 46). In the maxilla, ten implants were planned at sites 16, 15, 14, 13, 11, 21, 23, 24, 25 and 26; these were to be inserted later to provide adequate healing time in the maxilla.

After the insertion of the mandibular implants, the patient received provisionals made by the dentist, and an impression of the situation was taken.

The resulting mandibular master cast with implant analogues was mounted in the articulator. Since the anteriors of the maxillary denture were planned to be repositioned palatally for aesthetic reasons and the midline was to be moved, a bite rim was created for additional guidance.

We – the laboratory – received the diagnostic casts and the bite rim from the dentist, with the initial request to produce a mandibular Prettau® Bridge and an interim restoration as an aesthetic preview of a possible Prettau® Bridge in the maxilla, potentially to be fabricated and delivered later.

The dentist opted for Prettau® Zirconia as a restorative material because the patient wanted a metal-free, highly aesthetic and easy-to-clean rehabilitation.

Due to its high translucency, optical properties and outstanding customizability, particularly natural solutions can be obtained with Prettau® Zirconia.

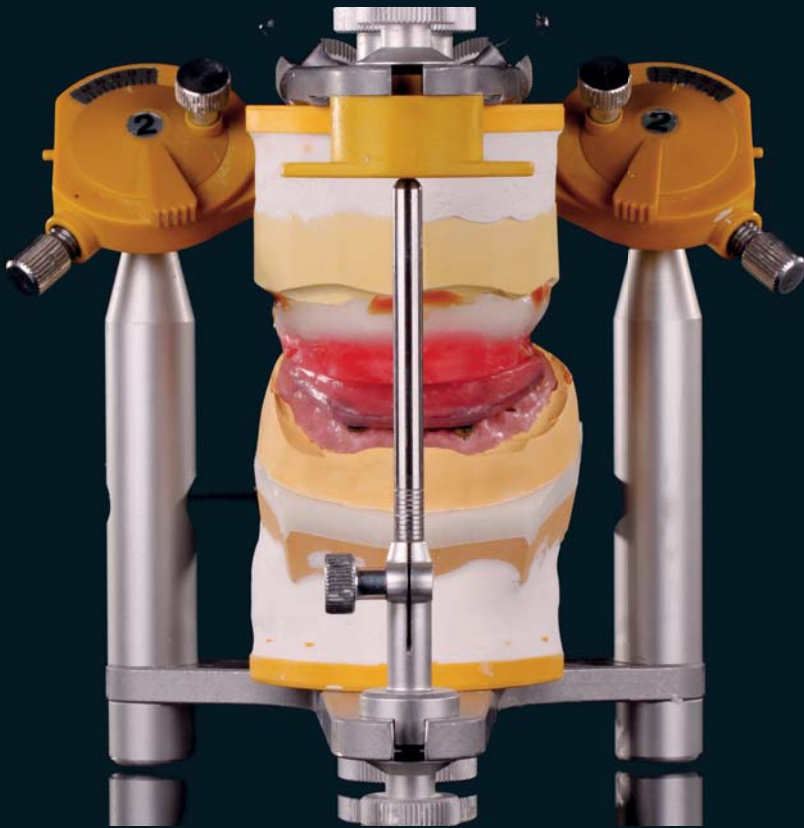
The material can be used to full contour, with a ceramic veneer. This implies that there is no risk of ceramic chipping. In the present case, only the aesthetic zone was to be veneered with ceramics.

Experience has shown that the translucent Prettau® Zirconia material blends in well with the natural tissue, so the missing gingival tissue in this case was also amenable to restoration in a highly aesthetic manner. The prosthesis was to be occlusally screw-retained and therefore removable by the dentist. This has the advantage that the restoration can be removed at the dental office and professionally cleaned. In terms of daily hygiene, it was also shown that the highly polished basal surfaces of the zirconia structures could be maintained very clean overall and did not irritate the mucosa.

To realize the interface between the implant and the superstructure, we opted for prefabricated titanium bases at the time. These can be adhesively connected to the restoration without internal tension and tightened to a higher torque than the zirconia abutment would permit if screwed down directly.

Realization of the mandibular Prettau® Bridge and the maxillary denture

The first step was to acquire the digital data for the patient situation.



Wax bite rim in the articulator.

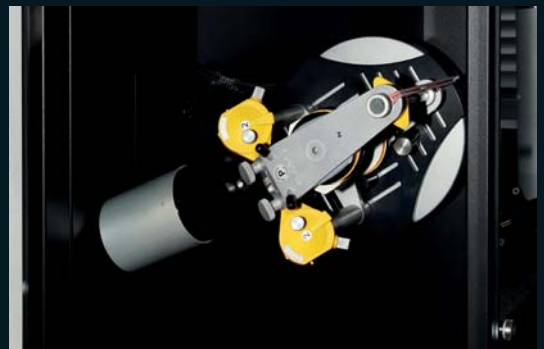


Mandibular master cast with analogues.

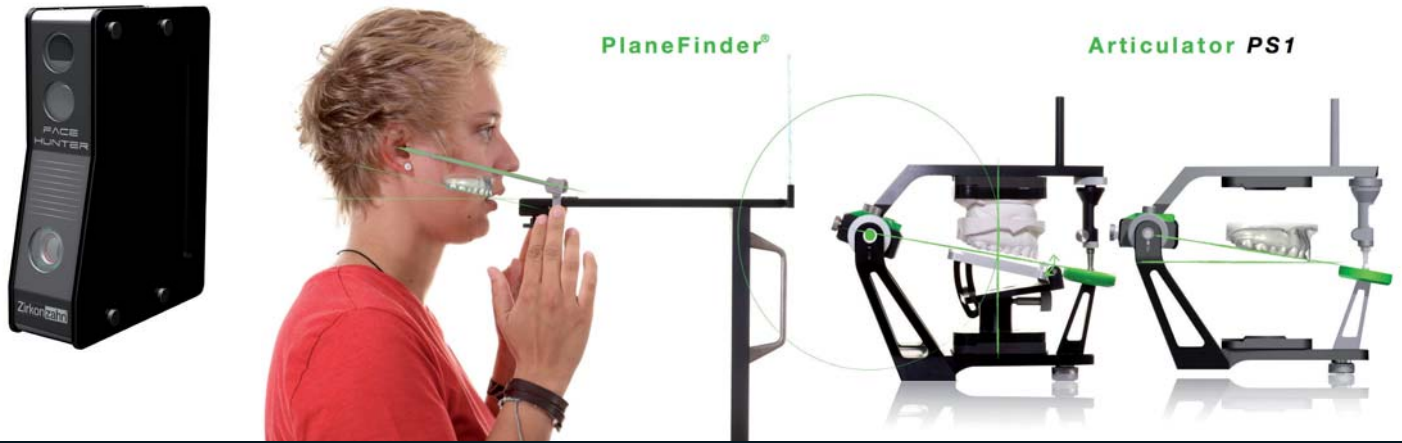


Plaster casts in the articulator.

To this end, we scanned the diagnostic casts mounted in the articulator, the master cast and the bite rim using the fully automated S600 ARTI structured-light scanner. The S600 ARTI's acquisition field is large enough for the models to be scanned right in the articulator.



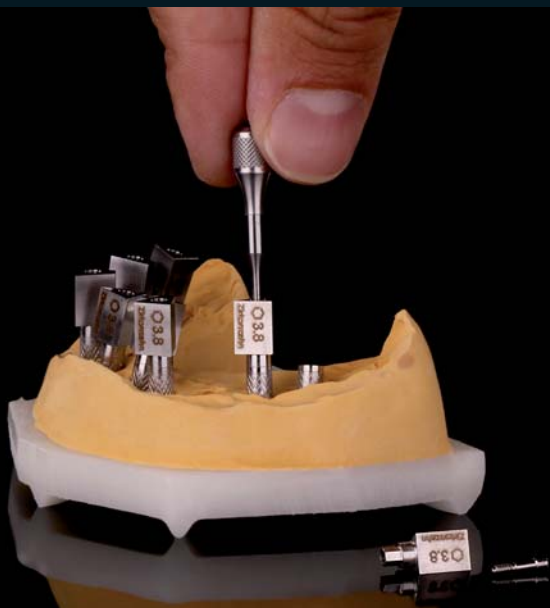
Acquiring digital data with the S600 ARTI scanner.



Facial Scanner Face Hunter and PlaneSystem® for 3D-patient analysis.

Of course, aesthetic and physiognomic facial features can be taken into account in the design of the restoration only to a limited extent if the technician is restricted to the information typically provided by the dentist. If we were to work on the same case today, we would first record the patient's face in three dimensions using the Face Hunter facial scanner and the PlaneSystem® and then faithfully translate the three-dimensional data, including positional data, into the coordinate system of the Zirkonzahn Modellier modelling software. On this basis, it would be possible to customize the restoration for the

patient's situation in terms of aesthetics and jaw relations. To be able to detect implant axes and selecting appropriate titanium bases, we used titanium scanmarkers. As these markers have a metallic surface, they must be coated with scan spray before scanning to avoid reflection-related artefacts in the data. Today, non-reflective White Scanmarkers (Zirkonzahn) made of ceramic-reinforced polyetheretherketone (PEEK) have been introduced that no longer require spraying. They are also excellent for intraoral scans.



The Scanmarkers are connected on the master model.



In preparation for the scan, the Scanmarkers are sprayed with scan spray to avoid reflections.

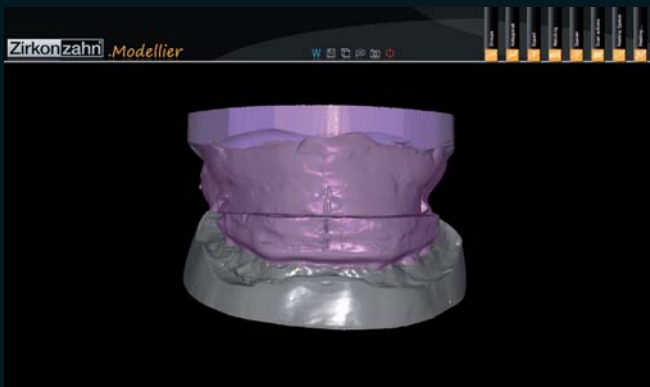


Digitally acquired mandible with implants in the modelling software.

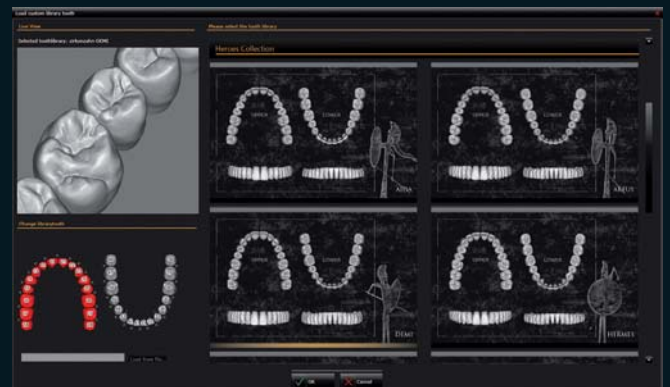


Selecting of the implant system and visualizing the implant axes.

Based on the scanned data, the design process for the superstructures was now initiated. First, the implant system was selected in the software and loaded into the model situation. We then proceeded to set up the teeth for both jaws, using the bite rim and the provisional prosthesis as reference points. We selected the tooth set from the “Heroes Collection” virtual tooth library that corresponds most closely to the shape of the patient’s denture teeth, which in this particular case turned out to be the AIDA collection.



Mandible and maxilla set up with the intelligent natural tooth library 'Heroes Collection'



HEROES COLLECTION THE INTELLIGENT NATURAL TOOTH LIBRARY

The virtual tooth library consists of ten complete matching sets of maxillary and mandibular teeth, which ensures a harmonious and aesthetic intermaxillary relationship as well as a good occlusion. The teeth are available with full or reduced contours. In the latter case, four designs, AIR, WATER, FIRE and EARTH, are available for the cutback.



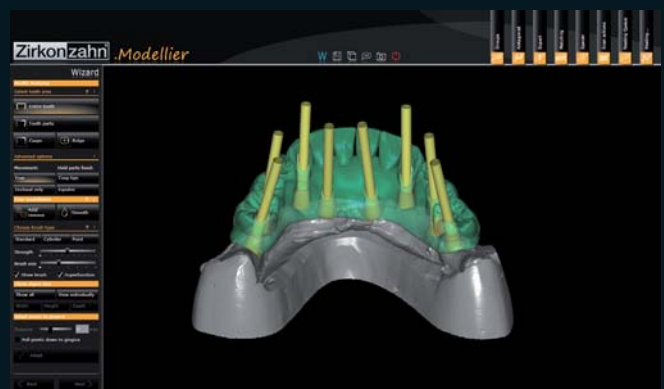


Teeth setting up with the help of intelligent natural tooth library "Heroes Collection AIDA".

The library teeth were now set up and aligned in relation to the diagnostic cast, taking into account the patient's physiological situation.

The fully contoured tooth shapes were used initially; they were subsequently reduced manually in the anterior region for partial veneering. The Heroes Collection has since been further upgraded to include tooth sets with a reduced anatomy. There is again a choice of four cutback designs, WATER, FIRE, EARTH and AIR.

We next checked the resulting occlusion using the appropriate software tools. To this end, we used the virtual articulator to simulate TMJ movements (such as retrusion, intrusion and laterotrusion). Any occlusal interferences are adjusted automatically. Before milling the maxillary and mandibular set-up for the first try-in plastic Temp Basic resin, we re-checked the screw access channels. In the mandible, these were all located in positions that were aesthetically irrelevant.



Checking the screw access channels.

The screw access channels in the maxillary anterior region could be disregarded, since we were not constructing the final mandibular restoration in zirconia but merely resin teeth on a palatal plate at that point.

The mandibular restoration was now theoretically ready for implementation in Prettau® Zirconia. However, at this point we always insert a control step, milling the design as a resin prototype for an intraoral try-in.

For the production of the resin prototypes, we positioned the two set-ups virtually within the Temp Basic block using the nesting function of the software. Having adjusted the automatically placed connectors (“sprues”) manually, we started the milling process with the M5 five-axis simultaneous milling unit.



Nesting of the mandibular provisional and the temporary maxillary resin teeth in the Temp Basic block.



Milling the designs using the M5 five-axis simultaneous milling unit.



Maxillary and mandibular resin prototypes as removed from the block.



Palatal plate milled from Temp Basic Tissue

The palatal plate, in which the maxillary teeth are anchored, was designed with the Bite Splint CAD/CAM software module and then milled from Temp Basic Tissue resin. The designed and milled maxillary resin teeth were connected to the plate with wax for an aesthetic try-in as a precursor to the maxillary zirconia restoration.



The maxillary resin teeth, connected to the plate with wax, and the mandibular resin prototype.



Veneering of the mandibular resin prototype with gingiva composite material.

The resin try-in intends to afford the dentist and the patient a realistic preview of the final restoration. This is why we always veneer the mandibular resin prototype with gingival composite materials.



The resin prototypes were now sent to the dentist for the try-in to check them for proper aesthetics, function, fit and phonetics.

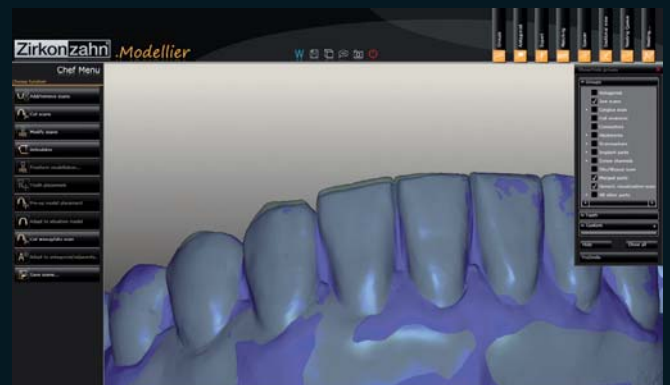
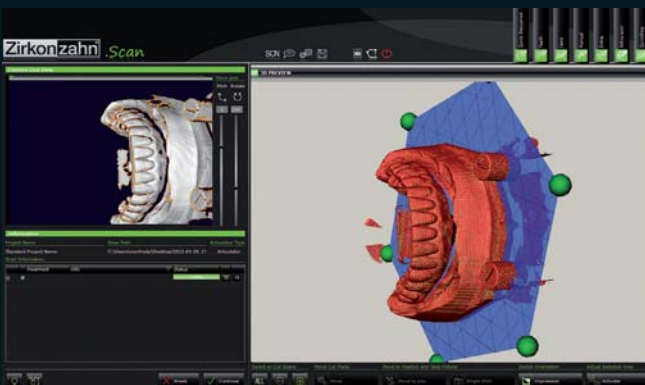
The try-in in this case was very successful; only a minor aesthetic correction was necessary: the tooth contours in the right mandible were slightly too high.

Try-in of the mandibular resin plastic prototype in the patient's mouth. The mandibular tooth contours were slightly too high.

After the mandibular denture had been returned to us, we manually adapted it minimally with a carbide bur.



Minimal aesthetic correction of the mandibular prototype.



The prosthesis now met the full expectations of the dentist and the patient. We rescanned it and defined it in the software as our new wax-up.



Window for selecting the milling strategies.

This concluded the design phase of the mandibular restoration. To mill the restoration in Prettau Zirconia, we positioned it in a Prettau® Zirconia block, aligned the automatically proposed connectors and created a sintering base, which is important to ensure that the restoration can be sintered without distortion. Finally, we defined the milling strategy. For cutting extra fine details, we select the milling strategy with a 0.3 C cutter.

The structure was milled in Prettau® Zirconia using the M5 five-axis simultaneous-function milling unit.



Milling the mandibular Prettau® Bridge using the M5 five-axis simultaneous-function milling unit.

Having separated out the Prettau® Zirconia restoration from the block of material, we performed a manual reduction of teeth 33 to 43 to customize the structure by inserting mamelons and prepare it for ceramic veneering. It is important to retain an initial protective edge to prevent ceramic chipping in this high-wear area.



Preparing the structure for ceramic veneering by manual reduction.

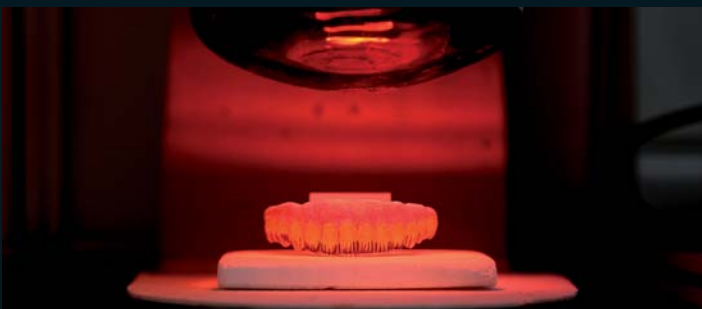
As an alternative to manual reduction, it is now possible to reduce the shapes in the virtual set-up stage or to select already reduced tooth forms from Heroes Collection (AIR, WATER, FIRE, EARTH).

After the reduction, we proceeded to custom staining. For this, we used Colour Liquid Prettau Aquarell, intensive shades and gums with a special colouring technique, applying the different shades to the zirconia structure a brush stroke at a time. The acid-free colouring liquids contain organic pigments, so that each brush stroke can be set in a targeted and well-defined manner.



Manual colouring of the zirconia structure.

We then dried the stained restoration under a drying light for 45 minutes. In a Zirkonofen 700 Vakuum furnace, the Prettau® Bridge was sintered overnight at 1,600°C under vacuum with a ceramic hood. The vacuum makes for higher translucency and a uniform structure. The ceramic hood ensures good colour retention and even heating and cooling. Pronounced temperature variations can cause micro-cracks in the zirconia structure.



Drying under lamp and sintering of the structure in the Zirkonofen 700 Vakuum

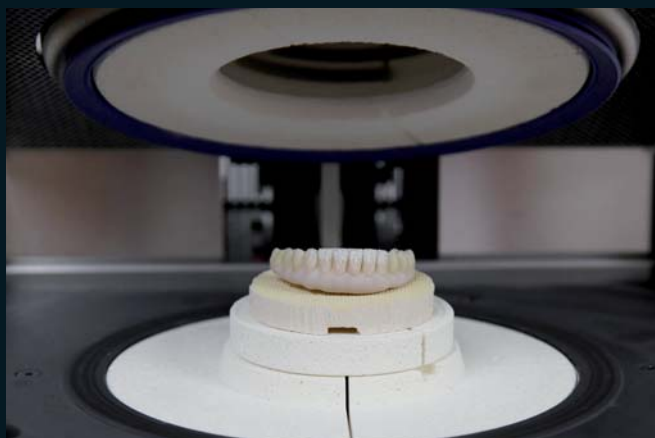
Once the material had been densely sintered, we checked the fit on the master cast and the titanium bases. The result was already very good in terms of aesthetics and fit.



Sintered zirconia restorations.



The shade was further refined by applying ICE Zirconia Ceramics as well as different effect, transparent and tissue materials in combination with wash and dentine firings.



Ceramic layering the anterior region of the mandibular restoration.

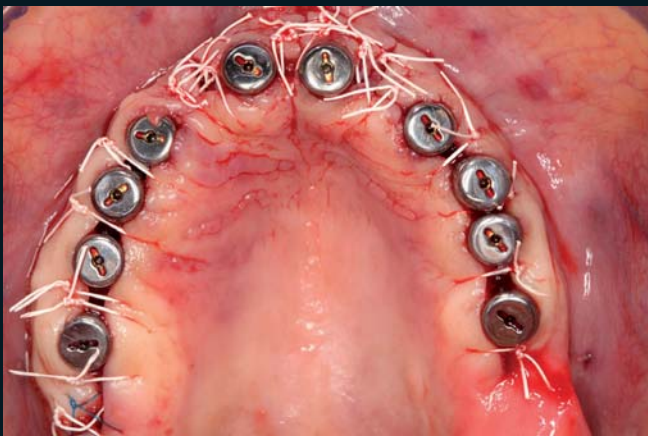


After the final stain and glaze firing, the Prettau® Bridge base was polished, and the titanium bases were connected with a strong composite adhesive. The finished mandibular Prettau® Bridge was sent to the dentist to be screwed in place in the patient's mouth.



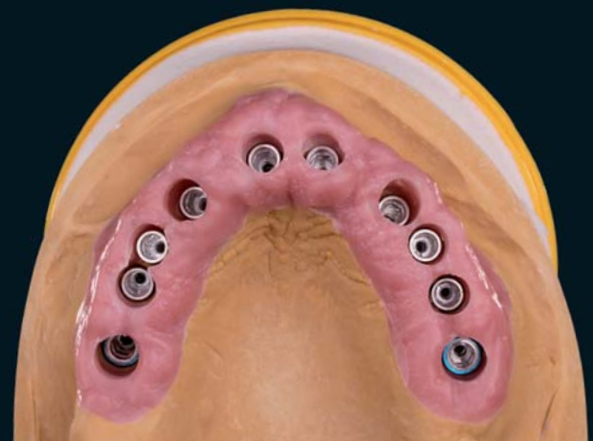
Final mandibular Prettau® Bridge.

In the meantime, the patient received the ten implants that were planned for the maxilla.



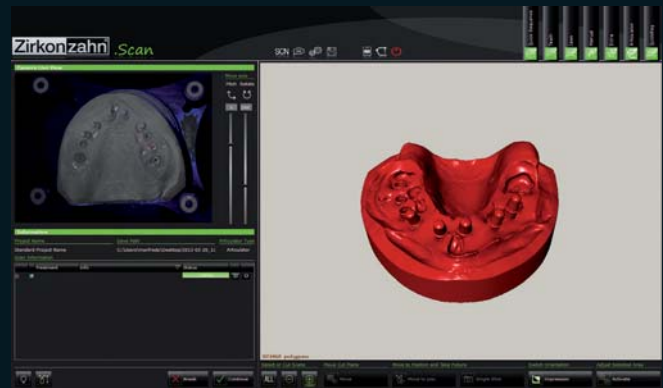
Implants placed in the maxilla.

After an appropriate healing phase we received a new master cast with analogues and a bite rim in an articulator.



Bite rim and new master cast for the maxillary restoration.

Our task was now to create the maxillary Prettau® Bridge. We acquired the digital data as with the mandibular cast.



Digitisation of the new baseline situation.

We used scan markers to record the axial inclination of the implants. As the screw access holes of the implants would have exited vestibularly in the maxilla, we opted for a tripartite maxillary restoration.

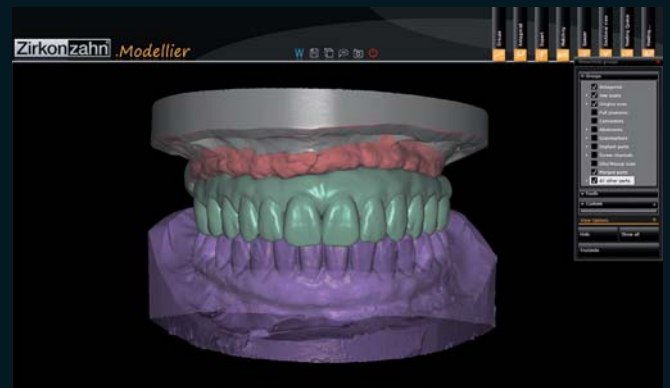
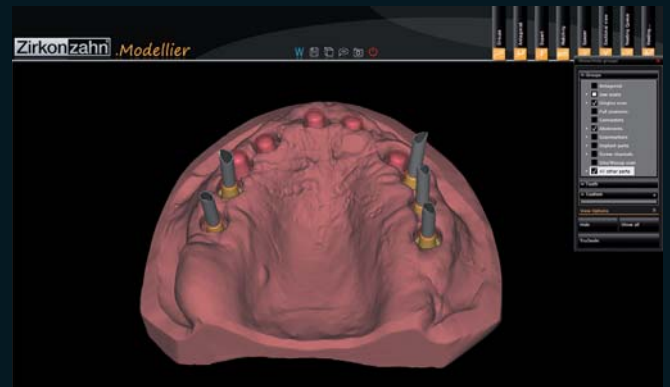
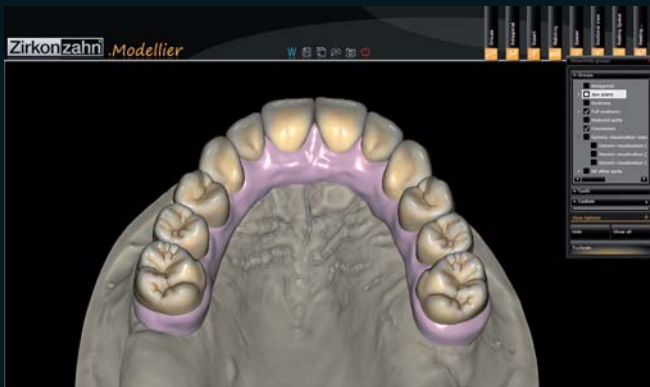
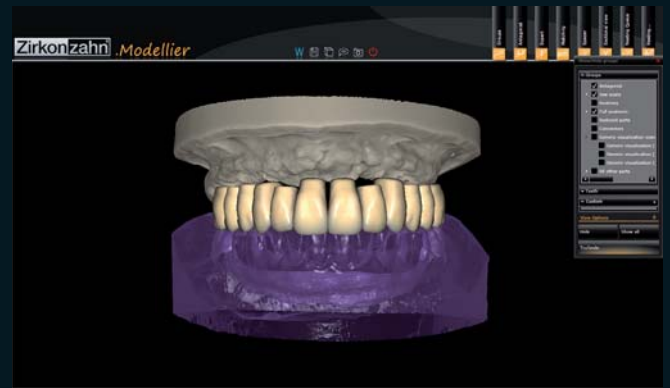
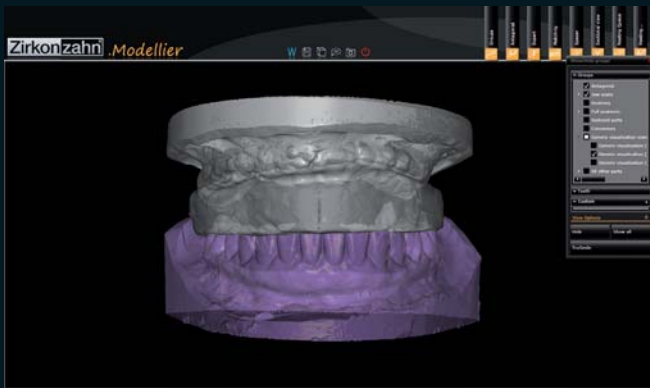


Vestibular positions of the screw holes in the maxilla.

The primary zirconia structure at sites 14 to 24 was to be cemented onto custom zirconia abutments. Today a possible alternative would be to use the new high-performance Tecno Med resin as frictional copings for a removable solution for the anterior region of the maxilla.

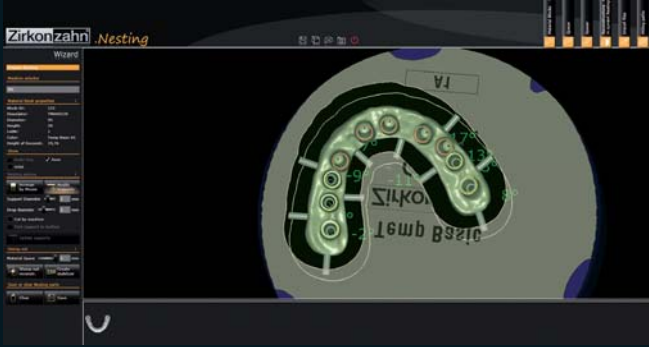
At sites 15/16 and 25/26 we provided occlusally screw-retained posterior bridges. We could have included implant 14 in the posterior bridge, but the segmentation would then have been visible when the patient smiled, and in addition, a larger bridge span provides added stability during cementing.

Based on the digital data thanks to easy access to the archived patient case, we were able to adjust the “old” set-up to the new master cast with a few clicks. The alignments of the implants were calculated; for the cemented central restoration, the implants were defined as “blind”.



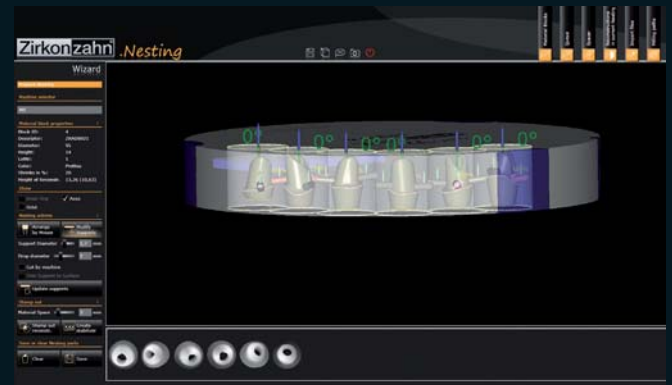
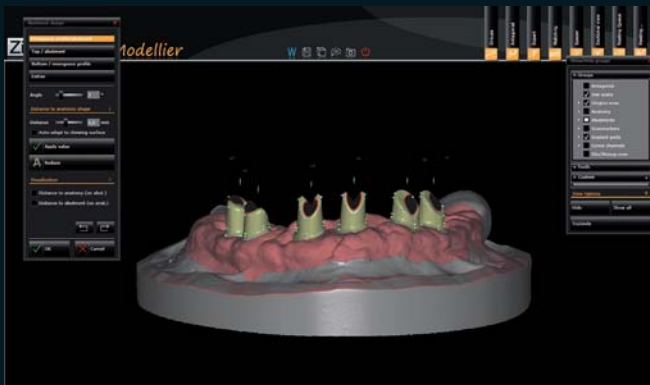
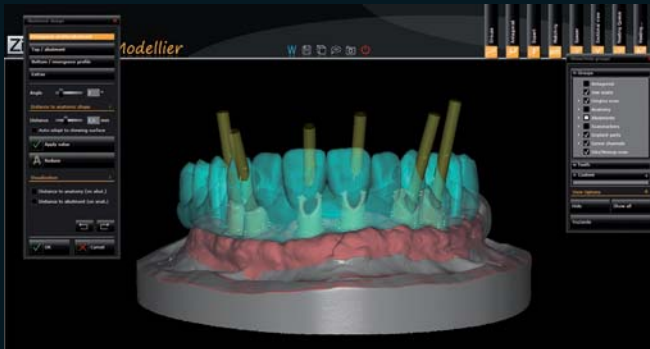
Model of the maxillary restoration as adapted to the new situation.

Now the maxillary model can be milled. Once again we performed our standard control step by first creating a resin model for intraoral try-in. For this purpose, we left the maxillary structure in one piece and again veneered them with gingival composites. In this way, the resin prototype could be used as a provisional until the completion of the final restoration.



Resin prototype for the maxilla, veneered with Gingiva Composite material.

Neither the dentist nor the patient communicated any change requests, so we began milling the maxillary restoration from Prettau® Zirconia. To this end, we defined the anterior custom zirconia abutments as primary elements.



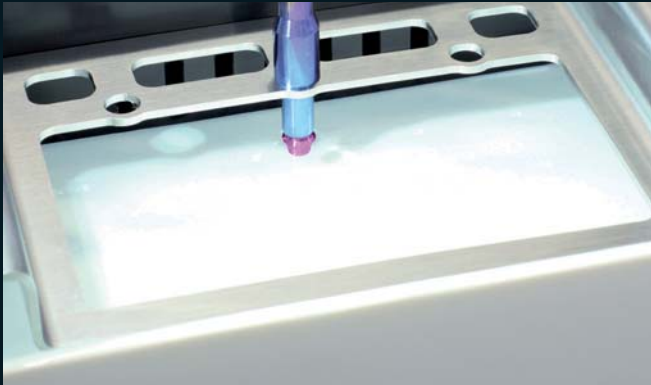
Modelling...

These primary elements were also milled in Prettau® Zirconia using the M5 five-axis simultaneous-function milling unit, then stained with Colour Liquid Prettau Aquarell and densely sintered in a Zirkonofen 700 Vakuum furnace.

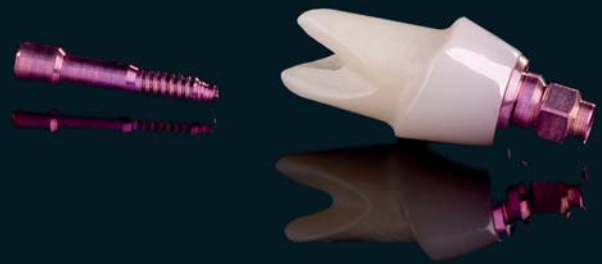


... and production of the custom zirconia abutments.

The custom zirconia abutments were bonded to the titanium bases. To prevent the titanium bases below the zirconia superstructure from being visible as a greyish shimmer, we anodized all titanium bases and all screws with Titanium Spectral Colouring Anodizer in pink. This ensures unadulterated natural aesthetics, particularly in the anterior region.



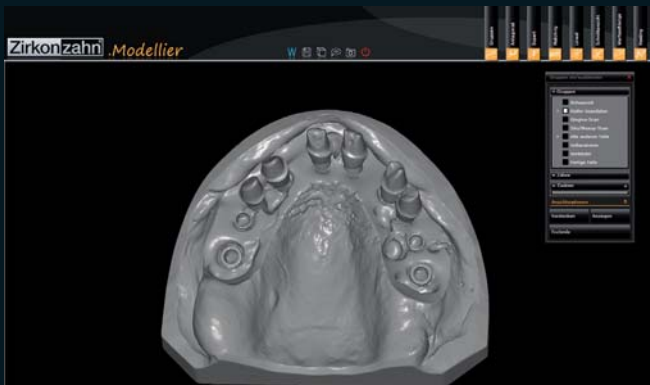
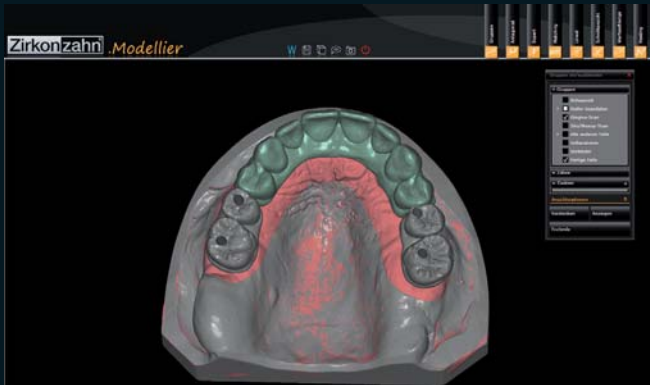
Anodizing of all titanium bases and screws in the Titanium Spectral Colouring Anodizer.



Zirconia abutments bonded to titanium bases in the master cast.

The zirconia abutments bonded to the titanium bases were now screw-connected to the master model, then scanned and defined as the new primary structure for the maxillary Prettau® Bridge. Before the scan, the abutments were sealed with wax and again sprayed with scan spray.

The secondary structure was adapted to the new situation. This was also the point at which to effect the segmentation of the restoration in the software. The two posterior bridges as well as the anterior bridge were nested in the block, provided with sintering bases and connectors and milled from Prettau® Zirconia using the M5 milling unit.



Virtual adaption and milling of the secondary structures.

Following manual finishing and staining, the bridge components were densely sintered. Their fit was checked on the master cast.



Individual colouring of the maxilla Prettau® Bridges.

The anterior bridge was veneered with ceramic and, together with the posterior bridges, received their final characterization with ICE Zirconia stains and glaze.



Final anterior Prettau® Bridge for the maxilla.

The posterior bridges were bonded to titanium bases, also anodized in pink, and the fit of the entire completed restoration was once again checked on the master cast.

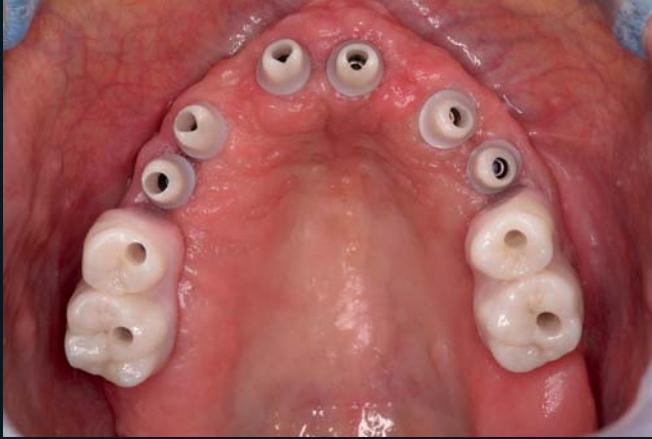


Checking of the complete restoration on the master cast.

The tripartite maxillary restoration made of Prettau® Zirconia was sent to the dentist for delivery using cement or screws.



Final tripartite maxillary Prettau® Bridge.



Final restorations in the patient's mouth.



New situation X-ray.

At the control visit after four months, the patient reported that now had a carefree and confident smile and could eat and speak easily again. She was also pleased with the easy access to her restoration for oral hygiene.



Wael Att

DDS, DR MED DENT,
PHD PROFESSOR

As a Professor and a high ranked doctor of medicine, and also in charge of the post grad education at the Faculty of Dentistry at the Universitat of Freiburg, and Chairman, Department of Restorative Dentistry, Dubai College of Dental Medicine, Dubai, UAE, too.

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DT.

MANFRED PÖRNbacher

Born in Brixen (South Tyrol, Italy)

- Completed his training as a dental technician from 1988 to 1993 at the vocational school for dental technicians in Baden, Vienna (Austria)
- 1992–1995 dental technician in the practice of Dr. Walter Lüfter in Bruneck, South Tyrol (Italy)
- 1995–2010 dental technician at "Burg Dental – Hochwertige Zahntechnik" in Sterzing, South Tyrol (Italy)
- Since 2011 dental technician, course instructor (especially photography courses) and part of the team for research and development at dental laboratory Steger in Bruneck, South Tyrol (Italy)



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