Minimally invasive prosthetic treatment with various ceramic materials

By Dr Marko Jakovac, Croatia, and Michele Temperani, Italy

In cases where a full mouth reconstruction is required, it is essential to follow a systematic procedure and use carefully coordinated materials.

The following case study describes the treatment of a patient with tooth agenesis.

New materials and innovative techniques for modern esthetic and minimally invasive dentistry are coming to the market every day. As a result, patient-focused treatment protocols are continuously improving. If complex treatment is indicated, however, personal aspects in addition to the functional and esthetic requirements of the patient need to be addressed – for example, psychological stress or financial constraints.

In this article, we will explore the possibilities of providing minimally invasive treatment, taking these factors into consideration.

Case study

The twenty-three-year-old patient showed severe hypodontia (tooth agenesis) with a total of fourteen missing teeth (Fig. 1). Seven teeth were missing in both the upper and lower jaw. Severe hypodontia of this kind usually results in a very low vertical dimension of occlusion. In some cases, it disturbs the chewing function. At the beginning of this type of treatment, psychosocial aspects have to be taken into consideration.

In the present case, the patient did not smile during the first appointment, and he covered his mouth with his hand when he spoke. Due to the financial constraints of the young candidate and his fear of an operative intervention (treatment with implants), it was decided to pursue a conventional prosthetic treatment approach. According to the treatment plan, the upper anterior teeth would be restored by means of an all-ceramic bridge and the lower anterior teeth with lithium disilicate veneers. The decision was taken to treat the posterior teeth with metallceramic restorations.

Fig. 1: Patient with hypodontia: portrait picture of the initial situation. A total of fourteen teeth were missing in the upper and lower jaw.

Fig. 2: Anterior Lucia jig for the evaluation of the centric relation.

Fig. 3: Capturing a protrusive bite record with Virtual CAD/CAM
Clinical examination and treatment planning

The first part of the oral rehabilitation process involved a clinical examination in which the facial and dental conditions were analyzed. This investigation showed a substantially reduced vertical dimension of occlusion. The patient was missing 14 permanent teeth. Furthermore, several deciduous teeth were still in place. Tooth 36 had been destroyed by caries, making its extraction inevitable.

In order to provide the dental technician with the information required for wearing up a provisional restoration, details related to the vertical dimension of occlusion and facebow records must be supplied in addition to the impression. If the vertical dimension of occlusion needs to be increased, the correct centric position has to be evaluated first. In this case, an anterior Lucia jig made of a thermoplastic material was used as a registration aid (Fig. 2). A facebow was used to establish the relationship of the maxillary jaw to the horizontal reference plane or basi-line line. In the fabrication of extensive restorations, the prosthesis and the prosthodontic prosthesis bases had to be recorded in order to make any necessary adjustments in the articulator. An additional silicone, for example, Virtual® CAD-bite can be used for this purpose. In most cases, this type of material produces faster and more accurate results than wax. When wax is used for bite-taking, the patient has to be shown how to move into the protrusive or lateralocclusal position. Experience has shown that it is easier to let the patients produce these movements of their own accord and stop them when they arrive at the “right” position (Fig. 3). Virtual CAD-bite is injected while the teeth are in this closed position.

Wax-up and mock-up

The following minimum documentation was required for the fabrication of the wax-up: precision impressions of the upper and lower jaw, a facebow transfer record, a centric bite record in wax with the predetermined vertical dimension of occlusion, portrait pictures of the patient as well as close-up pictures of the situation when the patient is smiling. This information was used to build up the restoration in wax and bring the teeth into their ideal functional and esthetic position. Furthermore, the occlusal plane and the Spee’s curve were adjusted (Fig. 4). For the purpose of checking the laboratory work intraradically, a mock-up of the wax-up was made (Telio® CS C&B) (Fig. 5). All the functional and esthetic parameters were then checked in the patient’s mouth.

This stage of the treatment is very important for many reasons. Patients are given the opportunity to actively participate in designing their new smile, which is a very motivating experience. In addition, the functional wax-up, the maximum intercuspation, the new vertical dimension and the prosthesis and the lateralocclusal movements can be tested in a realistic situation. Moreover, the mock-up serves as a model for the provisional restoration. Therefore, it should be produced with the highest degree of accuracy. Once the patient is completely satisfied with the proposed result and the mock-up fulfills all the clinical criteria, the actual treatment can begin.

Preliminary treatment

At present, the preparatory measures for minimally invasive procedures and the topic of tooth preparation are receiving a lot of attention. Nevertheless, there are some other aspects that should not be neglected. For example, the properties of the materials used strongly influence the result. State-of-heart materials are offering increasingly sophisticated solutions. Before using any new materials, it is important to learn more about the application recommendations of the manufacturer. Excellent planning and a carefully crafted mock-up will reduce the preparations necessary to the fabrication of the final restoration. With the help of the mock-up, for example, the teeth can be successfully prepared for veneers or even crowns. The use of optical appliances such as dental loupes and microscopes also makes work easier and more accurate.

In the present case, the teeth were cleaned very thoroughly. The necessary extractions were performed and the tooth was endodontically treated. Then the teeth were prepared and evaluat ed as a part of the aesthetic treatment (Figs 6 and 7). The long-term temporary was fabricated using CAD/CAM equipment. Therefore, the wax-up was digitized with the help of a laboratory scanner. This information served as a basis for the computer-aided design of the provisional. The CAD/MiMillFire® fabricated provisional made of tooth-coloured composite (Telio CAD) also served as a test object or trial impression during the healing period. Its function and esthetics were closely examined and adjusted in detail (Fig. 8).

Fabrication of the permanent restoration

The final prosthetic phase started after the long-term temporary had been worn for an adequate period of time. Before impression taking, the teeth were prepared again and polished. It is very important to transfer the vertical dimension of occlusion and the information about the tooth-to-tooth relationship from the provisional to the final restoration with great care. The “cross-mounting” technique is suitable for this purpose. This method entails first making a bite record of the prepared teeth in the upper and lower jaw. Subsequently, a second record is taken of the provisional restoration in the upper jaw and the prepared teeth in the lower jaw. A third record is captured of the prepared teeth in the upper jaw and the provisional restoration in the lower jaw.

The dental technician required the following minimum information in order to fabricate the restoration: precision impressions of the upper and lower jaw, precision impressions of the provisionals, a facebow transfer record and three bite records (cross-mounting), and the recent trait pictures of the patient wearing the provisionals as well as photos of the patient smiling.

The aim at this stage was to “copy” the shape and occlusal plane of the provisionals and to accurately transfer this information to the final restoration. For this purpose, the cast models were placed into the articulator after the “cross-mounting” process. Since the final situation had been successfully attained by means of the provisionals, the frameworks could be fabricated relatively easily.

As a result of using the CAD/CAM approach, the final restoration could be visualized, modified and/or duplicated with the assurance that all the design guidelines would be observed. The Wieland Precision Technology (WPT, Naturns, Italy) milling centre was responsible for fabricating the frameworks for the metal-ceramic restorations in the anterior region as well as the zirconium oxide framework for the upper anterior teeth (Fig. 9). The framework was tried in to confirm the correct fit of the restoration. Most of the inaccuracies that usually occur are due to errors made during impression taking, casting or model fabrication. The veneers for the lower teeth are also ceram ic and were made as assistance of digital technology. They were subsequently pressed with lithium disilicate glass ceramic (IPS e.max®).

The metal frameworks were veneered with the new FPM system IPS Style®. It allowed us to achieve the desired natural-looking, translucent shade without having to sacrifice on brightness. The thin metal framework offers a major advantage in that it can be optimally adapted to the IPS e.max Ceram. As a result, the veneers on the metal frameworks could be optimally adapted to the IPS e.max Ceram. The veneers were permanently affixed to the final restoration. The veneers were completed by fitting on a thin layer of IPS e.max Ceram Ac, followed by a thin glaze layer (Fig. 10). Before the restorations were seated, the teeth were cleaned and a rubber dam (OptraDam® Plus) was placed. Provisional composites such as Varion® Esthetic are suitable for the attachment of this type of restoration. This cement exhibits excellent adhesive properties and clinically beneficial characteristics such as easy removal of excess and long-term shade stability. The system offers an additional advantage in that it includes the shade of the dual-curing (DC) and the light-curing (LC) luting composite are the same. The DC cement is used for crowns and bridges (Fig. 11) and the LC cement for veneers. Furthermore, we used Monobond® Plus & Prime. This condition the veneers (adhesive cementation). After gentle sandblasting, the zirconium oxide and metal-ceramic restorations were prepared for placement by applying Monobond® Plus & Prime. The air Strip was applied in order to prevent the formation of an inhibition layer. The final restoration was completely satisfied by all the parties involved. The situation which was established during the treatment phase was exactly transferred to the final restoration (Figs 12a and b).

Conclusion

In extensive cases, it is particularly important to develop a well thought-out plan including all the treatment steps, which needs to be followed at all times. In the described case, a variety of ceramic materials were cleverly combined to produce a harmonious result. Excellent communication between the dentist and the dental technician together with well-coordinated state-of-the-art materials provided the basis for this highly satisfactory outcome.

Dr Marko Jovanic
Department of Fixed Prosthodontics
School of Dental Medicine
University of Zagreb
Zagreb (51000, Croatia)
jovanicmarko@ffzg.hr

Michele Temperani
Laboratorio Clinico Tecnico
Temperani
Viale Michelangelo,
50142 Florence, Italy
micheltemperani@gmail.com

Fig. 1: The prepared upper anterior teeth (IPS e.max Press)
Fig. 2: The CAD/CAM fabricated long-term provisional (Telio CAD) in the mouth
Fig. 3: The CAD/CAM fabricated framework on the model of the upper jaw
Fig. 4: Wax-up: ideal functional and aesthetic position and adjusted occlusal plane and Spee’s curve
Fig. 5: Mock-up fabricated with the help of the wax-up for the intraoral examination of the functional and esthetic components
Fig. 6: The prepared upper anterior teeth
Fig. 7: The prepared lower anterior teeth
Fig. 8: The CAD/CAM fabricated long-term provisional (Telio CAD) in the mouth
Fig. 9: The CAD/CAM fabricated framework on the model of the upper jaw
Fig. 10: Metal-ceramic posterior bridge (IPS Style), all-ceramic upper anterior bridge (IPS e.max Ceram); veneers on the lower anterior teeth (IPS e.max Press)
Fig. 11: Upper anterior restoration after placement with an esthetic luting composite (Vitavanc® Esthetic DC)
Fig. 12a: The permanently placed restoration in the mouth
Fig. 12b: A portrait picture of the patient.
3Shape CAD/CAM in a major Dental Lab

It was the technicians’ choice

By 3Shape

The versatility and solution coverage offered by 3Shape systems has enabled Glidewell to grow and develop well ahead of its competition by continuously expanding the range of its products and services. Now all types of restorations and large orders are handled digitally each day, with over 50 of 3Shape’s installations covering every Glidewell department.

The Challenge

Glidewell’s proclaimed ambition is to be a pioneer in the Digital Dentistry Revolution, and, to achieve this, they know they must work with the best systems. Investing in a single CAD/CAM brand was not the important issue for them. Glidewell simply wanted to use best-of-breed systems for each service they provided.

With a dampened mood in the economy, more and more small and mid-sized laboratories were looking for sources of digital technology services in order to remain competitive, and this opened new business opportunities for full-service labs like Glidewell. More than ever, it became imperative to have fast and productive systems that could provide attractive digital services and products of high quality.

Glidewell develops their own systems and methods for many applications, including abutments, implants, milling and special materials, and they required flexible and highly versatile software systems to support these. They needed a system that was not limited—a system that could grow with them, ensuring that they could continue bringing their in-house developed products to the market while broadening their range of services.

The Solution

Glidewell initiated a technology solution business plan whose goal was to become familiar with the market’s flexible CAD/CAM systems. 3Shape was one of the first to present itself, but other brands were installed later. And Glidewell technicians soon became familiar with operating a wide range of systems.

Despite Glidewell’s readiness to employ best-systems for different purposes, 3Shape accuracy, ease of use and efficiency continued to win preference in every department. Alternative 3D scanners and software systems were simply being pushed aside to make room for 3Shape. Glidewell’s technicians “at the bench” slowly but surely gravitated to 3Shape’s solutions for most of their tasks.

Today, Glidewell Laboratories has over 50 3Shape DentalSystem™ and Xevo series scanner installations spread throughout the full areas of Glidewell’s many departments. In step with the ever-increasing integration of 3Shape into their workflows, Glidewell has instituted convenient on-line services for other Dental labs using 3Shape, enabling them to upload their 3Shape scans or design files direct to Glidewell for special processing and production with Glidewell’s own materials.

The Results

It has become clear to Glidewell that their 3Shape solutions are a major factor in enhancing their business, and they credit this to the system’s accuracy, consistency, predictability and reproducibility of output. Many incoming orders explicitly express the condition that they are to be executed using Glidewell’s 3Shape systems.

The accuracy of the 3Shape system enabled Glidewell to introduce two highly successful products that are enjoying explosive market growth. BruxZir® full Zirconia restorations and Inclusive® Implant Abutment applications. No other CAD/CAM solution contained the powerful design capabilities necessary to morph the explicit full contour required. Designs made with 3Shape could be milled directly without flaws—thus opening windows to new productiveness and profitability with Zirconia material.

BruxZir® Zirconia soon became the fastest growing product in the history of the laboratory, and today Glidewell is making 8,000 BruxZir® restorations per week using 3Shape’s technologies.

The flexibility of 3Shape as a system and a company fit perfectly with Glidewell’s goal to help pioneer the growth of digital dentistry. Glidewell’s technicians continuously communicate with 3Shape, giving feedback regarding their daily challenges, and often seeing direct solution answers in later 3Shape software releases.

Source: Greg Minzenmayer, Robin Bartos, Rudy Ramirez

inLab MC X5: FREEDOM OF CHOICE.

Experience new freedom in your lab processes breaking the chains of former dependencies with inLab and the new 5-axis milling and grinding unit inLab MC X5. Open for all restoration data, combining the largest material range and the possibility to machine both wet and dry disks and blocks – for no limitations to your production. Enjoy everyday with Sirona.

INLABMCX5.COM

THE DENTAL COMPANY