

# Methods of aesthetic adhesive splinting

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## Introduction

Thanks to the ever-increasing range of composite materials, glass fibre strands and innovative methods of fabricating restorations, dentists are now able to perform therapeutic treatments designed to stabilise mobile teeth. As a result, the use of light-curing composite glass fibre strands (FRC = fibre reinforced composites) is now taking on ever greater importance, and is possible for the following indications:

- mobile teeth as a consequence of periodontal diseases;
- necessary stabilisation of teeth following trauma;
- all types of retainers (with preservation of the interdental space);
- considerable destruction of the crown;
- palatal position or absence of a tooth.

The restorations can take the form of veneers, adhesive bridges, splints and combined restorations, and can be performed chairside or labside. Whatever form is ultimately selected, it is always essential to include a sufficient number of stable teeth. They support the periodontium of the loose teeth with its reduced morphological function, serve to anchor the adhesive restoration and ensure secure long-term stabilisation. The splinting of premolars and molars prevents their mesiodistal movement and to some extent their buccolingual movement, too. The immobilisation of incisors reduces orovestibular movement.

In the direct method, the adhesive restoration is shaped in the mouth. In the semidirect and indirect methods, the splint is produced on models in the lab. No preparation of the dental hard tissue is required for extracoronary splinting (the aprismatic enamel layer is simply ground away with burs, and the surface is etched with acid). Intracoronary splinting requires preparation (recesses are made for insertion of the reinforcement).

The splinting of teeth with Grade I mobility does not usually require a groove on the tooth surface; for Grade II–III mobility, a groove 1–1.5 mm deep is made. It is recommended to prepare an occlusal groove when splinting posterior teeth, and a palatal one for the upper incisors.

Adhesive splinting brings with it a whole range of positive aspects. Firstly, the procedure for direct fabrication of the restoration can usually be performed in just one treatment session. Secondly, there is no need for major removal of tooth substance or devitalisation of the pulp. Glass-fibre-reinforced composite satisfies aesthetic requirements and offers wearing comfort thanks to its small dimensions. If there is a defect within a dental arch, it can be rectified by cementing an artificial tooth to the adhesive splint.

## Direct method

Prior to the splinting, the teeth should be cleaned professionally, the supracontacts (high spots) selectively ground and the patient given instruction on proper oral hygiene. Once the teeth have been cleaned using instruments and fluoride-free paste, the shade of the composite is determined. The occlusal contacts are checked with articulating paper, and the contours of the subsequent restoration planned: the “splint-tooth margin” must not coincide with the occlusion points.

If the mobile teeth are in the upper jaw, a broad groove at least 2 mm in width is usually excavated from palatal with a ball diamond bur (under anaesthetic if necessary). The groove is prepared around 1.5 to 2 mm from the incisal edge of the tooth. For the mandibular teeth, it is sufficient to remove a thin layer of enamel, as long as there is no substantial mobility.

In order to measure the required length of the glass fibre strand for retaining the teeth in the required position, a narrow strip of film is placed in the area of the future splint. An instrument is used to press the strip of film into the interdental spaces in such a way that it follows the contour of the tooth crowns, in close contact, and surrounds the anchoring teeth as fully as possible. The strip of film is shortened to the required length. The glass fibre strand is then cut to match the length of the strip of film.

The prepared surfaces are etched with a gel containing phosphoric acid, rinsed, dried, covered with a thin layer of an unfilled bonding agent and light-cured. A thin layer of flow composite is then applied to the prepared surface. The glass fibre strand is pressed through the layer of composite and onto the teeth, and pressed into the interdental spaces with an instrument, following the contour of the tooth crowns. Following adaptation of the strand, the excess composite is removed and the material is smoothed in the direction of the gingiva and the cut edge of the splint. The splint is light cured from two sides (lingual and vestibular) for 30–40 seconds per tooth.

A suitable instrument is used to apply a thin layer of hybrid composite to the splint, smooth it and light-cure it. The polishing is performed in accordance with the surface finishing required for the composites.

#### **Semidirect technique (labside application)**

The advantages of the semidirect procedure are the simple handling of the materials (time and access to the teeth are not limited) and the fact that the construction is not in contact with the oral environment (clean, dry operating site).

In order to achieve higher accuracy when applying the splint, it is recommended to drill recesses into the lingual surface of each tooth with a medium-grain ball bur in advance. Alginate impressions are then taken to allow fabrication of a stone plaster model in the lab.

Once the model is finished, the glass fibre strand is cut to the requisite length. The interdental spaces are then expanded on the model from the lingual tooth surface, and the teeth are isolated with a covering of transparent varnish. A thin layer of the lightest hybrid material is applied to the lingual surface of the teeth involved in the splinting. The strand is pressed against the teeth and carefully pressed into the interdental spaces one after another, from tooth to tooth, using the instrument and without moving the strand.

A little composite is applied to the margins and the gingival and cut edge of the splint and light-cured for 30–40 seconds. Another thin layer of composite is applied to the splint with a suitable instrument and smoothed. The construction is cured in a polymerisation or light-curing unit. This is followed by polishing, without damaging the strand. The surface of the splint facing the teeth is treated with a sand blaster and roughened with an etching gel in the lab.

In the dental practice, the prepared enamel of the mobile teeth is etched and a thin layer of bonding agent applied. The splint is fixed in place with a transparent (light- or dual-curing) hybrid material. During the curing of the composite, the splint is pressed against the tooth surface vertically so as to prevent it from shifting towards the incisal edge. The spaces between the restoration and teeth are filled with composite, which is inserted into the corresponding gaps with an instrument. Each tooth is light cured from vestibular and lingual for 40–60 seconds. The splint is then polished. Finally, the teeth are treated with a fluoride preparation.

#### **Case study**

A 48-year-old patient complained about dislocation, caused by mobility, and sensitivity to cold of the central incisors. The examination revealed considerable dislocation of the central incisors in relation to the dental arch, considerable gap formation, exposed dental necks and that a quarter of the root of tooth 21 (upper left central incisor) was exposed (Fig. 1), as a consequence of periodontitis. The patient experienced pain when the thermal vitality test was conducted on the teeth.

As the clinical findings (minor pain when exposed to temperature stimuli, slightly painful preparation, electrical excitability in the range of 10  $\mu$ A) did not indicate a need for root treatment of the teeth, the decision was taken to fabricate an adhesive splint. In addition, it was necessary to shape the labial surface of the anterior teeth. Based on the indication, GrandTEC adhesive fibres (VOCO) and the light-curing composite GrandioSO (VOCO) were employed. GrandTEC is comprised of light-curing, resin-impregnated glass fibre strands for use in the dental adhesive technique (Fig. 2). The indications are: stabilisation of teeth following orthodontic or periodontal treatment and fixation and splinting of dislocated or mobile teeth.

However, there was one peculiarity in this patient's case: the glass fibre strand had to be routed over the labial surface of the anterior teeth and not over the palatal surface as recommended. The reason for this modification of the technique was an overbite, which would have rendered treatment on the palatal surfaces more difficult and presented difficulties for fabrication of a splint without occlusal impairment. In a final step, the teeth were then to be furnished with veneers.

At the start of treatment, the teeth were mechanically treated with special brushes and a cleaning paste. This was followed by selection of the shade for the composite by means of comparison with the intact teeth. The recommendation was to use a flow material (GrandioSO Flow, VOCO) and both a light opaque and a transparent, enamel-coloured composite material (GrandioSO).

GrandioSO is a light-curing composite indicated for restoration of anterior and posterior teeth. The advantages of the photopolymer are its natural shade reproduction, the simple application process, the rapid aesthetic result and the plastic consistency, which renders it easy to shape. The material is characterised by high resistance to ambient light in the treatment room and high colour stability. Its “chameleon effect” makes it possible to produce restorations which blend in perfectly.

In order to estimate the size, shape and microrelief of the restoration, we observed the morphological features of the anterior tooth group and took as a basis a triangular shape with slight angle and curvature features of the dental crown (Fig. 3). The patient-specific peculiarities included an oval, paragingival margin of the tooth crown, a straight incisal edge and the lack of a pronounced relief of the vestibular surface.

In the further course of treatment, the length of the adhesive restoration was determined with the aid of a strip of film. The strip was placed along the dental arch, pressed into the interdental spaces between teeth 23 and 13 and then shortened to the marked length. This strip of film served as the template for the length of the glass fibre strand.

The anterior teeth were prepared in order to allow application of the adhesive fibre strip and shaping of the restoration. The labial surface was abraded to a depth equivalent to the thickness of the veneer (0.5–0.8 mm). In order to create space for the strip (taking the overbite into consideration), a 2 mm-wide groove was prepared from distal to mesial on the labial surface of each incisor. The depth of the groove corresponded to the thickness of the adhesive fibres (approx. 1 mm). This was done with diamond burs, first with a medium and subsequently a fine grit size. The prepared surfaces were then rinsed off thoroughly with water (Fig. 4).

Then the adhesive fibre strip was prepared. The length of the strip corresponded to the length of the dental arch section intended for the splint construction (these measurements were determined in advance, during the planning, with the help of a strip of film). The adhesive preparation began with etching of the prepared surfaces with Vococid gel (VOCO) (Fig. 5). After rinsing off the etching gel and drying with an air syringe, a bonding agent was applied and light-cured (Fig. 6). The next layer, which was applied in the area of the groove made for the strip, was a flow composite, which was not light-cured because the adhesive fibre strip was pressed directly through this layer at the base of the groove, starting at tooth 23 (upper left canine) (Fig. 7). The strip was placed around the canine, pressed into the interdental space and routed to the lateral incisor. Next, the adhesive strip was adapted to all the prepared teeth, one after another, and pressed into the respective interdental spaces. Once this step was complete, each section of the restoration was light-cured.

In order to prevent the strip from showing through, the whole area was covered with a thin layer of an opaque composite. The same material was also used to mask the dentine of the exposed roots in accordance with the planned anatomical features, and a slight curvature was shaped on the mesial side. In addition, the incisal edge and angle of the crown of each incisor were shaped. In order to seal the interdental spaces, a composite was spread from the vestibular surface to distal on the central incisors, and from the same surface to mesial on the lateral incisors. The oval shape in the paragingival area, the straight incisal edge and the linear contact between the lateral surfaces of the teeth were checked.

Enamel-coloured composite layers were then applied to all the shaped surfaces (Fig. 8).

The final step consisted in finishing and polishing the restoration. The “restoration/enamel” transition and the free surfaces of the restored teeth were covered with the fluoride varnish Bifluorid 12 (VOCO) (Fig. 9).

The patient then received treatment for her periodontitis and attends regular dental check-ups.

### Summary

In aesthetic dentistry, adhesively bonded splints for stabilising teeth in patients with various stages of periodontitis are widely employed in order to avoid further dislocation and mobility. The strong fibres retain the teeth in their optimal position and the light-curing composite allows shaping of the aesthetic restoration.

Captions



Fig. 1. The patient's pre-operative clinical situation: dislocation of the central incisors, formation of a diastema and exposed dental necks



Fig. 2. GrandTEC adhesive fibre strip (VOCO)

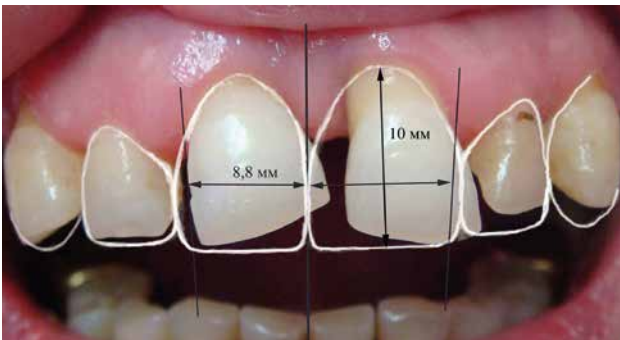


Fig. 3. Planning of size and shape of splint



Fig. 4. Prepared surfaces of teeth 13 to 23



Fig. 5. Application of etching gel



Fig. 6. Application of bonding agent



Fig. 7. Adaptation of glass fibre strand in the region of the central incisors. In this case, from vestibular because of an overbite. In addition, it was possible to preserve palatal tooth substance.



Fig. 8. Covering of opaque base with a layer of composite in an enamel shade



Fig. 9. Finished aesthetic adhesive restoration with veneers

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