Full-arch: Full rehabilitation of the upper jaw—Part 2

The complete rehabilitation of a compromised residual dentition represents a major challenge in terms of implantology as well as function and aesthetics. There is a great desire for fixed dentures with a satisfactory aesthetic and functional realisation. In addition, patients are increasingly interested in biocompatible dentures and surgical concepts that take biological criteria into account. Biological dentistry with metal-free implants and zirconium oxide dentures can meet this demand at a high level. In the first part of the article, the authors dealt with the diagnosis and its special features, the preparation of the patient and the surgical procedure for implant placement. In the second part, the dental technical procedure is now explained.

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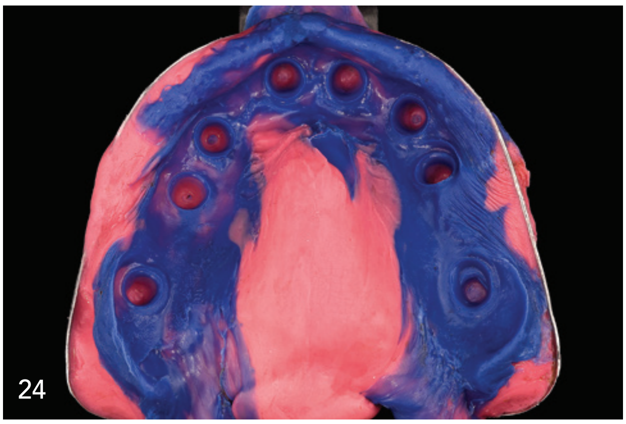
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As a reminder: the 41-year-old patient wanted a biologically neutral and metal-free overall rehabilitation of his compromised residual dentition in the upper jaw and caries treatment of his lower teeth. In the maxilla, there was a residual dentition in regions 15 and 17 as well as two root remnants in regions 13 and 15 *in situ*, on which a partial denture from 12 to 21 was located. All four remaining teeth had already undergone endodontic treatment and were no longer worth preserving. In the lower jaw, teeth 37, 36, 45 and 47 showed carious lesions. Tooth 46 was devitalised, decayed, and showed extensive apical whitening on radiographs. The remaining teeth in the mandible were vital. Moderate chronic periodontitis was found in both the maxilla and mandible.

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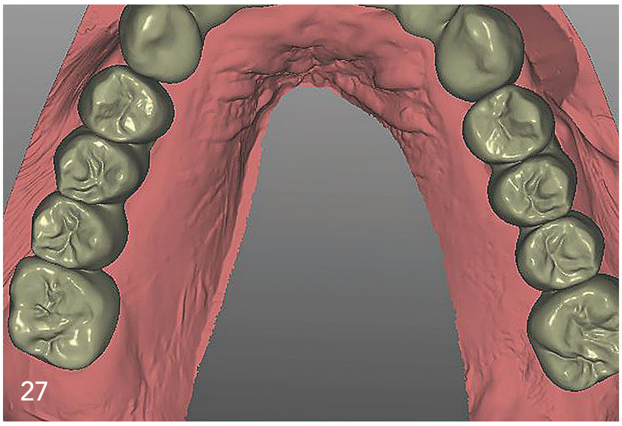

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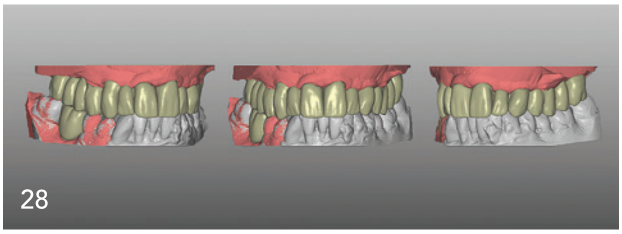

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Prosthetic rehabilitation of the patient

The success of a restoration is highly dependent on careful planning in advance. There is a lively exchange of information between the dentist, patient, and dental technician. Everything revolves around the following questions: what are the expectations? What is sensible and what is technically feasible? It is extremely important to involve the patient in the entire decision-making process—after all, it is the patient who will have to live with the finished work. Once all the important questions have been clarified, we realise the planned work as a dummy (prototype) and check everything again for "oral suitability".

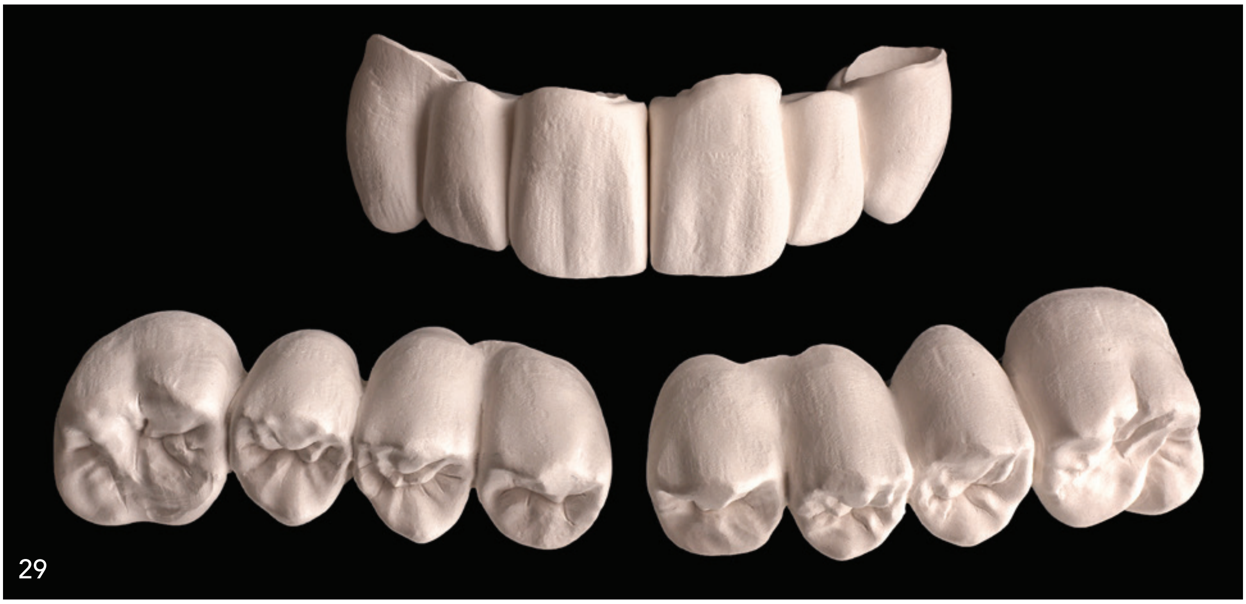
"Occlusion cannot be understood by looking at the morphology of individual teeth, but rather from the living structure (cybernetics) of the entire organism."

Carl Hildebrand, the founder of VITA Zahnfabrik, in the 1930s.

Procedure

Our focus is always on the whole person. Therefore, their posture and, above all, their "comfortable bite position" play a central role for us. Particularly with such a compromised maxillary residual dentition, it is important not to lose sight of the fact that the person may have become accustomed to an incorrect bite position over the years. We therefore check the posture and whether we need to intervene therapeutically in advance with the help of a splint treatment. We discuss the patient's wishes and select the desired tooth mold together. Based on all this information, we create a dummy in our laboratory that corresponds to the final restoration in terms of shape and design. This dummy is made of acrylic with the aid of the scanned actual situation of the patient with and without the inserted prosthesis and a conventional, fully adjustable articulator. A virtual wax-up was first generated from this data, from which we also prepared the various surgical aids—an orientation drilling template and various transparent control foils—as shown in the first part of the article. Practice shows us time and again that despite the immense technical, instrumental, and computer-assisted effort involved, there is always a discrepancy between the appliance and the biomechanical system of hard and soft tissue. Despite precise mathematically calculated joint paths and eccentric excursions of a virtual articulator, the measure of all things is still the patient's mouth.

An occlusal restoration is always a compromise. Occlusion is not something that can be measured. Occlusion is something individual. Even at the beginning of articulation research, dental technology greats such as Gysie, Hanau and Thielemann recognised that a "biological system" cannot be implemented on a mechanically, mathematically precise chewing simulator. Carl Hildebrand, the founder of VITA Zahnfabrik, said in the 1930s: "Occlusion cannot be understood by looking at the morphology of individual teeth, but rather from the living structure (cybernet-



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ics) of the entire organism."[9] Following this guiding principle, we use our patient as the best articulator a dental technician could wish for. During the healing phase of the implants, the dummy used serves to memorise the eccentric movements. This grinding-in behaviour manifests itself in patient-specific grinding facets, which we can then transfer 1:1 to the final restoration. All we must do is scan our dummy *in situ* again when the patient visits the practice for a check-up and aftercare anyway. The dental practice sends us the data obtained in this way to the laboratory so that we can transfer the ground facets directly to the final restoration.

Follow-up appointment in the practice

The patient came back to our practice after a healing period of around three months. After scanning the dummy, we were able to remove it. Underneath, we found a completely irritation-free gingiva with beautifully healed implants (Figs. 22 & 23). We now molded this situation using silicone and placed the temporary restoration on the implants again (Figs. 24 & 25). We were then able to submit the documents generated in this way—i.e. scan and silicone impression—to the laboratory for completion of the final restorations.

The principle of cranial respiration

It used to be assumed that the skull was a kind of "bony steel helmet" that only served to protect the underlying parts of the brain. Today we know that the bony structures of the skull are a vibrating element in the organism. The skull itself is made up of a very complex structure of numerous cranial bones. These form a three-dimensional interlocking gear train, whereby each cranial bone moves in all three levels in two directions (back and forth, forwards, and backwards, from medial to lateral), i.e. in six directions. The cranial bones as a whole "oscillate" in a kind of "breathing movement"—this is also referred to as "cranial breathing". That means that they move rhythmically, alter-

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nating between shortening, expanding, lengthening, and narrowing over a certain period of time, without the volume of the skull changing quantitatively. Not only can this rhythm of movement be pathologically altered, i.e. increased or decreased, but individual cranial bones can also be jammed or displaced in such a way that their mobility and thus that of the entire system is restricted.[10]

Creation of final maxillary prosthesis

After we received the documents from the practice, we realised the fabrication of the final restorations in zirconia. We have favoured monolithic restorations in our laboratory since 2005. We see this as the greatest possible benefit for the patient. One of the main advantages of ceramic implants made of zirconia is their excellent biocompatibility. Compared to conventional titanium implants, zirconia offers several advantages. Firstly, zirconia is considered hypoallergenic, making it an ideal choice for patients with metal sensitivities or allergies. Unlike titanium, zirconia does not trigger any adverse reactions in the body, ensuring a comfortable and stress-free dental implant experience. In addition, zirconia ceramic implants have remarkable resistance to corrosion and plaque build-up. This reduces the risk of peri-implantitis, which is characterised by inflammation and infection around dental implants. The non-porous surface of zirconia prevents the adhesion of harmful bacteria, which leads to healthier gums and increases the overall longevity of the implant.[11] In order not to compromise the advantages of the inserted zirconia implants, the entire team has decided to favour zirconia for the dental part as well.

The entire prosthetic was divided into three segments and constructed as three bridges. In this way, we consider the cranial breathing described above so that we do not exert any pressure on the difficult masticatory and cranial bone system. Using the silicone impression, we produced a plaster model according to the usual procedure (Fig. 26). We scanned this and digitally created the desired constructions (Figs. 27 & 28). It is part of our philosophy that we always design all basal surfaces that rest on the gingiva to be closed from the outset. We then sent the data collected in this way to our milling cutter and initially obtained the three bridges from the raw material (Fig. 29). After the first burning, the advantages of the zirconium oxide used (VITA YZ ST, VITA Zahnfabrik) that we were aiming for were already evident in the impressive aesthetics (Fig. 30). The shade characterisation of the bridges was then carried out using the VITA AKZENT Plus shades. For even better aesthetics, additional shade individualisation was carried out with the VITA YZ EFFECT LIQUID infiltration shades. After the finalising wettability glaze firing, we polished all gingival areas to a high gloss as standard for the aesthetically visible areas (Figs. 31 & 32). In our opinion, this is the most gingiva-friendly version of dental work. The resulting advantage is described in bionics as the


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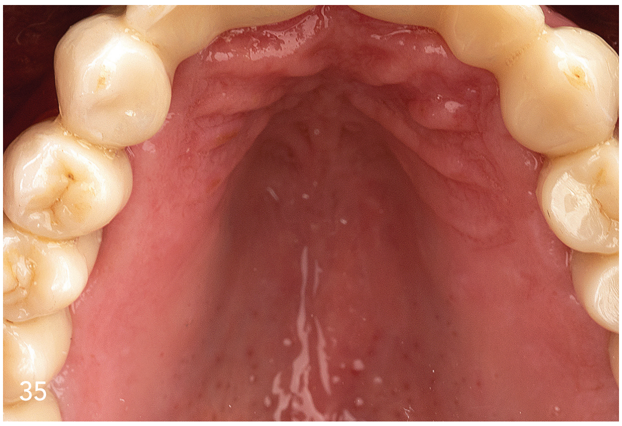
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lotus effect, which refers to the low wettability of a surface, as can be observed in the lotus plant Nelumbo. Water rolls off the leaves in droplets or slides off the leaves, taking all dirt particles on the surface with it. This is due to the complex micro- and nanoscopic architecture of the surface, which minimises the adhesion of dirt particles.[12] In principle, this surface coating not only improves aesthetics, but also reduces plaque adhesion to the restoration, promotes long-term stability and reduces abrasion processes on the (natural) antagonist.[13] This procedure enables us to completely dispense with any plaster niches. We see this as an absolute advantage, as constant interdental cleaning often only irritates the gingiva unnecessarily and we run the risk of it receding. Finally, the work was packed according to the standard plasma cleaning concept in the sense of "Highfield-Clean-Prostethics"[14], disinfected via plasma and handed over to the practice for the placement appointment.

Insertion date in practice

As soon as the final prostheses have arrived in the practice from the laboratory, the bridges are placed on the implants (Figs. 33–38), firmly cemented and the fit is visually checked once again. It is nice to see how harmoniously the overall situation integrates into its natural environment. The optimised aesthetics of the front also comes into their own (Figs. 39– 44). Finally, the situation was checked using an X-ray image (Fig. 45). The patient was already delighted with the new appearance of his temporary restoration. The fact that the final restoration made of zirconia integrates so harmoniously into the overall oral structure of the mouth and did not bother the patient unpleasant for a second as a foreign body, was not least because we had transferred his individual chewing behaviour as a grinding pattern from the temporary directly into the final restoration.


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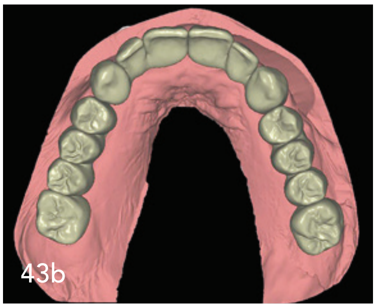
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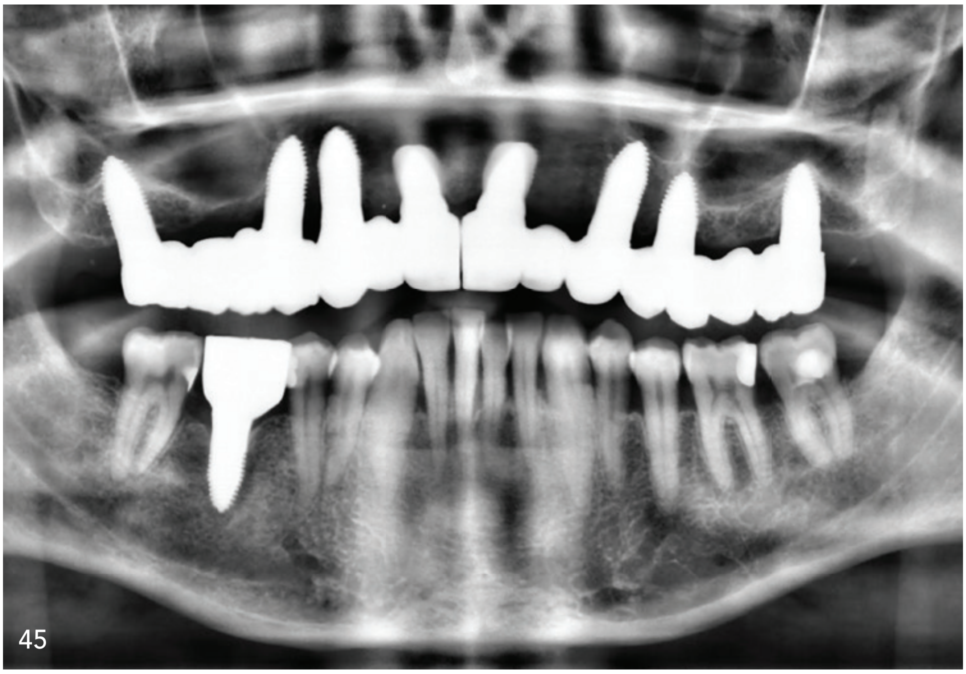
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Summary

For us, the patient case shown is a good example of the impressive results that are possible when the dentist, dental technician, and patient work together perfectly and all the tools available to us are used at the right time. We see disinfection via plasma as a central point—whether in the dental part during implant placement or as the final step in the fabrication of prosthetics. The cleaner the materials used, the more biological and the lower the risk of contamination of the materials jeopardising the longevity of the entire implant prosthetics system.

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