

Restoring severely discoloured anterior teeth using minimally invasive procedures

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Introduction

Endodontically treated incisors may entail serious esthetic deficiencies as a result of severe discolouration and present a challenge to the restorative team. The objective of the treatment is to reconstruct the biomechanical and optical properties of the affected teeth, at the expense of as little natural dental tissue as possible. By following a clearly coordinated procedure, the treatment team may achieve satisfactory results with an internal bleaching method, an adhesive post build-up and a preparation technique that suits the requirements of the restorative material. The invasiveness of this approach is considerably reduced as compared with conventional restorative techniques.

This article discusses the rehabilitation of two upper central incisors by placing fibre-reinforced composite posts, using build-up materials and subsequently restoring the teeth with 360° veneers made from lithium disilicate ceramic (LS₂).

Initial situation

A 28-year-old male patient came to the practice and expressed the wish to have his endodontically treated and severely discoloured upper central incisors restored. He said that he had not experienced any problems since the resection of the root some years previously; however, he was dissatisfied with the impaired esthetic appearance caused by the affected teeth (Figures 1 to 3).

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Figure 1: The pronounced discolouration and the inadequate tooth position of the upper central incisors impaired the esthetic appearance.



Figure 2: The severe discolouration of tooth 11 also caused a discolouration of the marginal gingival area.



Figure 3: The asymmetrical tooth axes of the central incisors are clearly visible.



Figure 4: Leaking composite restorations and secondary caries in the endodontically treated teeth 11 and 21.

The clinical and radiological evaluations revealed tight and properly executed root canal obturations in teeth 11 and 21. There were no signs indicating the presence of root canal posts, but the extensive composite restorations in both teeth were leaking and showed secondary caries (Figure 4). At the time of the clinical evaluation, the restorations were already five years old. The specific challenges facing the treatment team was the patient's wish to have the esthetic appearance of his teeth restored in a timely fashion. The patient required that his natural tooth shade and position be restored and, to the extent possible, that the remaining tooth structure be stabilized in the long term.

Treatment planning

Before we proceeded to planning the permanent restoration, the inadequate fillings of the anterior teeth as well as the secondary caries were removed. This allowed us to assess the extent to which the teeth had been damaged. In addition, a possible contamination of the two root canals with microorganisms – resulting from the inadequate fillings which had been in place for years – had to be ruled out.

Both root canal fillings had been tightly sealed at the cemento-enamel junction with separate fillings. The canals therefore did not have to be re-opened. Internal bleaching of the crown portions of both teeth using the walking bleach technique was planned.

After an initial technical and clinical evaluation, the following treatment plan was determined: First, the tooth position and proportions should be corrected by means of an analytic wax-up. The brightness of the affected teeth was then to be adjusted by internal bleaching to match the



Figure 5: The root canal fillings were checked prior to the internal bleaching procedure, and the cemento-enamel junction was additionally sealed. The cavities were now ready for the application of the bleaching agent.

brightness of the neighbouring teeth during a preliminary treatment phase. Given the extensive lesion, we opted for a direct adhesive build-up after endodontic treatment with cemented fibre-reinforced composite posts. For the final restoration of the severely destroyed anterior teeth, we decided to use 360° veneers based on a lithium disilicate material. In order to achieve an optimum esthetic outcome, the veneers were to be fabricated in the cut-back technique.

Preliminary treatment and preparation

After the coronal pulp chamber of the two incisors had been cleaned, an additional seal was placed at the cemento-enamel junction using a small amount of phosphate cement. This measure ensured that the



Figure 6: Two weeks later: The severe discolourations were almost entirely removed by the internal bleaching treatment.

bleaching agent which would be applied later did not diffuse into these sensitive areas (Figure 5). For the internal bleaching, a mixture of sodium perborate powder and distilled water was applied using the walking bleach method. The palatal access to the coronal pulp chamber was sealed with cotton pellets soaked in bonding agent (Heliobond) and a low-viscosity composite (Tetric EvoFlow®). The next appointment was scheduled one week later. The desired tooth shade had not yet been achieved, and therefore fresh bleaching agent was applied. After another week with the bleaching agent in place, a satisfactory brightness value was observed on both abutment teeth (Figure 6). A calcium hydroxide preparation (CalciPure®) was inserted into the pulp chamber and left in place for a week in order to neutralize the bleaching agent.

After the neutralization phase, we proceeded to the post-endodontic build-up of the abutment teeth. For this purpose, the coronal sealing of the root canal fillings was removed and standardized holes for the fibre-reinforced composite posts (FRC posts) were drilled. The posts were luted with Variolink® II (dual-curing, low viscosity, shade: white-opaque) and a multi-step adhesive (Syntac®). After the posts had been covered with a low-viscosity composite (Tetric EvoFlow), a bright, highly filled viscous composite (Tetric EvoCeram®, Bleach XL) was applied to create the direct build-up (Figure 7). A high-power curing light (bluephase® G2 with > 1,000 mW/cm²) was used for the final polymerization of the cementation and buildup materials. A diagnostic pattern was employed for the minimally invasive preparation. This template was fabricated on the basis of the wax-up and contained all information relating to the correction of the tooth position and the outer contour of the final restoration.



Figure 7: The built-up and prepared incisors. Given the severe degree of destruction, adhesively cemented fibre-reinforced composite posts combined with mouldable composite materials were used.

Temporization and fabrication of the final veneers

The diagnostic template was also used for creating the direct veneer temporaries. The temporary restorations could thus be fabricated in a fairly straightforward manner using a Bis-GMA-based temporary material (Telio® C&B, A2). A bonding agent (Heliobond) was applied to the finished, non-etched preparation surfaces and to the inner side of the temporaries and light-cured after removal of excess material.

After a four-week evaluation phase of the tooth shape and position, which both were determined by the wax-up and transferred to the temporaries, a precision impression of the prepared teeth and an impression of the antagonist jaw were taken. This information was sent to the laboratory together with the facebow, the registration of the jaw relation and an image of the prepared abutment teeth. The image showing the preparations helped the



Figure 8: Lithium disilicate-based 360° veneers made of IPS e.max Press. In order to better mask the dental structure with a minimum layer thickness, an MO ingot was selected.



Figure 9: The optimum masking of the extensively built-up abutment teeth achieved by an MO ingot coping and a try-in paste in the shade white-opaque became evident already during the try-in of the veneers.



Figure 10: Frontal view of the veneers during try-in. The use of lithium disilicate as the basis of the restoration ensured a homogeneous appearance regardless of the substructure.



Figure 11: The 360° veneers were seated with the luting cement that corresponded to the try-in paste used; a multi-step dentin adhesive system was used. Thus, an excellent esthetic outcome could be achieved reliably and predictably.

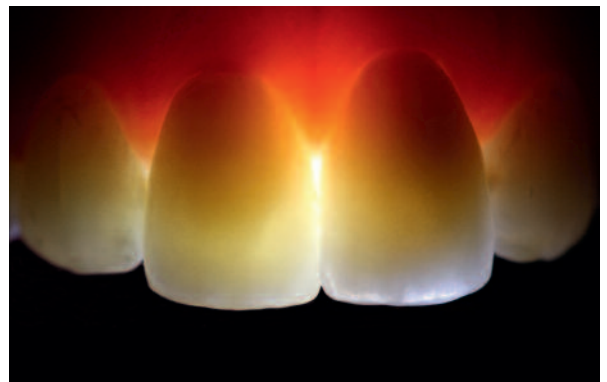


Figure 12: The restorations in transmitted light. By combining translucent build-up materials and glass-ceramic veneers, a light transmission that matches the properties of natural teeth was achieved.

laboratory to assess the required degree of opacity for the framework structure. Given the different levels of translucency, the different buildups of the abutment teeth and to ensure an improved masking capability in case of a relapse of the discolouration, the treatment team chose to use press ceramic ingots with a medium opacity level in shade 0 (MO 0). The IPS e.max® Press frameworks were veneered with the IPS e.max® Ceram veneering ceramic in the shade A2 (Figure 8).

Try-in and seating

After removal of the temporary restorations, residues of the bonding agent were removed with cleaning brushes and a fluoride-free cleaning paste. In order to check the

shape and shade of the veneers in the patient's mouth, the restorations were tried in with a shaded glycerine gel (Try-in Paste, Variolink II, white-opaque). A perfect masking of the abutment teeth was already achieved at this stage and the resulting situation showed a harmonious appearance regardless of the substructure (Figures 9 and 10).

The inner aspects of the glass-ceramic veneers were etched with a hydrofluoric acid gel (< 5% IPS® Ceramic Etching Gel) for 20 seconds. Subsequently, a bonding agent (Monobond Plus) was applied. Only the multi-step dentin adhesive system Syntac was applied to the tooth. The restorations were luted into place with the Variolink II system (white-opaque) (Figure 11).



Figure 13: Postoperative view with mandible in protrusion. The final check of the functional and esthetic parameters was satisfactory. The tooth shade excellently matched the adjacent teeth.



Figure 14: Portrait image of the final outcome: The discolourations were removed, the tooth position corrected and the tooth proportions adjusted (for comparison, see Figures 1 and 2).

Conclusion

A light transmission which corresponds to that displayed by natural teeth was achieved by using translucent build-up materials in conjunction with glass-ceramic lithium disilicate veneers (Figure 12). The final outcome with regard to functional and esthetic parameters was found to be very satisfactory at the final evaluation. The tooth shade was in perfect harmony with the surrounding dentition. In addition to removing the severe discolouration of the hard and soft tissues, we were able to correct the tooth position and adjust the tooth proportions (Figure 13). The patient was fully satisfied with the esthetically pleasing outcome and did not experience any phonetic problems resulting from the correction of the tooth position (Figure 14).

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