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 and 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 demographics. 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 statics will always be at a high level. Any compromises in statics and function would not be acceptable.

Preoperative situation

The 75-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 concern 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

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 PE) 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 likeness to the dentures. In addition, the teeth are made of a material that meets the requirements for durability, consisting of highly cross-linked DCL polymer (Double Cross Linked) polymer. According to the manufacturer, the DCL polymer is a modified polymethylmethacrylate 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. In this way, an ideal setup was achieved for the upper 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. 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 mention 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 dent-
tures are locked into place in the mouth with the help of six clasps. If the patient should lose another tooth, the denture can be easily extended. Special care was taken to ensure that the model cast framework featured an open periodontal design to facilitate self-cleansing.

The SR Ivoclar® 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 Ivoclar 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 invested and the sprues attached, the moulds were boiled out from the plaster, the sprues removed, and the moulds were sandblasted. Special care was taken to ensure that the model cast framework was tended. Special care was taken to ensure that the model cast framework was tended. Special care was taken to ensure that the model cast framework was tended. Special care was taken to ensure that the model cast framework was tended. Special care was taken to ensure that the model cast framework was tended. Special care was taken to ensure that the model cast framework was tended.

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 Ivoclar 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 color 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 micro- and macro-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.

**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 achieve 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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Driving innovation forward

By Dentsply Sirona

As the Director of Research and Development, Dentsply Sirona GmbH’s 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 your daily activities? What is driving your development strategy?

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 communication, great communication skills and inventive thinking.

How does science, clinical studies, and research fit under the Dentsply Sirona LabName? Can you provide a little background on what this means for dental professionals?

For the development team, one of the most important things was to get a product into a dental lab before it actually goes into development, and ultimately goes to market.

Due to the fact we are working in the medical devices market, we fulfill a great number of demands for testing and design control processes. For example, when developing a new material, we need to look at the biocompatibility as well as risk management starting from the production process, to the user, all the way to the end result — our patients. Besides proving and surpassing all requirements from applicable standards, we also want to know how our customers accept the workflow of the product. Before we launch, we take a close look at how it fits into the actual workflow of real-life dental laboratories, and we then start additional vigorous clinical testing after the launch as well. We include our customers quite early on in this process to allow us to react to their outcomes and feedback, and then be able to improve the product within the development timeline.

What makes Dentsply Sirona unique is that the entire workflow is, and can be linked to other workflows and combined into an integrated solution.

When it comes to the prosthetic treatment of an implant using an abutment and full ceramic crown, for example, Dentsply Sirona has the right partner for laboratories. But the treatment workflow as a whole starts from the earliest stage of diagnostics and the implantology, treatment, and ends with the restoration finally being cemented or screwed in place. For this purpose, Dentsply Sirona and its Imaging, Implants, and Restorative business create integrated workflows for both dentists and dental laboratories.

One of your roles within Dentsply Sirona is to constantly provide material innovations that expand lab offerings to their dental clients, while improving their workflow. How do you gather the information needed to improve upon these offerings?

We use groups of our core customers, labs and dentists. Sometimes the most effective feedback comes from our labs and dentists who are everyday partners because they know their ideal workflow routine, and are able to communicate their emerging concerns and ongoing daily challenges.

Can you tell us a little about Celtra® Press, the newest material for laboratories? What was the industry missing? How does this material now offer new possibilities?

Celtra® Press has significantly improved the workflow in the lab by being easier to press (with excellent flowability) and excluding the time-consuming and dangerous use of hydrofluoric acid to get rid of the matrix layer. Despite this, it is still one of the most preferred high-strength glass-ceramic materials in the market. Therefore, Celtra® Press provides a simpler workflow in the lab, the dentist receives a robust material with a very good fit and easy polishingability, and the patient absolutely loves the natural-looking aesthetics and beauty of her or his new teeth.

What do you foresee Dentsply Sirona offering in the near or distant future as far as material advancements?

We will soon present a new generation of CALYACAM material, hand in hand with the lab material combining Celtra® Press with other materials that are suitable for every all ceramic case. We are also planning further material improvements in other material sectors coming very soon!

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

By Brendan Day, DIT

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 practitioner. Dental Tribune International spoke with Rik Jacobs, dental vice president and general manager at 3D Systems; Sebastiaan Cornelissen, CEO of Cordent Group and Core3dcentres; and Dr Michael Scherer, an American prosthodontist and the NextDent 5000’s 2015 future trends in dentistry.

Is the NextDent 5000 designed specifically with the dental lab in mind, or can it be used in a dental practice as well?

Rik Jacobs: Essentially, I designed this product to be used by both labs and clinicians with success.

Sebastiaan Cornelissen: We found that the most important thing was to have a system that can incorporate multiple machines and multiple materials if necessary. This flexibility was the main feature that we were looking for, and the NextDent 5000 delivers this.

Dr Michael Scherer: For 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 prioritised. With the multiple materials and extremely fast printing that the NextDent 5000 offers, I think that clinicians can now offer a realistic chairside solution for patients.

What are the benefits of the NextDent 5000 for dental labs?

Cornelissen: In the dental lab, you have similar time pressure issues to a dental practice. You need to be able to produce things fast, in multiple colours and often in large quantities. To be frank, these are all easily achievable with this printer.

Often, a dentist will send some scans to us so that we can quickly create a smile design for the dentist to print a mock-up in his or her office. Though we are based in the Netherlands and have clinicians working with us from Germany, 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 do you foresee Dentsply Sirona offering in the near or distant future as far as material advancements?

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 delivery what they ask for.

Are there software updates included?

Jacobs: Absolutely. As long as the user is connected to the Internet, he or she will be able to have 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 printers 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.