Versatility of Ribbond in Contemporary Dental Practice

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Provision of innovative treatment solutions to various problems has always been the motto of medical scientific brains. Dentistry is no exception to this endeavor. 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. Designed with a lock-stitch feature, it effectively transfers forces throughout the weave without stress transfer back into the resin, providing excellent manageability characteristics. Having virtually no memory, Ribbond adapts to the contours of the teeth and dental arch. It is translucent, practically colorless and disappears within the composite or acrylic without show-through offering excellent esthetics. Ribbond's fibers are the standard in biocompatibility. The same material is also used in the construction of artificial hip and knee joints. By virtue of such wide spectrum of intended properties, it enjoys varied applications in day to day dentistry like: endodontic posts, periodontal splints, aesthetic space maintainers, bondable bridges and single bridges and orthodontic retainers. This paper is an attempt to showcase the versatility and applicability of this wonderful material in day-to-day dental practice.

Introduction

We humans have taken a lot from the nature and would continue to do the same. If we look the tree, it consists of innumerable number of fibres, which gives its structure, configuration and strength. Fibre reinforcement is one such achievement, which has been accomplished by inspiration from the nature. Fibre reinforcement is a proven technology today which is being in almost every field like the bus industry to ship manufacture to something complex like the wind mills to one of most important in today's world the bullet proof vests and jackets. Dentistry is no exception in accepting this technology in its stride. The use of fibre reinforced composites/ ribbons has become a day to day practice in clinical dental practice which has made life easier for the dentist at the same time helping him provide quality care to the patients.

Fibre reinforced composites

Fibre- reinforced composites are resin-based materials containing fibres aimed at enhancing their physical properties. These were introduced first in the 1960s by Smith when glass fibres were used to reinforce polymethyl methacrylates. This group is very heterogeneous one depending on the nature of the fibre, the geometrical arrangement of the fibres and the overlying resin material.

The main materials used are glass, ultra-high strength polyethylene fibres and Kevlar fibres. The arrangement of the fibres can be unidirectional with all fibres running in one direction or a weave or meshwork design fibres. The arrangement can be either braided fibres or woven fibres.

The manufacturing method of these fibres can be either through resin pre-impregnated ones or the types, which require a chair-side impregnation method, either ways the end result is the same. Key factors which influences the physical properties of fibre reinforced structures are: Fibre loading within the restoration and Efficacy of the bond at the fibre resin interface, fibre orientation and fibre position in the restoration.
Commonly used bondable reinforced fibres in clinical practice are: Ultrahigh molecular weight polyethylene fibers- Ribbond (Ribbond), Connect(Kerr), Glass Fibers- GlasSpan (GlasSpan) and fiber Splint ML(Polydentia), Fibers preimpregnated with resin Vectris (Vivadent), StickNet (StickTech) and FibreKor (Jeneric/Pentron).

Ribbond
Ribbond fibres introduced in 1992 to the market is a bondable reinforced fibres consisting of ultra-high strength polyethylene fibres. 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.

Structure
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. Having virtually no memory, Ribbond adapts to the contours of the teeth and dental arch. 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. Since fiber reinforced resin structures derive their strength primarily from making laminates, high manageability and lack of memory is essential for close and accurate layering of the fibers. Inaccurate fiber placement results in voids or excessive composite on the tensile side of the fibers that will be prone to fracturing. The unique fibre design renders the following properties to Ribbond: (Fig 1)

Adaptable and Manageable. Does not unravel when cut or manipulated. Reinforces multidirectionally durable & impact absorbent. Transfers stresses efficiently throughout the fiber network.

Other properties seen in Ribbond:

Highly Bondable
Ribbond bonds to any composite system. You choose the composite Magnified 110,000 time, SEM’s demonstrate complete incorporation of the resin to Ribbond’s fibers (note lack of voids). Forces within the resin are easily transferred to the fibers insuring that the Ribbond is an integral strength member of the prostheses.

Bonding to Composites
Place the cut piece of Ribbond on a contaminant-free (having no wax or oil). Mixing slab, pad or light-safe box and wet it with a few drops of unfilled bonding <adhesive, composite sealant or modeling resin. A “pit and fissure sealant” can also be used to wet Ribbond. Important: It is not recommended to wet the Ribbond with one step or 5th generation bonding systems. Sometimes these systems contain components (such as acids to etch the dentin or solvents) that can compromise the adhesion between the resin and the fiber. To avoid diluting the filled composite resin, blot off the excess unfilled bonding adhesive with a lint-free gauze or a patient bib. It is easier to work with the Ribbond if it is not overly saturated with unfilled resin. Once Ribbond is wetted with unfilled bonding adhesive, it can be handled as you would touch resin (with powder-free gloves or clean fingers). To minimize premature setting of the unfilled composite on the Ribbond, protect the wetted Ribbond from the light until ready for use.[1]

Bonding Ribbond to Acrylic Resins
In general, when autopolymerizing 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.

Figure 1: Unique cross-link lock stitch leno weave pattern of Ribbond Fibres.
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Esthetic
Ribbond is translucent, practically colorless and disappears within the composite or acrylic without show-through. Not only does Ribbond offer excellent esthetics, its translucency also allows the use of light cured composites.

Biocompatible
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.

Versatile
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.

Family Of Ribbond Fibres:
Since its introduction in 1992 because of the increased demand for more ideal properties in the fibres with enhanced 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

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.

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. Ribbond-THM offers the same crack-stopping leno-weave and high strength fibers of Original Ribbond with greater manageability, greater ease-of-use, and thinner results. Thinner Ribbond-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 creates a smoother surface to the tongue. Ribbond-THM covers easier with composite with less show-through of the fiber. Ribbond-THM is designed for use with applications in which thinness and higher modulus are the primary concerns. These applications include periodontal splints, orthodontic retainers, endodontic posts and cores or short span anterior bridges. Original Ribbond is the preferred material for applications in which the final breaking strength is the primary concern. These applications include provisional bridges, composite bridges and reinforcement of removable prostheses.

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. This patented design provides significantly greater multidirectional fracture toughness and greater modulus of elasticity than our other Ribbond products. 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. In addition to its greater strength and modulus of elasticity, another advantage of Ribbond-Triaxial for these applications is that it easily holds its form before polymerization and only requires one layer within the pontic area. Because Ribbond-Triaxial is thicker, it usually requires preparations. For applications in which preparations are not desired, Ribbond Triaxial can be used in conjunction with Ribbond-THM. (Fig 2).

![Figure 2. Comparison of thickness between Ribbond original & Ribbond THM.](image-url)
Applications In Dentistry:

**Ribbond endodontic post and core**

Technique minimizes the chance for root fracture and 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. 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. Furthermore, because Ribbond's translucent fibers take on the color characteristics of the composite it allows, for the natural transmission of light through teeth and crowns. This provides an exceptionally esthetic result [7,8] (Fig 3).

![Figure 3: Use of Ribbond for post and core preparation.](image)

**Constructing Periodontal Splints**

By bonding a Ribbond-composite laminate to the lingual of the teeth, you can construct a structural member that can stabilize periodontally involved teeth, act as a fixed orthodontic retainer, support a pontic, or retain an avulsed tooth. All these applications involve variations of a common technique. In general, it is easier to use the direct technique for the construction of periodontal splints, orthodontic retainers and splint-bridges using the avulsed tooth as the pontic. It is easier to use the indirect technique for the construction of bridges. [12](Fig 4).

![Figure 4: Splinting To Stabilize An Avulsed Or Traumatized Tooth Constructing Orthodontic Retainer](image)

Ribbond Orthodontic is designed to be used only for post-orthodontic mandibular retainers for non-bruxing patients with 1/2 mobility or less. It can also be used to maintain maxillary diastema closures when the relapse forces are passive. If the relapse forces are more active, the 1-mm ultra narrow or 2-mm Ribbond should be used. (Fig 5).

![Figure 5: Ribbond in post orthodontic patients as retainers.](image)

**Cementing Ribbond Bridges To The Teeth**

**Anterior Bridges**

In general, the construction of directly bonded bridges is a variation of the splint construction technique. This procedure is best done indirectly. If the teeth are very mobile, the Ribbond framework should extend over additional abutment teeth for added stabilization.
Maryland Bridge Framework

Using A Denture Tooth As The Pontic: Direct Technique

Because of the unpredictability of bonding acrylic resin to composite resin, it is not recommended using an acrylic denture tooth as a pontic for anything other than a provisional bridge. This technique is a variation of constructing an anterior bridge. Select and fit a denture tooth to the pontic space. Construct and cure a Ribbond framework beam. Modify the denture tooth on the lingual so that it fits closely over the Ribbond framework. Cut exaggerated mechanical retention in the modified area. Sandblast the retentive area of the denture tooth and wet it with a heat cured monomer. Apply an unfilled bonding adhesive to the groove and cure it. Fill in the retentive area of the denture tooth with hybrid composite resin and place it over the beam. Shape and smooth the composite resin. Light-cure the resin and check occlusion, finish and polish.

Crown Retained Bridges

Reinforcing an Acrylic Provisional Bridge

Wet cut pieces of Ribbond with a runny mix of acrylic resin, lay them in the channel and cover with acrylic. If the Ribbond has a tendency to float to the surface, it can be pressed back into the channel with a doughy mix of acrylic. If possible, use multiple layers of Ribbond with acrylic between each layer. Ribbond does not polish well. Avoid cutting into the Ribbond fibers.

Composite Repairs

Wet the Ribbond with the unfilled adhesive resin, composite sealant or modeling resin and blot off the excess with a lint-free gauze, cloth or a patient bib. Do not use one-step or 5th generation resin to wet the Ribbond. Place a filled composite resin in the deepest area of etch channel. Compress the wetted Ribbond into the composite resin. Light-cure for 40 to 60 seconds.

Apply an additional layer of filled composite resin and finish and polish. If possible, use multiple layers of Ribbond with composite between each layer.

Reinforce or Repair a Denture

Place the Ribbond as close to the oral-cavity side as possible, opposite the tissue surface on which the denture is pivoting. The greater the area covered with Ribbond, the stronger the repair will be. Follow the preceding directions for acrylic repairs.

Conclusion

It has always been the effort of scientific brains to provide innovative solutions to any problems faced by mankind. In this effort Ribbond as a highly versatile materials with an array of desirable properties certainly helps us in achieving this goal and in fulfillment of our dreams to help mankind and thus help ourselves.

References