

Composite resin – the material of choice

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Introduction

Re-creating the original tooth as faithfully as possible is a challenging task for both the operator and the dental material. However, modern materials and layering schemes modeled on the natural structure of the tooth provide a sound basis on which predictable esthetic results can be achieved. The present case study describes the restoration of a fractured anterior tooth and discusses the biomimetic properties of IPS Empress Direct.

The young female patient was dissatisfied with the appearance of her upper teeth, which resulted from an accident a few years previously in which tooth 11 was injured. Therefore, she wished to have corrective work done. After the dental trauma, the tooth was restored with composite resin.

The clinical examination showed that the teeth were free of caries and in overall good condition in accordance with the patient's age. The patient clearly practiced excellent oral hygiene (Figure 1). Compared with the adjacent teeth, the natural part of tooth 11 looked yellowish and the composite build-up appeared greyish and translucent. With the exception of tooth 11, all the teeth reacted to the sensitivity test. The probing depth of the

gingival sulcus measured less than three millimetres. Tooth 11 showed minimal percussion sensitivity. The periapical X-ray revealed traces of an apical lesion (Figure 2). The root canal seemed to be extensively calcified.

As discussed with the patient, root canal treatment was planned for tooth 11. Furthermore, subsequent internal bleaching of the tooth was proposed, in preparation for the new composite build-up.

Root canal treatment

The oral cavity was isolated with a rubber dam before the root canal was opened. The canal was difficult to locate, despite the use of an operating microscope. Nevertheless, it was found at a depth of 13 millimetres. The root canal was prepared and a calcium hydroxide medicated filling placed for two weeks. Subsequently, the root canal was filled with thermoplastic gutta-percha points and sealed. The cervical structure of tooth 11 was internally bleached with sodium perborate until the tooth structure acquired the shade of the adjacent tooth.

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Figure 1: The preoperative situation shows that tooth 11 has been restored rather unattractively.



Figure 2: X-ray showing apical periodontitis in tooth 11.



Figure 3: Close-up of teeth 11 and 21.

Analysis of the tooth shape and shade

A close look at the two central incisors showed that the teeth were slightly asymmetrical (Figure 3), that is, the crown of tooth 11 looked somewhat wider. When the patient was questioned about this finding, she confirmed that she had had a median diastema, which was closed when the restorative work was done after her accident.

The appropriate enamel and dentin materials were selected with the shade guide from the IPS Empress Direct Set. The dentin materials were matched to the cervical area of the tooth and the enamel material was selected in accordance with the incisal area of the adjacent teeth.

The build-up of a tooth is a very sophisticated procedure, which needs to be planned very carefully. In order to ascertain and visualize the desired result before the tooth is built up, it is useful to draw up a "map" of the tooth's characteristics. For example, this "map" will show the areas that are highly translucent or opaque. Furthermore, a photo of the preoperative situation, which can be viewed on the display of a digital camera as necessary, could be of invaluable use in the subsequent buildup procedure. Nevertheless, it is important to note that digital photos only provide a rough indication regarding the placement of the different composite resins and staining materials. Photographs do not convey true colour. In the present case, the following materials were used for building up the composite resin restorations: A3 Dentin, A2 Enamel, Trans Opal and Tetric® Color white.

Mock-up and silicone matrix

A mock-up was prepared for the purpose of fabricating a silicone matrix. The shape and contour of the existing restoration were congruent with the neighbouring tooth 12 to a large extent. Therefore, only small adjustments of shape were necessary. For example, the incisal edge was slightly lengthened in the distal region. Silicone putty was



Figure 4: The old filling has been removed and tooth 11 has been prepared.

used to record the information provided by the mock-up. Since only the palatal part and the incisal edge of the silicone matrix were needed for building up tooth 11, the matrix was correspondingly trimmed with a scalpel.

Preparation, adhesive pretreatment and adjustments to the adjacent tooth

The old composite resin restoration was removed with rotating instruments. Furthermore, the enamel margins were beveled. A wide area was prepared in the labial region in particular (approx 2 mm) to ensure the invisibility of the final restoration margin (Figure 4). A rubber dam was placed in the anterior teeth (up to the first premolar) to establish a full view of the treatment field. Ligatures helped to completely isolate the anterior teeth requiring treatment and to displace the rubber dam towards the gingival margin. A three-step system including phosphoric acid etching (eg Syntac® Classic) was used for the adhesive pretreatment of the tooth structure. In order to make the two anterior teeth look symmetrical and to close the diastema, the mesial region of tooth 21 had to be widened a little with enamel material.

Build-up of palatal and proximal surfaces

The main aim of the anatomic layering technique is to create an artificial "enamel shell", which establishes the palatal and proximal contour of the original tooth. In the present case, a small amount of transparent enamel material (A2 Enamel) was placed in the trimmed silicone matrix and distributed to a thin layer with a spatula. The defect had to be covered as completely as possible. Some flowable Tetric EvoFlow® was applied to the palatal defect margin of the prepared tooth 11. Next, the silicone matrix together with the enamel materials was placed on the anterior teeth from the palatal aspect and checked for correct fit. If the enamel material in the silicone matrix has



Figure 5: After the adhesive pretreatment the palatal “enamel shell” is created.



Figure 6: The dentin core is deliberately built up generously.



Figure 7: The built up dentin core provides only very little space for the enamel material.



Figure 8: The restoration is ready for polishing after it has been characterized with translucent and white-opaque materials and sculpted.

been properly placed, it will reach the cervical margin of the defect. The flowable material on the tooth is thus displaced and fills out possible voids. Furthermore, it ensures good marginal adaptation.

The restoration was initially polymerized from the labial aspect. Next, the silicone matrix was carefully removed and the built up composite resin was polymerized from the palatal aspect. Small amounts of excess in the palatal and proximal areas were easy to remove with a scalpel (Size 12). The palatal surface prepared in this way produced the desired width in the incisal area. Nevertheless, the proximal part of the restoration did not make contact with the neighbouring tooth at this stage. The chosen matrix technique has a decisive influence on the creation of the most natural-looking proximal contours possible. As the mesial and distal portions of the defect were located superingivally in the present case, transparent matrices were used, which were held in place with wooden wedges. The proximal wall was built up with utmost precision. After the matrix and wedges were removed, the thin composite layer significantly enhanced the appearance of the incisal, palatal and proximal contours of the tooth (Figure 5).

Build-up of the dentin core

The subsequent layers were placed with opaque dentin material (IPS Empress® Direct Dentin, A3). The dentin core was built up (Figure 6). In comparison with natural teeth, this part of the tooth was larger. As a result, the space available for the enamel coating was very limited. It seemed to make good sense to cover the enamel bevel with dentin material as well.

This measure prevents the restoration margin from becoming visible as a grey line. Towards the incisal part the dimensions and the morphology of the dentin core were determined by the neighbouring and contralateral teeth. In the present case, mamelon structures were created. In the incisal area, enough space was provided for the translucent enamel materials (Figure 7). Each increment was cured for 20 seconds using a bluephase® LED light.

Incisal characterization

The incisal part between the mamelons was filled with a special composite resin material (IPS Empress® Direct Opal). A natural opalescent appearance was simulated with this technique. In addition, a white staining material (Tetric



Figure 9: After polishing: A natural-looking surface lustre and a fine morphological structure was produced with the suitable polishing technique.



Figure 10: Four weeks later, the follow-up examination showed a normal clinical situation.



Figure 11: The final X-ray showing the root canal filling and composite restoration.



Figure 12: The smile of a satisfied patient.

Color white) was selectively applied in order to re-create the whitish opaque areas of the enamel.

Build-up of the labial areas

The restoration was completed by applying a last thin enamel layer (IPS Empress® Direct Enamel A2) on the labial side (Figure 8).

While the resin composite was still soft, the surface texture of the restoration was created with a brush. The tooth shape was modeled in a way that would reduce the subsequent finishing work to a minimum.

Finishing and polishing

Excess material was removed with a scalpel (Size 12). Suitable finishers and polishers were used to adjust the surface gloss and micro-morphology of the tooth to that of the adjacent teeth. Restorative margins were finished and adjustments of the proximal and incisal areas were made

with flexible discs. In labial areas, these instruments must be used with great care to prevent the destruction of the morphology and the accidental removal of enamel material. Concave areas in the buccal surface were deepened in places with silicone polishers. High-gloss polishing was done with silicon-carbide impregnated brushes (Astrobrush®) (Figure 9).

Recall

Four weeks after the treatment ended, the clinical situation looked healthy. The restoration in tooth 11 was virtually invisible. Symmetry has been restored to the anterior dentition (Figure 10). In addition, the radiological follow-up exam did not show any irregularities (Figure 11). The patient was free from any complaints and highly satisfied with the overall result (Figure 12).

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