

Minimally invasive restoration of abraded dentition according to functional and esthetic aspects

Jan Kersting,¹ Alexander Miranskij²

Many different therapeutic components combine to produce a treatment solution which focuses on both functional and esthetic parameters. However, the different “pieces” have to be carefully matched in order to obtain a satisfying long-lasting result. A well-structured treatment plan is requisite, particularly in extensive restorative procedures. Devising this type of plan is like creating a mosaic out of numerous individual pieces. Continuous interaction and communication between the practitioner and the dental technician throughout the treatment and the patient’s confidence in these specialists represent important components in the process of restoring the esthetics and function of the patient’s dentition. In addition, the materials used play a pivotal role. The high-strength lithium disilicate glass-ceramic IPS e.max® Press offers excellent physical and esthetic characteristics, which makes it the ideal choice for many indications. Apart from its high strength, the material has a very attractive appearance, allowing exceptionally esthetic results to be achieved even if space is limited.

Initial situation

When the patient consulted our practice for the first time he had severely worn anterior and posterior teeth. The strongly built man had participated in competitive sports for many years. His facial muscles were exceptionally well-pronounced (Fig. 1). Today’s dental professionals are increasingly faced with cases showing this type of pathological loss of tooth structure. Its causes include erosion (demineralization of the teeth without the involvement of microorganisms), attrition (physiological or pathological occlusal contacts) or abrasion (mechanical processes, bruxism).



Figure 1: Point of departure: Lowered vertical dimension of occlusion. The picture shows the well-developed masseter muscle on both sides of the face.

Preoperative considerations

The patient originally presented to the dental practice with the intention of having a carious lesion in tooth 46 repaired. Since we noticed the obvious dysfunction of his jaw, we explained to him the medical importance of undergoing a suitable treatment. In order to ensure the long-term success of the treatment, we first had to realign the physiological vertical



Figure 2: Splint therapy: Customized occlusal appliance raising the vertical dimension by 12 approx. 2,5 mm.

¹ Dr Jan Kersting
Dental office Dr Roland Ritter
Leipziger Platz 1
90491 Nuremberg
Germany
jankersting@t-online.de
www.dres-ritter.de

² Alexander Miranskij, MDT
Dentalmanufaktur Nürnberg
Ulmenstrasse 52a
90443 Nuremberg
Germany
mail@dentalmanufaktur-nuernberg.de
www.dentalmanufaktur-nuernberg.de



Figure 3: Wax-up incorporating the vertical dimension evaluated via the occlusal appliance.

occlusion. Therefore, we needed to establish the cause of the destruction, as this significantly influences the treatment planning and also the choice of the materials used in the process. Often wear is caused by many different factors. In this case, the strenuous physical activity of the client seemed to be the main contributor to the loss of tooth structure. As a result, we were able to devise a minimally invasive treatment plan for him. It was discussed with the client, and all the necessary patient details were recorded. Due to the extensive loss of vertical occlusion, the patient's physiognomy had changed dramatically. His facial features were asymmetrical and his smile was crooked. The corners of his mouth were not properly aligned. Contrary to esthetic guidelines, the curve of the lower lip was not parallel with the upper incisal edge. The incisors had been so badly abraded that they no longer formed an upward curve. Furthermore, the lower lip drooped on the right side. The patient reported that he often clenched his teeth, especially during physical exertion. He also complained of tenseness in his jaw muscles.

Objectives: The dental team took on the challenge of realigning the vertical dimension, stabilizing the occlusion and creating an attractive result.

Treatment plan: After the occlusal splint therapy and the provisional phase, the patient would be treated with occlusal veneers ("table tops"). In order to improve the overall esthetic appearance of the dentition, we also recommended that the upper anterior teeth be restored with veneers.

Materials: A lithium disilicate ceramic (IPS e.max Press) was chosen for the full-contour fabrication of the lower posterior teeth. This material's high strength was a decisive factor in



Figure 4: The wax-up was rendered in composite by means of a silicone matrix.

the decision-making. A composite was chosen for the intraoral reconstruction of the lower anterior teeth 32 to 42. The teeth would be restored with the help of a silicone matrix made from a diagnostic wax-up.

Planning phase

The initial diagnosis involved the evaluation of intraoral and extraoral photographs and a clinical functional analysis. In addition, study models were assessed. A diagnostic wax-up that was based on a digital esthetics analysis (Digital Smile Design according to C. Coachman) delivered essential information about esthetic aspects, the vertical dimension of occlusion, the occlusal design and bite elevation. The existing structures were rebuilt in wax using an additive method, and the physiological state was restored. In this case, the wax-up was not simply used to evaluate the initial situation and guide the treatment process, it was also used as a communication device. The wax-up allowed the patient to visualize the treatment result. Furthermore, the model served to motivate him to persevere in pursuing the challenging and time-consuming treatment goals.

Occlusal splint therapy

In the first part of the treatment, the patient was fitted with a customized occlusal appliance. The aim of the splint therapy was to restore the physiological bite of the patient. Before the appliance was fabricated, a comfortable physiologic rest position was evaluated. Furthermore, a 2.5 mm increase in the vertical dimension was diagnosed (Fig. 2). Several days after the splint was placed, the patient reported that he felt comfortable with the "old-but-new" vertical dimension of occlusion. He wore the appliance for three months, during which time he did not experience any functional problems. The muscles relaxed quite visibly.



Figure 5: Long-term temporary: The composite occlusal veneers were adhesively cemented on the tooth structure without any prior preparation.



Figure 6: Sequential preparation for the permanent restoration by maintaining the vertical dimension of occlusion.



Figure 7: Bite taking after the preparation of tooth 36, 46 and 43.



Figure 8: The prepared lower teeth.

Stabilization of the situation

The occlusal situation that was established with the appliance was stabilized by treating the patient with long-term temporary restorations. We decided to provide him with non-invasive occlusal veneers made of composite, which would be adhesively cemented in the lower jaw. For this purpose, the study models were set up in the articulator in the arbitrary hinge axis position on the basis of a functional analysis. The anticipated final situation was waxed up according to the diagnostic setup (Fig. 3). The waxed-up restorations were recreated using composite with the help of a clear silicone matrix, and then the occlusal veneers were completed (Fig. 4). In the process, we paid particular attention to the functional and morphological principles. Next, the veneers were adhesively cemented in the mouth of the patient and the functional parameters were checked. This temporary restoration represented a decisive step in the treatment procedure and a significant component in achieving a lasting result. The patient could not be

expected to wear the occlusal appliance continuously for 24 hours. The long-term temporaries, however, enabled the movement patterns to be optimally established, since they were cemented in place (Fig. 5).

Preparation for the preservation of the supporting area

The situation stabilized within the following three months. The patient indicated that he felt very comfortable. The temporaries did not show any signs of wear. The patient was pain free. Now the time had come for the final treatment phase to begin. We had carefully assembled all the strategic pieces up to this point. At this stage, the success of the permanent restoration would depend completely on the preparation technique. Neither the horizontal nor the vertical maxillomandibular relationship could be disturbed. The sequential preparation phase started with the provisional occlusal veneers. In the first step, tooth 36, 46 and 43 were prepared (Fig. 6), and three-point support was established. Subsequently, the maxillomandibular jaw relationship was



Figure 9: The occlusal veneers were modelled with wax according to conventional wax-up principles..

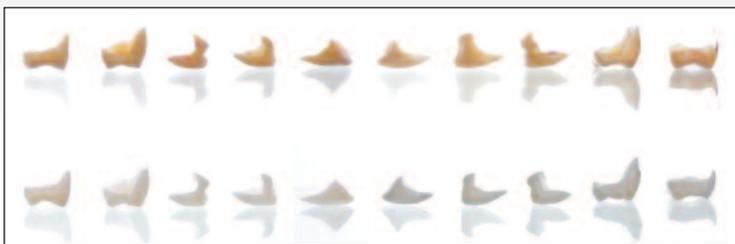


Figure 10: The successively waxed-up restorations were recreated 1:1 with ceramic (IPS e.max Press).



Figure 11 and 12: The occlusal veneers were placed with the adhesive technique and the lower anterior teeth were built up with composite. The restorations blended in smoothly with the remaining dentition. Due to its high strength, lithium disilicate can stand up to high chewing forces.

recorded (Fig. 7), and the teeth 33 to 37 as well as 44 to 47 were grounded. The teeth were prepared according to minimally invasive principles. This is currently the acceptable standard in esthetic and functional restorative treatment, since it corresponds to the requirements of patient-oriented and responsible dentistry.

The patient's teeth showed a number of cervical lesions (damaged fillings, untreated wedge-shaped lesions). As a result, the preparation strategy was adjusted to take these lesions into account. First, the damaged fillings were replaced with composite (Tetric® Flow). Next, the now intact fillings and the wedge-shaped lesions were included in the enamel preparation and sealed with the occlusal veneers. We made sure that the preparation margins were located in the enamel and were free of composite (Fig. 8). We decided not to prepare or build up the teeth with composite in the lower anterior jaw.

Material selection

After the impressions were taken, the study models were fabricated and mounted in the articulator in relation to the horizontal plane. Before the final mandibular restoration was completed, we discussed the esthetic and functional reconstruction of the upper front teeth (veneers for teeth 13

to 23) with the patient. We helped the client to visualize the anticipated result by building up the teeth in wax. The teeth acquired a distinctive shape and a suitable length. The wax-up was used to fabricate a mock-up, which was tried in by the patient. He was extremely pleased with what he saw and was completely satisfied with the veneer solution. Nevertheless, he wanted our assurance that we would not unnecessarily grind any healthy tooth structure.

The preservation of tooth structure is a vital component of modern, patient-oriented treatment strategies.

State-of-the-art materials that can be cemented with adhesive methods enabled us to fulfil his wish. In this case we used ultra-thin lithium disilicate veneers which we bonded to the healthy tooth structure for long-lasting results.

Fabrication of the final restorations

High strength was a priority in the posterior dentition. Therefore, full-contour restorations (monolithic) were fabricated with IPS e.max Press (Figs 9 and 10). The occlusal veneers were produced in wax according to customary methods. The



Figure 13 and 14: The ultra-thin anterior veneers were applied to pressed frameworks (cut-back).

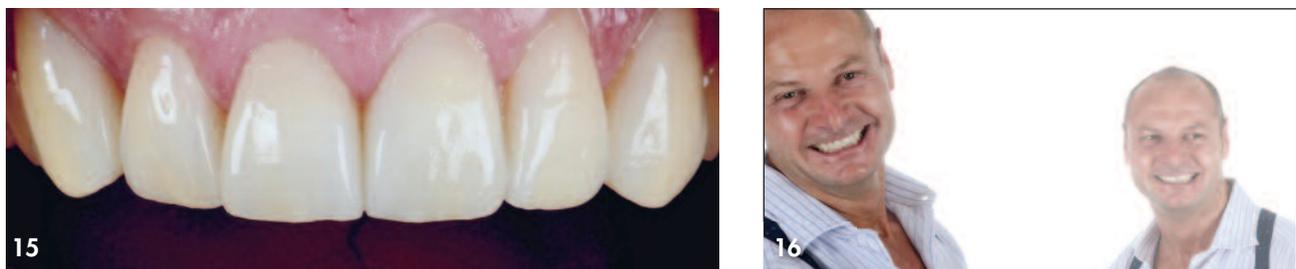


Figure 15 and 16: The restorations in situ show a lifelike internal play of colours. A well-structured treatment plan and high-strength ceramic restorations enabled the dental team to adjust the vertical dimension of occlusion of the patient and improve his appearance quite dramatically.

restorations were created with ceramic using the press technique and then prepared for adhesive cementation. The teeth were conventionally prepared according to the requirements of the adhesive technique. For the permanent cementation of the restorations, we used a dual-curing luting composite (Variolink® II). The teeth in the lower jaw were built up with a highly esthetic composite resin (Tetric EvoCeram®) (Figs 11 and 12).

The upper anterior teeth (13 to 23) were prepared by removing a minimal amount of tooth structure. A model was produced and then the veneers were fabricated with IPS e.max Press HT ingots (High Translucency). The pressed veneers were cut back and customized with a veneering ceramic (IPS e.max Ceram) (Figs 13 and 14). In the layering process, we strove to achieve a lifelike appearance and therefore paid a considerable amount of attention to this step. With the help of gold powder we were able to produce a lifelike surface texture. We polished the restorations manually. All the parties involved were impressed with the result after the adhesive cementation of the restorations. The inclined all-ceramic restorations showed excellent fit and physiological function. As a result, a very natural-looking appearance was achieved (Figs 15 and 16). A lifelike play of colours was observed within the veneers.

Conclusion

A well-coordinated treatment plan composed of many mosaic-like pieces is required in situations where complex restorative treatment including bite elevation is necessary. In the process, it is important to treat patients responsibly and inspire them with the required confidence. Careful deliberation is particularly important in the establishment of the physiological bite elevation. In the described case, a non-invasive strategy was devised to re-establish a stable vertical dimension. The teeth were ground for the preparation of the final restoration only after a suitably long temporary phase (occlusal veneers made of composite) and stabilization of the bite elevation.

All the mosaic pieces at a glance

Trust of the patient; exact analysis of the initial situation; restoration of the physiological vertical dimension of occlusion, taking functional parameters into account; stabilization of the situation; sequential preparation, including preservation of the supporting area; preservation of tooth structure; permanent restoration of the teeth, taking advantage of the possibilities offered by different materials.

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