Fiber Reinforced Composite (FRC)

One of the typical indications for the fiber reinforced composite technique with glass fibers in dentistry is the splinting of loose teeth due to:

- Accidental trauma
- Loss of periodontal foundation
- Occlusal trauma
- Orthodontic treatment

For splinting procedures, one can use:

- Wire (Twist flex)
- Wire nets
- Kevlar fibers (Surf Shop)
- Polyethylene mats (Ribbond)
- FRC Fiber reinforced composite (Glass fibers-silanized and bonded)
  - mats
  - nets

The quick, effective and clinically advantageous method of choice is the FRC technique provided by the Dentapreg™ materials. There are several other systems on the market, however, in my experience of 17 years using various FRC systems, Dentapreg™ fibers are the best due to the excellent balance of properties, easy handling and cost effectiveness.

In my practice, the main indication for the Dentapreg™ system is the splinting of loose teeth in periodontics. The biggest problem in the treatment of periodontal disease is medium to long term immobilization of the loosened teeth to allow successful conservative treatment. Thus, this article deals mostly with this frequent indication.

Periodontal Splinting

Splinting periodontally involved teeth is an integral part of periodontal treatment today. If the resorption of the alveolar bone has already progressed to an advanced state, periodontal treatment has to begin with pre-treatment measures (especially oral hygiene, correlating decrease in inflammation) and splinting of the teeth with increased mobility. It is known that simple improvement in oral hygiene and use of splinting can lead to successful treatment.

There are two ways to use periodontal splint:

1. **Indirect Splinting**: Indirect splints are mainly worn at night. The disadvantage is that there is no continuous rigid splinting of the mobile teeth during a 24 hour period.

2. **Direct Splinting**: Direct splints are bonded to the teeth and act continuously for 24 hours. This type of splint can be created with the FRC systems such as Dentapreg™, which stabilises loose teeth instantly and should increasingly gain more stabilisation during the periodontal therapy.

During treatment it is important to make sure that the planned fixed splint doesn't interfere with the patient's ability to perform oral hygiene or negatively affect the patient with respect to speech and creations of Para functions. Therefore, it is important to check the occlusion and the space available for a non-visible splint which is not disturbing and can be easily cleaned.
Upper Anterior Teeth

Direct Technique
The teeth that were to be splinted were cleaned and etched. Wedges (normally used with rubber dam) were placed in the interproximal spaces to form “channels” for Superfloss and interdental brushes. (Fig.1, 2, 3, 4).

The appropriate Dentapreg™ FRC strip was selected. The length of the FRC strip was measured with a calibrated periodontal probe (as an alternative you can use a strip of pink wax to measure the required length of the FRC strip). FRC Strip (flat pre-impregnated woven fiber ribbon) from Dentapreg™ SFM strip was cut to the required length. (Fig.5, 6, 7, 8) The trimmed FRC Strip was kept on a light-protection tray to prevent a premature cure by the surrounding light.

A thin layer of a micro-fine hybrid resin composite was applied to the palatal surfaces of the upper anterior teeth and the interproximal spaces between the marginal ridges were closed. (Fig.9) The FRC strip was adapted to the teeth as close as possible and polymerised step by step, i.e. tooth by tooth with the help of Dentapreg™ Shield spatula to keep the polymerisation light as a spotlight. The palatal surfaces were followed up and down with the strip. (Fig.10) Subsequently, a thin covering layer of flowable composite was applied, formed with the help of a brush and polymerized completely with two curing lights. (Fig.11, 12).

The occlusion was checked, corrected (if needed) and the splinting was examined to ensure that the interproximal spaces could be cleaned. (Fig.13) (For orthodontic retainers the same splinting technique as shown above is used).
Indirect Technique
A long term splint was produced in the laboratory as an orthodontic retainer with the Dentapreg™ System by curing the formed FRC strip with a covering composite layer on a dental stone model in a light curing oven. After cure, the splint was cemented with dual curing adhesive cement after a try-in. The procedure was completed with an examination of the occlusion and ability to clean.
Lower Anterior Teeth

If there are worn facets on the incisal edges of the lower anterior teeth, the best splinting technique is the interdental inter-incisal connection between the lower anterior teeth. The technique can be used for anterior teeth with a mobility of 1 degree or higher and abraded incisal edges with exposed dentine. (Fig.14, 15)

First the teeth are cleaned. A fine diamond bur is used to prepare 1 to 2-mm-deep grooves in the incisal edges of the teeth which, are to be splinted. Special care must be taken to avoid injury to the pulp. The height of the pulp chamber should be determined first from X-rays. (Fig.16, 17) The site for the FRC splint is etched, rinsed and carefully dried. (Fig.18, 19) The length of the groove should be measured out with a calibrated Perio probe.

A strip of Dentapreg™ SFU (flat unidirectional fiber reinforced strip) is unpacked and cut with sharp scissors still within the inner package. (Fig.20, 21) The inner package consists of a double sleeve. Between thumb and forefinger, the covering foil sleeve is pulled away to reveal the FRC Fibers. (Fig.22) On a hard support, thin out with a scalpel to the appropriate width of the prepared grooves of the lower anterior teeth. (Fig.23) The stretched strip can be cut easily (Fig.24) The trimmed glass fibers should be kept out of the light as much as possible otherwise they will begin to cure. The fibers should be kept on a light-protected mixing slab (Fig.25).

The advantage of the glass fibers used in this technique is that they form a firm chemical bond with the resin composite through silanization and bonding; thus, they can be polished very easily. In addition, no individual fibers are exposed and irritating the patients soft tissue.

Dentine bonding adhesive is applied and cured (Fig.26). The first layer of flowable resin composite is syringed into the groove (Fig.27). The prepared glass fiber bundle is embedded in the uncured layer of composite (Fig.28). The incisal edge is shaped with a coat of resin composite and then light cured carefully (Fig.29). Splinting is complete once the occlusion is checked and the appearance of the splint is acceptable. (Fig. 30, 31). Covering the exposed incisal dentine also prevents the discoloration of the teeth from progressing. If the teeth are severely discolored, bleaching can be considered (Fig.32).

If one of the splinted teeth is becoming seriously infected and has to be removed, an additional splint on the lingual side is necessary. Remove the infected root in a small flap operation, round off the tooth to a pontic and keep the splinted block as a semi-permanent fixed bridge.

**Fig. 14 Mobile lower anterior teeth**

**Fig. 15 Incisal edges with exposed dentine**

**Fig. 16 Incisal grooves are prepared**

**Fig. 17 Incisal grooves from above**
Fig. 18 Etching the grooves

Fig. 19 Controlling after rinsing and drying

Fig. 20 Dentapreg™ SFU strip is chosen

Fig. 21 Fibers are measured and cut within the inner packaging

Fig. 22 Uncovering by peeling the inner foil sideways

Fig. 23 Thinning out the Fibers with a scalpel

Fig. 24 If cutting is needed- stretch it

Fig. 25 Protecting the fibers from light
Fig. 26 Applying dentine adhesive

Fig. 27 First layer of flowable composite is syringed into the grooves

Fig. 28 Placing the fiber bundles into the groove

Fig. 29 Light curing the FRC

Fig. 30 Checking the occlusion

Fig. 31 Marking the occlusal stops - need to be trimmed

Fig. 32 Final result of the FRC inter-incisal splint
Upper Posterior Teeth

Internal periodontal splinting, also referred to as A-Splinting, comprises of the following steps. Firstly, occlusal grooves are ground into the interproximal surface of the posterior teeth which are to be splinted (Fig.33, 34). The length of the grooves are measured with a periodontal probe (Fig.35) and the glass fibers are cut to the required length (Fig.36, 37). The glass fibers must be protected from the light once they have been trimmed to the correct length, as polymerization is initiated with all exposure to light, including the operating light, sunlight and the curing light. The grooves are etched with phosphoric acid for 30 seconds, rinsed for 15 seconds, and dried carefully (Fig.38). Wedjets are inserted into the interproximal spaces to preserve their shape (Fig.39) If there is exposed dentine, a dentine adhesive is applied.

A base layer of flowable resin composite is applied and interim light curing is performed (Fig.40). The prepared glass fibers are placed in the prepared cavities and positioned with a disposable brush (Fig.41). The fibers are covered with a second layer of flowable resin composite and the cavities are completely filled (Fig.42).

The covering layer is contoured with a disposable brush (Fig.43). The splint is carefully cured with two curing lights from opposite sides; this process should begin laterally through the enamel (Fig.44).

The splint is finished, occlusally adjusted and polished. The patient is shown how to clean the embrasure spaces. A medium sized interdental brush should glide easily through the openings created by the wedges. (Fig.45, 46) If this splint breaks during the periodontal therapy, which can at times occur with mobile teeth, it can easily be repaired with flowable resin composite and glass fibers.
Fig. 39 Wedjets are inserted to preserve the shape of the embrasure spaces.

Fig. 40 A base layer of flowable resin composite is applied.

Fig. 41 Fibers are placed lengthwise into the cavities and subsequently adapted.

Fig. 42 Fibers are covered with composite.

Fig. 43 Covering layer is contoured with a disposable brush.

Fig. 44 Careful final curing is carried out with two light sources.

Fig. 45 Finished splint.

Fig. 46 Embrasure spaces are examined to ensure that they can be cleaned with an interdental brush.