Cherry on top in complete denture prosthetics: individuality and naturalness

Removable prosthetics as high-quality restorative treatment in the edentulous patient

By Erwin Eitler, Switzerland

Restorative treatment of the edentulous jaw requires, above all, sound knowledge of the function and statics of dental prosthetics. Customised pink-and-white aesthetics that match the expectations of the patient represent the “cherry on top,” here, adding extra quality to the treatment.

We all know it, but let’s say it again: The number of edentulous patients will increase sharply over the coming years due to ongoing changes in demography. The older people grow, the larger the number of edentulous patients will become. Complete prosthetics will therefore remain of high relevance for both clinicians and technicians and should not be neglected neither in the education and training nor in the day-to-day work of dental professionals. Sound knowledge coupled with clinical and technical expertise are essential to achieve satisfactory results. Upfront, complete dentures for edentulous patients appear to hold little promise from an economic point of view. However, the writer of this report maintains that this is a question of perspective. Complete denture prosthetics is a supreme discipline that allows a customised approach for each individual patient. An appropriate treatment strategy can be selected from a range of processing techniques to meet the individual needs of the patient being treated. Accordingly, outcomes range from e.g. highly aesthetic, custom-made tooth replacements to “basic” complete dentures manufactured using a digital method. Whichever method is used, function and stability will always be at a high level. Any compromises in statics and function would not be acceptable.

Preoperative situation

The 73-year-old female patient presented with severe periodontal damage in the upper and lower jaw (Figs 1 and 2). The oral cavity was free of inflammation and looked well maintained. However, the periodontium had been irreversibly damaged by periodontal disease. The clinical diagnosis showed that the teeth in the upper jaw could no longer be preserved. Some of the lower teeth also had to be removed. However, the lower premolars and canines were still in a good enough condition to be used as anchors for a dental prosthesis. A conversation was held with the patient to discuss her expectations and treatment options. She wanted to have dentures that could give her stability. Most important of all, she wanted to be able to chew normally again. She also described her difficulties in speaking and expressed her discomfort about her appearance. She wished to have a “beautiful” smile again and be able to speak without impediment. In addition, the dentures should be easy to clean and handle and they should be hard-wearing. Implant-based treatment measures were not an option, as she wanted to avoid any additional surgical intervention. It was therefore decided to restore the upper jaw with a complete denture and the lower jaw with a partial model cast denture.

Treatment planning

Crafting a tooth replacement for a family member is always a special task for a dental technician, especially if, as in this case, said family member was the technician’s own grand- ma. This increases the challenge of a task that is already demanding (complete dentures). The goal was to create dentures that harmonize with the face of the patient in a naturally beautiful and discreet way. Function- al and yet highly aesthetic dentures should be achieved.

Primary requirements of the patient on the dentures:

- Restored chewing function
- Improved phonetics
- Discrete integration of the dentures
- Individualized aesthetics
- Easy to clean

Anterior teeth and setup in the oral cavity

First, the teeth in the upper and lower jaw that could no longer be preserved were extracted and the extraction wounds were allowed to heal. After that, impressions of the oral situation were taken. The diagnostic casts were used to establish the arrangement of the upper anterior teeth. For this task, high-quality prefabricated denture teeth (SR Vivadent® S PF) were used. These moulds provide impressive individualized aesthetics for the anterior region. The expressive texture and internal stratification of the teeth lend an age-appropriate natural liveliness to the dentures. In addition, the teeth are made of a material that meets the requirements for durability, consisting of highly cross-linked DCL (Double Cross Linked) polymer. According to the manufacturer, the DCL polymer is a modified polymethyl methacrylate variant that offers higher compressive strength and better durability than conventional PMMAs – while the material’s flexibility is similar as that of conventional resins.

After the casts had been analysed, the teeth were set up according to the known parameters. Despite clearly defined aesthetic guidelines, it is crucial to check the setup on the patient and to adjust it as needed. The anterior setup was adjusted in the mouth of the patient to meet her individual aesthetic and phonetic requirements. The patient was instructed to perform various phonetic exercises and produce certain sounds so that her speech pattern could be observed. These observations were then used to adjust the arrangement of the teeth (Fig. 3). In this way, an ideal setup was achieved for the anterior tooth row.

Tooth setup

Master models were created on the basis of a maconatic impression of the upper jaw. The models were then mounted on the articulator in a centric relation in line with the bite registration. The four anterior teeth in the lower jaw were set up to match the setup established in the oral cavity (Figs 4 and 3). In an intermediate step, a posterior try-in was performed with the help of wax rims to check the bite height defined in the oral cavity. Posterior setup was then performed accordingly. The teeth were set up in a one-tooth-to-two-teeth relation taking all the principles of complete denture prosthetics into account. The SR Orthotyp® S PE posterior moulds are also made from DCL polymer. The beautifully shaped tooth necks of the anterior and posterior moulds, modelled on nature, merit particular mentioning here. They facilitate the aesthetic conversion into composite because the shape imitates the appearance of solid teeth growing from the “gums.” A try-in of the setup in the oral cavity helped to verify the arrangement of the anterior teeth established in wax stage by stage.

Completing the dentures

A model cast framework was produced for the lower jaw. The den-
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Summary
Processing technologies that enable restorative treatments customised to the needs of the individual patient are increasingly becoming established in complete denture prosthetics. For instance, digital methods allow the fabrication of solid"basic" dentures using relatively little effort. Alternatively, these basic applications can be supplemented with high-quality materials combined with – as cherry on top – a manual layering technique (gingiva) to create highly aesthetic results. Irrespective of economic aspects, the basic functional and static parameters always remain the same. Every complete denture ought to restore full functionality Sound knowledge and experience in complete denture prosthetics provide the basis for achieving this.

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Fig. 6: The denture base was injection moulded and thinned to create space for creating soft tissue customisations.

Fig. 9: Modelled cast denture in the lower jaw with an open periodontal design (left).

Fig. 12: Upper and lower dentures in situ. The customized pink and white aesthetic effects make the dentures look very natural – the teeth look as though they have grown from the gums like natural teeth.

Fig. 7 and 8. The completed upper denture distinguishes itself through its characterization with gingival composite and phono textually aligned teeth.

Fig. 10: Completed dentures on the upper and lower jaw models.

Fig. 11: Upper and lower dentures in situ. The customized pink and white aesthetic effects make the dentures look very natural – the teeth look as though they have grown from the gums like natural teeth.

The SR IvoBase® system was used for transferring the maxillary wax-up into resin – a system that couples efficiency with reliability. The injection procedure offsets the chemical shrinkage of the resin during polymerization. High-strength PMMA-based IvoBase was used for the manufacture of the denture base. The wax-up dentures were invested and the sprues attached. After the moulds had been cast and the wax boiled out from the plaster, the flask and the denture teeth were prepared for the application of the denture base material with the injection moulding technique. The preformed denture base material was mixed and filled into the injection together with the flask. The appropriate programme was selected and the injection process started. The accuracy of fit on the plaster model was ideal on the first try; reworking was minimal.

A try-in of the setup in the oral cavity helped to verify the arrangement of the anterior teeth established in wax stage by stage. The patient was able to speak and laugh without any difficulty. She was pleased with her new set of teeth already at this stage.

Customising the denture base
The denture base was reduced – similar to a cut-back – for individual veneering to make the dentures look as discreet and natural-looking as possible (Fig. 6). The soft tissue (pink) aesthetics of the denture base could now be designed with a variety of shades to resemble the natural gums. With its comprehensive range of gingiva shades, the light-curing SR Nexco® lab composite is well suited for reproducing soft tissue characteristics. The material is easy to process due to its exceptional properties. It is optimally matched to the IvoBase denture base materials.

Generally, key anatomical features should be borne in mind when characterizing soft tissue parts to achieve a lifelike reproduction. For instance, keratinized gingiva has a light pink colour because less blood normally flows through it. By contrast, the mucogingival areas receive a far larger supply of blood (dark red) and are interspersed with fine blood vessels. Given the versatile range of gingiva shades, SR Nexco offers abundant possibilities for creating customised characterizations in these cases. The interplay of convex and concave surfaces in the area of the alveoli and subtle stippling effects lend three-dimensionality and depth to the gingiva and these characteristics were reproduced with the help of the paste-like materials. Although they looked already very natural, the anterior teeth were additionally slightly customised using SR Nexco – a step that in this case was motivated by the high aesthetic ambitions of the dental technician (who, just to remind you, is the grandson of the patient). Step by step, the complete upper denture was given a natural look with the help of the light-curing lab composites. Final polymerization was followed by mechanical polishing (Figs 7 and 8). The model cast denture for the lower jaw was also completed (Figs 9 and 10).

The result
The patient was impressed with her new upper and lower dentures right away. Once inserted, their natural and highly aesthetic effect became even more apparent (Figs 11 and 12). This effect can be attributed, among other things, to the macro- and micro-texture of the anterior teeth and the vibrant interplay of shades between the teeth and gingiva. The harmonious interaction between the white and pink aesthetics is impressive. With the dentures in situ, the functional, aesthetic and phonetic parameters were again verified (Figs 13 and 14). The preliminary work was worth it. The dentures met all the requirements. The patient was happy and relieved that her grandson had mastered the double challenge so well.

In her own words, she discovered a whole new zest for life (Figs 15 and 16). Her tooth replacements offer her a much more satisfying situation than her own "old" teeth did in the past few years. Not only is she able to speak and eat again without impediment but she can also laugh again with all her heart. She has received positive feedback from her circle of friends and acquaintances and that has encouraged her even more. My grandma’s quality of life has improved considerably and she feels much more positive about life. She is now interested in meeting up with friends again and become involved in the social life around her.

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Fig. 13 and 14: View of the lips with inserted dentures in function.
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Driving innovation forward

By Dentsply Sirona

As the Director of Research and Development at Dentsply Sirona Lab, Markus plays a central role in terms of our innovation pipeline. He is the person who drives new product developments, for example, innovative materials such as Celtra® Press.

Thanks to his expertise, great communication skills and inventive thinking, Markus understands our customers’ needs and turns them into new and smart product ideas. His work philosophy reflects Dentsply Sirona’s unique positioning by always laying out the whole picture of the workflow. He is working closely together with other Dentsply Sirona business units to generate valuable links to related workflows. This means that you can benefit from thought-out end-to-end solutions, and subsequently benefit from tangible improvements in your daily work.

In this interview, Markus explains the various facets of his work as well as the secret behind real innovation.

Tell us a little about your role as Director of Research & Development? What are some of your daily endeavors and/or challenges?

A typical day for me is full of reviewing the statuses of all running product development projects, anticipating and identifying what obstacles or surprises (sometimes positive, sometimes negative) there are or might be, and how we can manage all of these things in order to either maintain timelines and deadlines or to be able to start new projects which are fitting in the overall portfolio of the company.

For the development team, one needs an open ear to absorb every single surrounding detail, which includes being completely receptive and having a comprehensive, up-to-date understanding of our production, quality assurance, product management, and even logistic teams.

In R&D, you need constant curiosity, great communication skills and inventive thinking.

How does science, clinical studies, and research fit under the Dentsply Sirona Lab name? Can you provide a little background on what it is about?

By Brendan Day, DTI

By Dentsply Sirona

POWERED BY 3D SYSTEMS’ PROPRIETARY FIGURE 4 TECHNOLOGY, THE NEXTDENT 5000 IS A HIGH-SPEED 3-D PRINTER DESIGNED TO SAVE TIME FOR BOTH PATIENT AND PROFESSIONAL.

As a clinician like myself, there’s been an embrace of 3-D printing in recent years. However, it’s always been the lower-cost models that have been prioritized with the multiple materials and extremely fast printing that the NextDent 5000 allows for this entire procedure to be conducted in less than 2 hours.

What has the feedback been since the launch of this printer? What have customers most liked about it?

Jacobs: What was important for us, besides these gentlemen, who have already mentioned, was that the printer have a high level of accuracy. With ten years of experience in the 3-D dental printing industry, I’ve learned that a lot of printers work fine in the beginning but lose their accuracy over time. When 3D Systems acquired my company, we decided to make sure that our printer would work without issue, day in and day out, for at least three years. Flexibility, speed, accuracy and, ultimately, affordability of the machine and the materials—these, along with training and ongoing support from our outstanding salespeople, are the foundations of the NextDent 5000.

We got a lot of feedback from users of this printer, like Michael and Sebastian, and thankfully, our R & D team in San Diego really listened to what they asked for, what the market asked for. I think this is what our company should always do: listen carefully to our customers and develop what they suggest.

Are software updates included? Jacobs: Automatically. As long as the user is connected to the Internet, he will be able to receive the latest updates automatically downloaded to the printer.

It’s predicted that, within three to five years, more than 50 per cent of dental labs globally will have an in-house 3-D printer. What, in your opinion, is driving this growth? Jacobs: Well in 2018, we definitely passed a tipping point for 3-D printer users here at 3D Systems. Thanks to easier registration, certification, improved ease of use, and a range of other factors, it has become much more achievable to integrate a 3-D printer into one’s daily workflow.

Scherer: Clinicians are now expecting dental labs to be digital and to have printing capabilities. It’s no longer a case of whether a lab will take your files, but rather if they print themselves or still outsource it. That’s how fast 3-D printing has grown in dentistry.

Interview: “We definitely passed a tipping point for 3-D printers”