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Adhesive Fibers In Operative Dentistry And Endodontics

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Abstract

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Introduction

In the last 10 years, the rate of development of new dentin/enamel adhesives has been too rapid to allow for clinical evaluation of all materials. Laboratory tests have therefore been used to screen new adhesives for their ability to bond to enamel and dentin. Most early bonding systems were hydrophobic, which did not allow them to adapt to dentin properly. The adhesive must be able to diffuse and penetrate in an aqueous environment and, therefore, be hydrophilic or amphiphilic. Amphiphilic monomers contain bifunctional, hydrophilic and hydrophobic groups with a great affinity for both dentin and restoration material (Van Dijken & Horstedt, 1998) (1). SE adhesives condition and prime enamel and dentin simultaneously without rinsing, relying on their ability to partially dissolve hydroxyapatite to generate a resin-infiltrated zone with minerals incorporated (Perdigão, 2002) (2).

Self-adhesive cements are relatively new and detailed information on their composition and adhesive properties is limited. Its multifunctional monomers with phosphoric acid groups simultaneously demineralize and infiltrate enamel and dentin. The dominant setting reaction is the radical polymerization that can be initiated by light exposure or through the self-curing mechanism. These results in extensive cross linking of cement monomers and the creation of high molecular- weight polymers.

Self-adhesive cements do not require any pretreatment of the tooth surface. Once the cement is mixed, its application procedure is extremely simple. Application is accomplished in a single clinical step, similar to the application procedures of zinc-phosphate and polycarboxylate cements. According to the manufacturers' information, as the smear layer is not removed, no postoperative sensitivity is expected. Unlike zinc phosphate, polycarboxylate, and resin cements, self-adhesive cements are claimed to be moisture tolerant and to release fluoride ions in a manner comparable to glass ionomer cements. Furthermore, they are expected to offer good esthetics, optimal mechanical properties, dimensional stability, and micromechanical adhesion, analogous to resin cements. Such a combination of 48ehaviour48 features of conventional and resin cements is claimed to render self-adhesive cements suitable for a wide range of applications. At the same time, the clinicians' demands for simplification of luting procedures are addressed, as the application procedure purportedly leaves little or no room for mistakes induced by technique sensitivity.

Several products are currently available in the market. They differ in terms of delivery systems, working/setting times, number of available shades, and composition. According to the manufacturers, all currently available self-adhesive cements release fluoride ions. All these products are dual-curing radiopaque materials that are indicated for adhesive cementation of virtually any indirect restoration: ceramic, composite, metal, inlays (composite or metal), onlays, bridges, crowns, posts and screws (including fiber posts) made of metal, composite resin, and ceramic. The only procedure in which the use of self-adhesive cements is not indicated is the cementation of veneers. In this case, light curing veneer cements are recommended, as the practitioners usually require longer working times that allow the positioning and adjustment of several veneers simultaneously, prior to light initiation of the cement polymerization .

Provision of innovative treatment solutions to various problems has always been the motto of medical scientific brains. Dentistry is no exception to this 49ehaviour. The acceptance of advances in material science has really helped this cause.

Ribbond is one such material, which has occupied an important place in the dentist's repertoire.

It is bondable fibre reinforced material, made from the same ultra-high molecular weight polyethylene and ceramic fibers used to make bulletproof vests. The key to Ribbond's success is its patented leno weave.(3) Designed with a lock-stitch feature, it effectively transfers forces throughout the weave without stress transfer back into the resin, providing excellent manageability characteristics.

By virtue of such wide spectrum of intended properties,(4) it enjoys varied applications in day to day dentistry like: endodontic posts,periodontal splints, aesthetic space maintainers ,bondable briges and single bridges and orthodontic retainers.

Ribbond

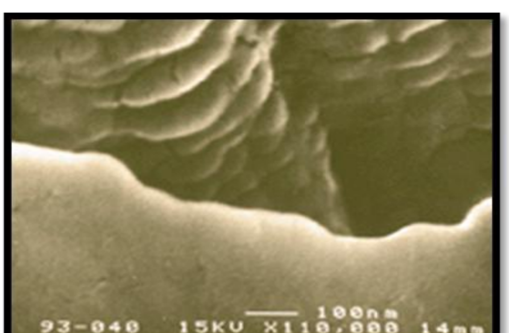
Ribbond is a bondable reinforcement ribbon that prevents fracture failure in dental composites and acrylics. It is perfect for a wide variety of dental uses.Ribbond prostheses are strong and maintain their strength with continued use. They are tough and durable. Ribbond's unique combination of ultra-high strength fibers, enhanced bonding ability and patented cross-link lock-stitch leno weave makes the strength and fracture toughness of Ribbond reinforced prostheses unsurpassed by other fiber reinforcements

Ribbond is made from the same ultra-high molecular weight polyethylene fibers used to make bulletproof vests. These fibers far exceed the breaking point of fiberglass and are so tough that specially made scissors are required to cut them. Unlike Kevlar, Ribbond's fibers absorb less moisture than the dental resins (5)

The key to Ribbond's success (and what distinguishes Ribbond from the other fiber reinforcements) is its patented leno weave. Designed with a lock-stitch feature that effectively transfers forces throughout the weave without stress transfer back into the resin, Ribbond's weave also provides excellent manageability characteristics. For example; when making a periodontal splint, Ribbond tucks in interproximally without rebounding. In addition, unlike loosely braided or bundles of unidirectional fibers, Ribbond does not spread or fall apart when manipulated.

Ribbond's Patented Cross-Link Lock-Stitch Leno Weave.

1. Adaptable and Manageable
2. Does not unravel when cut or manipulated
3. Reinforces multi-directionally
4. Durable & impact absorbent
5. Transfers stresses efficiently throughout the fiber network



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Ribbond's fibers are the standard in biocompatibility. The same material is also used in the construction of artificial hip and knee joints. Unlike fiberglass, if at anytime the Ribbond is cut into with a rotary instrument, the resultant particles and exposed fibers will not be a biocompatibility risk to the patient .

The unique combination of strength, esthetics and bondability allows Ribbond to be used for many different applications. Ribbond bonds to both composite and acrylic giving you a material with multiple uses.

A Ribbond splint takes less time than traditional methods, is more esthetic, less bulky and exceptionally failure resistant.

Family Of Ribbond Fibres

Since its introduction in 1992 because of the increased demand for more ideal properties in the fibres with enhaced ease of application and reduced chances of any failure,today Ribbond has a family of fibres suited for different application in the day to day dental practice.

It consists of :Ribbond THM,Ribbond original and Ribbond Triaxial (6)

Ribbond Original

Original Ribbond is a general purpose fiber reinforcement that can be used for the same applications as Ribbond-THM and Ribbond- Triaxial. It is thicker (0.35 mm) than Ribbond-THM .

Applications include : provisional bridges, composite bridges and reinforcement of removable prostheses.

Ribbond-THM (Thinner Higher Modulus)

Made from thinner fibers with a higher thread count, Ribbond-THM has a higher flexural strength than regular Ribbond and is only 0.18 mm thick .

THM adapts more closely to the teeth with even less memory than Original Ribbond and stays better in place before curing. Not only is the finished prosthesis thinner, Ribbond-THM it creates a smoother surface to the tongue .

Applications include : periodontal splints, orthodontic retainers, endodontic posts and cores or short span anterior bridges.

Ribbond Triaxial

The fibers in Ribbond Triaxial are oriented in a different design than our other Ribbond products. It is a hybrid of unidirectional and braided fibers forming a double-layered triaxial ribbon .

Ribbond-Triaxial is the material of choice for bridges, endodontic restorations, and other applications where strength, modulus of elasticity, and fracture toughness is the primary concern .

Applications In Dentistry

Ribbond Endodontic Post And Core:

It has the following advantages, compared to preformed posts, there is no additional tooth removal after endodontic treatment this maintains the natural strength of the tooth. It eliminates the possibility of root perforation because it is made when the Ribbond is in a pliable state, it conforms to the natural contours and undercuts of the canal and provides additional mechanical retention. There are no stress concentrations at the tooth-post interface. The Ribbond post and core is passive and highly retentive .

The core is only for retention of crown. It is essential that the crown preparations have a ferrule extending at least 1.5-1.2 mm onto the tooth .

Advantages of Ribbond-Composite Laminate Endo Post and Core are:

1. Because it is formed and shaped while the ribbond is in conformable state minimal to no additional removal of sound tooth structure is necessary in order to adapt the post to the root canal and pulp chamber.
2. Because Ribbond bonds to resin and adapts to the irregularities and undercuts within the root canal, it becomes retentive and anti-rotational once it is cured.
3. The Ribbond post and core requires no additional tooth preparation after endodntic treatment, which eliminates possibility of root perforation

Where esthetics are a primary concern, a Ribbond post, like a natural tooth, is translucent, as opposed to a metal post that presents opacity problems .

Trauma Stabilization

It allows for the construction of semi-rigid splints to stabilize mobile tooth during healing. Splints are easy to place, can be shaped and adapted to the teeth until cured, and esthetic. Splints are thin, smooth, and non-irritating to the injured lip.

Ribbond Trauma Stabilization Technique

1. Easy to make and remove .
2. Thin, smooth, and non-irritating to the lip .
3. Easy to control the degree of rigidity .

Composite Repairs

The key to Ribbond's attachment to composite is its patented leno weave. Designed with a lock-stitch feature that effectively transfers forces throughout the weave without stress transfer back into the resin, Ribbond's weave also provides excellent manageability characteristics. Having virtually no memory, Ribbond adapts to the contours of the teeth and dental arch .

Acrylic Repair

In general, when auto polymerizing acrylic resin is being used, the slower the set, the stronger the resin. Wet Ribbond with a "runny mix" of acrylic resin. Once Ribbond has been covered by a runny mix of acrylic resin you can handle it with your fingers. When doing a repair or using the channel technique for reinforcing an acrylic bridge, wet cut pieces of Ribbond with a runny mix of acrylic resin, lay it in the channel and then press it down into place with a doughy mix of acrylic resin. (7)

Periodontal Splint

Ribbond is perhaps best known for making periodontal splints. Ribbond splints are strong, highly bondable and esthetic. A Ribbond splint takes less time than traditional methods, is more esthetic, less bulky and exceptionally failure resistant. (8)

Advantage of splint:

1. Easy to Make
2. Esthetic
3. Strong
4. Durable
5. Proven
6. **Orthodontic Retainer**

For post orthodontic retainers for non-bruxing patients with 1/2 mobility or less, Ribbond offers the **Orthodontic Ribbond.** Using the same technique for making a periodontal splint, it is possible to make low bulk, bondable and esthetic retainers. (9)

Advantage of Retainer:

1. Easy to Make
2. Esthetic
3. Strong
4. Durable
5. Proven
6. Diastema Closure Maintanance

Advantage of Ribbond

1. Esthetic —No gray show-through
2. Durable —Does not harden and fracture like wire
3. Cementing Ribbond Bridges To The Teeth

Ribbond Reinforced Provisional Bridge Technique .

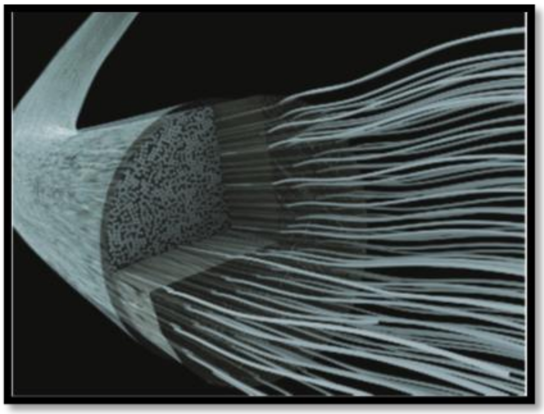
Because Ribbond also bonds to acrylic and bis-acryl, it is commonly used for making reinforced provisional bridges .

For longer-term bridges, multiple layers of Ribbond make a strong stress bearing laminate structure to act as a framework. For simple Provisional's, one piece is commonly used to prevent cracks from propagating through the resin past the Ribbond. Although a crack may start, the Ribbond prevents catastrophic failure and maintains the integrity of the bridges. (10)

Everstick

EverStick fiber reinforcement's are helpful in making endodontic post and core and various other endodontic and operative procedures. EverStick products address the advantages of minimally invasive dentistry where the patient´s own healthy tooth tissue is saved for as long as clinically possible. This also means that other treatment options remain available should the patient ever need them in the future. These are made of silanated glass fibers in thermoplastic polymer and light curing resin matrix which makes the strength and fracture toughness of EverStick reinforced prostheses unsurpassed by other fiber reinforcements. EverStick is a predictable tool to improve the applications of composite resins.

Cross-sectional view of everStick fiber.Silanated E-glass fibers are impregnated with resin to form the strong durable IPN structure



everStick fibers are strong due to IPN technology present. This IPN means that fibers can be positioned exactly where it is needed and they are easy to manipulate and control, these fibers are simple to place. It is having good aesthetics and because resin is impregnated throughout the fibers the subsequent application of bonding resin and composite is quick and simple.

The each fiber consist of reinforcement imbedded in a matrix of polymethyl methacrylate (PMMA) and bis-GMA (interpenetrating polymer network), making the fibers bondable not only to direct but also to indirect dental materials

Within the IPN structure,the individually silanated

E-glass fibers are surrounded by bis-GMA and PMMA

Family of everStick

Since its introduction because of the increased demand for more ideal properties in the fibers with enhanced ease of application and reduced chances of any failure.

Today it has a family of fibers suited for different application in the day to day dental practice. It consists of :

1. everStick®C&B,
2. everStick®POST,
3. everStick®PERIO,
4. everStick®NET,
5. everStick®ORTHO

1. everStick®C&B

It is used for minimally invasive fiber reinforced composite bridges as:

- Surface retained bridges
- Inlay and onlay bridges
- Hybrid bridges and temporary bridges
- Laboratory-made bridges

2. everStick®POST

It is used for advanced root canal post and core structures.it is provided with Individually formed root canal posts. It is also used in endodontic posts in combination with direct resin crown build-ups.

3. everStick®PERIO

It is used for the advanced root canal post and core structures and iti spspecifically provided with Individually formed root canal posts.

4. everStick®NET

It is used for easy and aesthetic splinting of traumatized teeth.,as

- Labial splinting of traumatized teeth
- Labial periodontal splinting
- Repair and reinforcing of veneers

5. everStick®ORTHO

It is used for aesthetic retention of maloccluséd teeths present and for the patient-friendly metal free orthodontic retainer.

Conclusion

Fiber-reinforced composite fixed pros-theses are an innovative alternative to traditional treatment. They have been increasingly studied during recent years and provide restorations with a considerable increase in strength. Structurally, fiber-reinforced composite is made up of two components: the fibers and the resin matrix. The resin matrix serves as carrier, protector and load-splicing medium around the fibers. To improve the mechanical properties of resin composites and to optimize the mechanical behavior of the material, in particular, oriented filler materials, such as glass fibers, aramid fibers, carbon/graphite fibers and ultra high molecular weight polyethylene fibers (UHMWPE), have been proposed.

In all of these cases, the acrylic or metal-composite bond was not sufficiently strong for long-term use and, due to these bond failures these techniques met with limited long-term success. In general, bonding a pontic fabricated of acrylic, composite, or the natural extracted tooth itself should be considered a short-term replacement. However, when an appropriate fiber reinforcement material is used, long-term success is more likely. The choice of material to reinforce composite resin should be based upon past history with clinical success.

The use of Ribbond®, a polyethylene fiber, is based upon the clinical reports of tooth replacement by Bredenstein and Sperber, Marcus, Miller, and Portilla, among others. Ribbond®. also has been described as being used for perio- dontal splints, strengthening removable prostheses, post and core fabrication, provisional and permanent bridges, denture repairs, and framework for composite onlays and crowns.

Splinting teeth for periodontal, orthodontic, or posttraumatic reasons is a common procedure. Although traditional methods are successful, splinting teeth with reinforcement fibers that can be embedded in composites has gained popularity.

Ribbond is a biocompatible, esthetic material made from a high-strength polyethylene fiber. The various advantages of this material include ease of adaptation to dental contours and ease of manipulation during the bonding process. Because it is a relatively easy and fast technique (no laboratory work is need), procedures can often be completed in a single appointment. It also has acceptable strength because of good integration of fibers with the composite resin; this leads to good clinical longevity. Because a thinner composite resin is used, the volume of the retention appliance can be minimized. In addition, in case of fracture during wear, the appliance can be easily repaired. There is no need for removal of significant tooth structure, making the technique reversible and conservative. It also meets the patients' esthetic expectations

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