1a. Ribbond THM
Ribbond

1b. Ribbond Triaxial
Ribbond

2. Ribbond
Ribbond

3a. Connect
sds/KerrLab

3b. everStick PERIO
StickTech

3c. Splint-It!
Pentron
### Composite Reinforcement Fibers

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<tr>
<td>Ribbond THM Ribbond</td>
<td>$2.73</td>
<td>$2.06–$2.12</td>
<td>Polyethylene</td>
<td>1, 2, 3, 4, 7</td>
<td>0.18</td>
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<td>1: Flat Ribbon</td>
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<tr>
<td>Ribbond Triaxial Ribbond</td>
<td>$2.73</td>
<td>$2.12</td>
<td>Polyethylene</td>
<td>Thin: 2.5 Dense: 3</td>
<td>0.35</td>
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<td></td>
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<td>0.41</td>
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<td>Ribbond Ribbond</td>
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<td>0.35</td>
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<td></td>
<td></td>
<td>1: Flat Ribbon</td>
</tr>
<tr>
<td>Connect sds/KerrLab</td>
<td>$1.17</td>
<td>$1.34–$1.39</td>
<td>Polyethylene</td>
<td>1, 2, 3</td>
<td>0.25</td>
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<tr>
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<td>1: Flat Ribbon</td>
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<tr>
<td>everStick PERIO StickTech</td>
<td>N/A</td>
<td>$10.30</td>
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<td>1.2</td>
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<td>1: Rope</td>
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<td>Splint-It! Pentron</td>
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<td>$1.67</td>
<td>Ribbons: S2 Glass Rope: Polyethylene</td>
<td>1, 2, 3</td>
<td>N/A</td>
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Reinforcing plastic with fiber is certainly not new. Probably the best known is the generic term fiberglass, which of course, is used to make numerous products. Composite reinforcement fibers are materials that presumably increase the flexural strength and thus help resist fracturing of high stress restorations and appliances such as bridges (definitive and provisional), natural tooth pontics, endodontic posts and cores (direct and lab-fabricated), periodontal splints, orthodontic retainers, and even dentures. Reinforcing various types of restorations/prostheses with a fiber is a reasonably simple technique to gain strength and will be necessary until composites are developed that are intrinsically much stronger.

For these materials to function properly, it is believed that they must be incorporated into the restoration during its initial fabrication and not merely added on after the fact. In other words, the reinforcement material must be completely integrated into the resin before any curing takes place.

When a reinforced restoration fails, it is rarely catastrophic. Usually the resin will fracture, but the fiber will hold the restoration together. In this vein, most of the failed restorations as reported from an Editorial Team survey point to bridges as the one most likely to fracture.

One universal problem is that the ends of these materials tend to fray. However, once resin is incorporated into them, this problem can be minimized. Another problem is when you try to repair a fiber-reinforced restoration that has fractured. If you try to roughen the surrounding composite with a sandblaster, the remaining fiber has a tendency to turn black. Roughening the adjacent composite with a coarse diamond instead of a sandblaster will usually solve the problem.

These materials can either be used directly in the mouth or fabricated on a model and bonded as any other indirect restoration. In general, fabrication on a model is easier than direct use. Even though each material has its own peculiarities, the general principles are similar.

**Procedure for Periodontal Splint or Orthodontic Retainer**

**Step 1**
Decide what length you need by using deadsoft matrix material, which can be adapted to the surfaces of the teeth to be included and pushed into embrasures to simulate the final position of the fibers. Then remove the deadsoft material and measure its length. This then becomes the length of the fiber that will be necessary to complete the splint.

**Step 2**
Treat the fiber as indicated by the manufacturer.

**Step 3**
Etch the teeth, apply an adhesive, and place a thin “ribbon” of composite on the teeth that are to be splinted.

**Step 4**
Carefully adapt the reinforcement material into the composite, which should help in preventing the fiber from rebounding off the teeth. Push the fiber into the embrasures and as close to the surfaces of the teeth as possible with an instrument and/or your clean, gloved fingers that have been lubricated with unfilled resin. Cure each area that your light tip covers for 10 seconds.
Step 5
Apply another layer of composite over the fiber-reinforced layer to completely cover any exposed fiber, including the facial embrasures. Cure again 20-40 seconds for each light coverage area.

Step 6
Smooth the cured splint with finishing burs and/or finishing discs followed by rubber polishing instruments for further smoothing and polishing. Finish with polishing paste if necessary.

The same type of splint can also be made extraorally on a conventional gypsum study model or a flexible model made from a stiff elastomeric impression material. If you use a study model, be sure to lightly lubricate it with a water-soluble separating medium before applying the first layer of composite.

Once the splint has been cured and removed from the model, sandblast its tooth surface prior to taking it to the mouth.

### NOTE

Most of these materials are white, but tend to become translucent when incorporated into the restorative material.

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**Ribbond THM**

**Ribbond**

**www.ribbond.com**

(4.5)

**Assorted Starter Kit**

Cost: $180.00/66cm ($2.73/cm)

Includes:
- 22cm of Ribbond THM in each size (2mm, 3mm, and 4mm)
- Special scissors
- Deadsoft tin foil for measuring teeth
- Practice model

**Post & Core Placement Instrument**

Cost: $15.00

**Refills:**

Cost: $140.00 ($2.06–$2.12/cm)

Includes:
- 22cm ea of 2mm, 3mm, and 4mm (can be customized) or 68cm of one size

---

**RAVES & RANTS**

- Thinner than original
- 1mm great for ortho retainers
- Can it really be thinner and stronger?
- Use as a post not as easy as it looks

---

**Composition**

Thin, white woven ribbon made from Spectra, which is a tenacious, ultra-high strength, high modulus, ultra-high molecular weight, extended chain, highly oriented, bio-compatible, polyethylene fiber. It is presumably 10 times stronger than steel (equal weight to equal weight) and more durable than polyester. The cross-linked, lock-stitched Leno weave reportedly minimizes the coalescence of micro-cracks within the resin matrix into cracks that could lead to failure of the restoration, presumably prevents Ribbond THM from unraveling when cut, allows it to maintain its size and width when adapted, and minimizes rebound. It also supposedly allows for the efficient transfer of stress within the fiber network. Ribbond THM is cold gas-plasma treated to enhance its adhesion to any synthetic restorative material used in dentistry by increasing its reactivity and wettability. The post & core placement instrument looks like a spreader with a small groove in its flat tip. It is used for placing Ribbond THM into canals during the post technique.

**Thickness**

0.18mm

**Widths**

5 1mm, 2mm, 3mm, 4mm, and 7mm. The 1mm is designed for fixed orthodontic retainers. The 4mm size can be used for composite and provisional acrylic bridges. The 7mm is designed for the reinforcement of removable prostheses like nightguards or dentures.
**Use**

Because of the plasma-treated surface, you need to coat Ribbond THM with a thin layer of resin before you manipulate it. Ribbond THM is carefully removed from its package using clean cotton pliers and is cut to the approximate length you need with the special scissors included in the kit. You need these scissors, since the material has such a high toughness rating and is especially abrasion resistant. The scissors are specifically tuned to cut Ribbond THM. They cannot be autoclaved, due to potential rusting. Chemiclaving, however, is acceptable.

After cutting, place Ribbond THM on a clean, lint-free 2x2. Then, transfer it to a dappen dish that contains unfilled resin. Dip the Ribbond THM into the resin and then blot the excess with the lint-free 2x2. It is now no longer susceptible to contamination (other than the typical types of contamination such as saliva).

**Packaging**

Gold cardboard box with removable top, contents secured in a removable black plastic tray. All the contents are arranged in an orderly manner, with the various widths of ribbon packaged in individual plastic envelopes for protection. These envelopes have different colored printing on the gold labels to make distinguishing between them easier (7mm comes with a white label, not gold). There are several warning stickers at the bottom of the black tray that give good advice and keep you from making errors. There is also a lower second premolar-to-second premolar model and a premeasured section of ribbon with which to practice. A brochure, CD, and price sheet are placed on top of the box and held in place with a rubber band. There is no expiration date on this kit, since as long as the ribbons are kept in their protective packaging, the shelf life is unlimited.

**Directions**

The 45-page instruction manual has been recently updated and is very helpful, with numerous line drawings and illustrations. In addition, there are four loose pages clinical step-by-step photos to help flatten the learning curve. There is also a CD that covers the clinical applications on splints, bridges, posts, trauma treatment and tooth fracture procedures. The format of the CD is also in a slide show format, and you can easily view each clinical application by using the arrow keys on your keyboard.

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**Composition**

See Ribbond THM.

**Thicknesses**

- 0.35mm (thin).
- 0.41mm (dense).

**Widths**

- 2.5mm (thin) & 3mm (dense).

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**Cost:** $180.00/66cm ($2.73/cm)

- **Includes:**
  - 2 Dense Triaxial ribbons (22cm ea)
  - 1 Thin Triaxial ribbon (22cm)
  - Special scissors

---

**Refills:**

Cost: $140.00/66cm ($2.12/cm)

- **Includes:**
  - 2 Dense Triaxial ribbons (22cm ea)
  - 1 Thin Triaxial ribbon (22cm)

---

**Raves & Rants**

- + Stronger than original
- + Two widths and two thicknesses
- - Does not adapt to teeth as well as original
- - Not available in 1mm width

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**Use**

Measure the length you need, cut with the special scissors, and proceed with the procedure. See Ribbond THM for specifics. The scissors are specifically tuned to cut Ribbond. They cannot be autoclaved, due to potential rusting. Chemiclaving, however, is acceptable.

**Packaging**

Cardboard box with removable silver-blue top. The contents are loose in the box and secured with paper clips. The ribbons are packaged in individual plastic envelopes with silver labels with blue printing for dense and black for thin.

**Directions**

Plain paper 14-page booklet with numerous line drawings and illustrations, but real clinical step-by-step photos would still flatten the learning curve.
Composition
See Ribbond THM.

Thickness
0.35mm

Widths
2mm, 3mm, 4mm, and 9mm. The 4mm size can be used for composite and provisional acrylic bridges. The 9mm is designed for the reinforcement of removable prostheses like nightguards or dentures.

Use
Measure the length you need, cut with the special scissors, and proceed with the procedure. See Ribbond THM for specifics. The scissors are specifically tuned to cut Ribbond. They cannot be autoclaved, due to potential rusting. Chemiclaving, however, is acceptable.

Packaging
Blue cardboard box with removable top, contents secured in a removable black plastic tray. All the contents are arranged in an orderly manner, with the various widths of ribbon packaged in individual plastic envelopes for protection. These envelopes have different colored labels to make distinguishing between them easier. There are several warning stickers at the bottom of the black tray that give good advice and keep you from making errors. There is also a lower second premolar-to-second premolar model and a premeasured section of ribbon with which to practice. A brochure, CD, and price sheet are placed on top of the box and held in place with a rubber band. There is no expiration date on this kit, since as long as the ribbons are kept in their protective packaging, the shelf life is unlimited.

Directions
The 45-page instruction manual has been recently updated and is very helpful, with numerous line drawings and illustrations. In addition, there are four loose pages clinical step-by-step photos to help flatten the learning curve. There is also a CD that covers the clinical applications on splints, bridges, posts, trauma treatment and tooth fracture procedures. The format of the CD is also in a slide show format, and you can easily view each clinical application by using the arrow keys on your keyboard.

Assorted Starter Kit
Cost: $160.00/66cm ($2.42/cm)
Includes:
• 22cm of Ribbond in each size (2mm, 3mm, and 4mm)
• Special scissors
• Deadsoft tin foil for measuring teeth
• Practice model

Post & Core Placement Instrument
Cost: $15.00

Refills:
Cost: $120.00 ($1.76–$1.82/cm)
Includes:
• 22cm ea of 2mm, 3mm, and 4mm (can customized)
or 68cm of one size

RAVES & RANTS

More research, more results
The original
We miss the gloves!
Is the owner's hair really Ribbond?
Composite Reinforcement Fibers

**Connect**
sds/KerrLab

*Intro Kit:*
Cost: $319.55/274cm ($1.17/cm)

*Includes:*
- 3 spools of Connect (108in/274cm total)
- 1 tweezer
- 1 btl of Connect Resin (10ml)
- 1 Connect Scissors

*Refills*
Cost: $121.95-$126.95/91.3cm ($1.34-$1.39/cm)

*Includes:*
- 1 spool (38in/96.5cm)
- Connect Resin (10ml)

*Connect Resin*
Cost: $94.95 ($9.50/ml)

*Connect Scissors*
Cost: $41.95

**Composition**
Flexible white woven ribbon made of ultra-high strength polyethylene fiber treated with cold gas plasma for adhesion to resin by increasing its reactivity and wettability.

**Thickness**
0.25mm

**RAVES & RANTS**
+ Teammate of belleGlass NG
+ Disappears into restoration
- Not as much research as Ribbond
- Brief instructions

**Widths**
- 3 1mm, 2mm, and 3mm.

**Use**
See Ribbond THM. Connect is used in a similar manner.

**Packaging**
Cardboard box with removable lid and foam with cutouts to secure the contents. Connect itself is on a plastic spool. Expiration date is on top of box and printed directly on the moisture-resistant label on the spool.

**Directions**
The 42-page instruction booklet is in six different languages. However, the English section is only seven pages and only laboratory procedures are covered — there is nothing clinical.

**everStick PERIO**
StickTech

*NEW*

Cost $247.30 ($10.30/cm)  
*Shelf life: 2 years*

*Includes:*
2 ropes of fiber (12cm ea)

**Composition**
Unidirectional E glass fibers that have been silanated and impregnated with BIS-GMA and PMMA. While the kit sent to us for review is marketed specifically for periodontal splinting, there are other versions that are virtually the same except for the diameter of the ropes.

**Thickness/Width**
1.2mm in diameter rope.
Use
After opening the foil packet with scissors, the rope can be accessed by pulling out the flexible tray that has a groove running lengthwise. In this groove resides the rope of fiber. Clever packaging. After cutting off the length of fiber you need, fold over the foil to protect the inside from the light, peel off the label on the pouch, and use it to seal the pouch. Because of the small diameter of the rope, it is unlikely to encroach on interdental papilla.

Packaging
Simple green and gray cardboard box with foil packets housing the fiber loose inside. Expiration dates are printed clearly on the box and on each foil pouch.

Directions
One large foldout sheet of glossy paper with promotional information on one side and instructions in seven languages on the back. Instructions are brief, to the point, easy to read and follow, and are accompanied by eight color photos of its application on a typodont.

Use
Measure the length you need, cut with the special scissors, and proceed with the procedure. See Ribbond THM for specifics.

Sizes
3 1mm (rope), 2mm (ribbon), and 3mm (ribbon).

Packaging
White plastic tray with cutouts secure the contents; top is cardboard. Ribbons are in black plastic trays that are divided into six sections, with each having rear-hinged lids. To access the strips, you pull up on the tab on the end opposite the hinge and open the lid. While this is not difficult, there is no instruction on this procedure, which could not be considered intuitive. Scissors have ceramic cutting blades and metal handles. Expiration date is printed on the bottom of the white tray and on a label on the bottom of each black plastic tray.

Directions
One large foldout sheet of glossy paper with promotional information on one side and instructions in seven languages on the back. Instructions are brief, to the point, easy to read and follow, and are accompanied by eight color photos of its application on a typodont.

Description
Ribbons are made from S2 glass fibers, which is described as a special glass blend, while the rope is braided polyethylene. The 2mm ribbons are woven, while the 3mm are unidirectional. Woven has less memory and the best choice for malposed teeth. All are resin-impregnated.
Ribbond THM (Thinner Higher Modulus) is similar to the original version, when it comes to composition, but even though it has thinner fibers, it also demonstrates higher flexural strength. Being especially good for periodontal splints and orthodontic retainers, THM seems easier to adapt and cover with composite, plus it disappears more completely into the restoration.

Ribbond Triaxial is a stronger version of the original product designed primarily for reinforcing various types of bridges, definitive and provisional. It features both unidirectional and braided fibers, but does not adapt to teeth quite as well as the other versions.

Ribbond has the most research and longest track record in this category. Its performance has been very good and it comes in the most sizes. In addition, its scissors are better (than those with Connect), and its instructional booklet, video, and CD give it an edge over the other products.

Connect comes in three sizes and seems to disappear into the restoration somewhat better than original Ribbond. Being very similar to Ribbond, it is thinner than the original version, but thicker than THM.

everStick PERIO has preimpregnated glass fibers rather than polyethylene. Its ropes are more applicable to groove-like preparations, although they can be flattened during application and used non-invasively. Since it is preimpregnated, contamination is less an issue. However, the strength of its unidirectional glass fibers compared to the weaves of the other materials is somewhat questionable. In addition, it is by far the most expensive product in this category.

Splint-it! is definitely the most translucent, saves a step by being pretreated with resin, has great scissors, and is the least expensive preimpregnated product. But it is stiffer and doesn't manipulate as well as Ribbond, and is more difficult to use as reinforcement for a post compared to the other materials.

OTHER PRODUCTS IN THIS CATEGORY

| Construct sds/KerrLab | GlasSpan GlasSpan | LockTooth Splint DRG Surgical | Tescera U-Beam Bisco |