Minimally invasive prosthetic treatment with various ceramic materials

Marko Jakovac[1] and Michele Temperani[2]

–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 14 missing teeth (Fig. 1). Seven teeth were missing in both the upper and the 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 metal-ceramic restorations.

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

[1] Dr Marko Jakovac
Zagreb/Croatia

[2] Michele Temperani,
Florence/Italy

Contact details:
Dr Marko Jakovac
Associate Professor
Department of Fixed Prosthodontics
School of Dental Medicine
University of Zagreb
Gunduliceva 5, 1000
Zagreb, Croatia
jakovac@sfzg.hr

Michele Temperani
Laboratorio Odontotecnica Temperani
Via Livorno 54\2
50142 Florence, Italy
micheletemperani@gmail.com

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

Fig. 3: Capturing a protrusive bite record Fig. 2: Anterior Lucia jig for the evaluation of the centric relation with Virtual CADbite

Fig. 4: Wax-up: ideal functional and esthetic 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

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 waxing up a 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 bipupillary line. In the fabrication of extensive restorations, the protrusive and the laterotrusive positions have to be recorded in order to make any necessary adjustments in the articulator. An addition silicone, for example, Virtual® CADbite 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 laterotrusive position. Experience has shown that it is

Fig. 8: The CAD/CAM-fabricated long-term provisional (Telio CAD) in the mouth

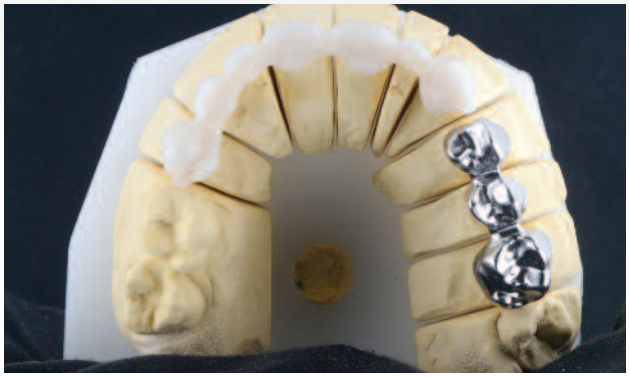

Fig. 9: The CAD/CAM-fabricated framework on the model of the upper jaw

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 CADbite 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 posi- Fig. 4: Wax-up: ideal functional and esthetic 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 tion. Furthermore, the occlusal plane and the Spee's curve were adjusted (Fig. 4). For the purpose of checking the laboratory work intraorally, a mock-up of the wax-up was made (Telio® CS C&B) (Fig. 5). All the functional and esthetic parame ters 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 protrusive and laterotrusive 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 of accuracy. Once the patient is completely satisfied with the proposed result and the mock-up fulfils 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-theart 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 needed for the fabrication of the final restoration. With the help of the mock-up, for example, the teeth can be suitably 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 first cleaned very thoroughly. The necessary extractions were performed and one tooth was endodontically treated. Then the teeth were prepared and readied for the prosthetic 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 provided a basis for the computer-aided design of the provisional. The CAD/CAMfabricated provisional made of tooth-coloured composite (Telio CAD) also served as a test object or blueprint during the healing process. Its function and esthetics were closely examined and adjusted in detail (Fig. 8).

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 (Variolink Esthetic DC

Fig. 12a: The permanently placed restoration in the mouth …

Fig. 12b: … and a portrait picture of the patient.

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 recent portrait 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 master casts were placed in the articulator after the "cross-mounting" process. Since the final situation had been successively 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 posterior region as well as the zironcium 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 were also made with the assistance of digital technology. They were subsequently pressed with lithum discilicate glass-ceramic (IPS e. max®).

The metal frameworks were veneered with the new PFM system IPS Style®. It allowed us to achieve the desired natural- looking, translucent shade without having to sacrifice on brightness. The IPS Style ceramic offers a major advantage in that it can be optimally combined with IPS e.max Ceram. As a result, the veneers on the metal frameworks could be optimally adjusted to the bridge in the upper jaw. After the first bake, the restoration was tried in. At this stage, the need for smaller adjustments of the ceramic was identified. Subsequently, the restorations were glaze fired and polished. The veneers were completed by firing on a thin layer of IPS e.max Ceram A1, 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. Luting composites such as Variolink® Esthetic are suitable for the placement 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 the shades 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® Etch & Prime to condition the veneers (adhesive cementation). After gentle sandblasting, the zirconium oxide and metal-ceramic restorations were prepared for placement by applying Monobond Plus. Glycerine gel (Liquid Strip) was applied in order to prevent the formation of an inhibition layer. The final result completely satisfied 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 carefully followed at all times. In the described case, various 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 systems provided the basis for this highly satisfactory outcome.

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