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Clinical Application Of Ribbond In Large Posterior Composite Restorations: A Case Report

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Abstract
Background: *Polyethylene fiber reinforcement offers a novel approach to managing large posterior composite restorations, especially in high C-factor cavities.*
Case Report: *This report discusses a case of a 13-year-old female with deep occlusal caries on tooth no. 36 and a 25 year old female with secondary caries under an old amalgam restoration. The tooth was restored using Ribbond reinforcement under composite. The step-by-step technique involved selective etching, bonding, Ribbond placement, incremental composite layering, and follow-up radiography. The technique enhanced adhesion and minimized shrinkage stress.*
Conclusion: *Ribbond reinforcement improves tensile strength and fracture resistance, providing a minimally invasive yet durable restorative solution.*
Keywords: *Ribbond, Composite, Fiber reinforcement, Posterior restoration*

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I. Introduction

Advancements in adhesive dentistry and the improved mechanical properties of composites have transformed restorative dentistry. Large posterior restorations, however, still face challenges due to polymerization shrinkage and fracture risk.

Ribbond is a commercially available polyethylene fiber with a patented leno weave pattern and lock stitch design [1, 2].

It is an ultra-high molecular weight polyethylene material that is woven into a lock-stitch weave. It adapts well to tooth structure, reduces polymerization shrinkage, acts as a crack arrester and deflector (similar to the dentino-enamel junction), and helps distribute stress over a larger area.

In situations where tooth structure is compromised, such as high C-factor cavities, undermined cusps when full coverage is impossible, and teeth with pulpal floor cracks, the use of fiber reinforcement may provide a significant clinical benefit to the patient.[3, 4]

With the idea that the presence of the glass or polyethylene network would create a change in stress dynamics at the enamel/composite/adhesive interface, Meiers et al[5] tested shear bond strength of composite to flat bovine enamel surfaces, and concluded that the higher modulus of elasticity and lower flexural modulus of the polyethylene fiber have a modifying effect on how the interfacial stresses are developed along the etched enamel/resin boundary.

Structure

Ribbond is a ribbon reinforcement material commercially available since 1992. It consists of pre-impregnated, silanized, plasma-treated, leno-woven, ultra-high molecular weight (UHMW) polyethylene fibers. The leno-weave is a special pattern of cross-linked, locked-stitched threads that increase the durability, stability, and shear strength of the fabric.[6] The open and lacelike architecture of the leno-woven ribbond allows it to adapt closely to the contours of the teeth and dental arch. The dense network of locked nodal intersections of the material reduces the potential for damage to the fabric architecture by preventing the fibers from shifting during manipulation and adaptation before polymerization. The material has a three-dimensional structure due to the leno weave or triaxial braid. These features provide mechanical interlocking of the resin and composite resin at different planes, enabling a wide processing window. Additionally, microcracking is minimized during the polymerization of the resin.[7]

Case Report 1

A 13-year-old female patient reported with chief complaint of sensitivity to cold in the lower left back tooth region. There was no spontaneous pain.

Clinical examination revealed deep occlusal caries on tooth no. 36, with no mobility or tenderness to percussion, and radiographs showed no periapical lesion.

Diagnosis: Reversible pulpitis.

Treatment plan: Restoration with composite over Ribbond reinforcement.

Procedure: All the carious portion of the tooth was excavated. Selective etching of the enamel with 37% phosphoric acid for 30-40 seconds was done. After maintaining proper isolation. Tooth was air dried and bonding agent(3M) was applied. It was activated for 20 seconds followed by quick air drying and curing for 20 seconds. After soaking ribbond in bonding agent for 5 seconds, it was placed on the pulp chamber. Then was layered by flowable composite and cured. Glass ionomer cement (zirconomer, shofu) was used to layer the restoration further then the cusps of the teeth was build following proper tooth contours.

A follow up x ray was taken after 15 days. Patient was asymptomatic. Glass inomer cement was replaced by composite (3M, 350 XT) following proper tooth contours.

Fig: 1

Fig: 2

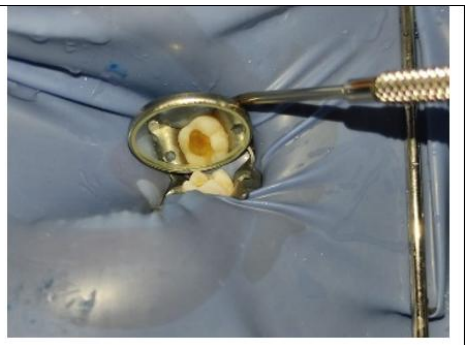

Fig: 3

Fig: 4

Fig: 5

Fig (1) pre op radiograph (2) pre op clinical picture (3) after caries excavation (4) ribbond placement (5) restoration with zirconomer

Case Report 2

A 25-year-old female patient reported with chief complaint of sensitivity to cold in the lower right back tooth region. There was no spontaneous pain.

Clinical examination revealed an old amalgam restoration with on tooth no. 46, with no mobility or tenderness to percussion.

Radiograph showed secondary caries and no periapical lesion.

Diagnosis: Reversible pulpitis.

Treatment plan: Restoration with composite over Ribbond reinforcement.

Procedure: All the old amalgam restoration was removed and the carious portion of the tooth was excavated. Selective etching of the enamel with 37% phosphoric acid for 30-40 seconds was done. After maintaining proper isolation. Tooth was air dried and bonding agent(3M) was applied. It was activated for 20 seconds followed by

quick air drying and curing for 20 seconds. After soaking ribbond in bonding agent for 5 seconds, it was placed on the pulp chamber. Then was layered by flowable composite and cured. Composite(3M, 350 XT) was used to layer the restoration further then the cusps of the teeth was build following proper tooth contours.

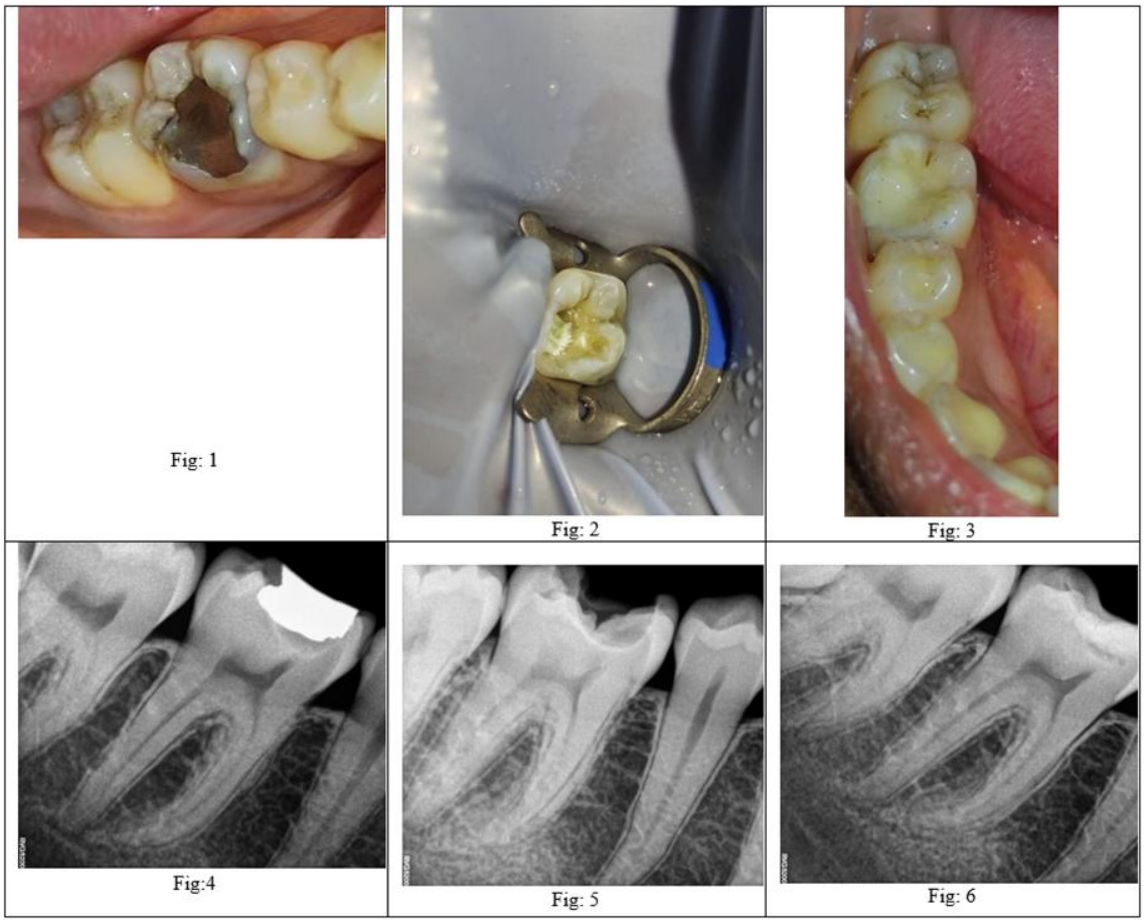

Fig (1) old amalgam restoration (2) ribbond placement (3) composite build up (4) pre op radiograph (5) radiograph after secondary caries excavation (6) post op radiograph

II. Discussion

Large posterior composite restorations present a unique biomechanical challenge due to high C-factor cavity designs that promote polymerization shrinkage stress, leading to marginal gap formation, debonding, and restoration failure. Incorporation of fiber reinforcement, particularly Ribbond, has shown promising outcomes in such clinical scenarios.[8] Ribbond, a high-strength ultra-high molecular weight polyethylene (UHMWPE) fiber with a patented leno weave, offers multiple advantages when placed at the base of composite restorations. Its flexible architecture allows it to conform to internal cavity contours, acting both as a crack arrester and a stress distributor—much like the natural dentino-enamel junction.[2] Studies by Meiers et al. and Freilich et al. have supported its role in enhancing the microtensile bond strength of composite resins and mitigating interfacial stress concentration in high-stress zones. [2,5]

In our technique, Ribbond was soaked in bonding agent and applied to the pulpal floor, followed by incremental layering of flowable and universal composites. This "wallpapering" approach, as highlighted by Sfeikos et al., modifies internal cavity stress dynamics and improves adhesion by reducing the bulk of the composite at the stress-prone floor.[9] While this technique shows significant promise, long-term clinical studies are needed to substantiate the survival rates of Ribbond-reinforced posterior restorations in high-stress occlusal conditions. Additionally, concerns regarding polymerization through Ribbond in deeper cavities must be considered, particularly with bulk-fill materials.

III. Conclusion

The use of Ribbond under composite restorations in large posterior cavities offers a predictable, conservative solution. It improves fracture resistance and longevity of restorations, making it a valuable adjunct in adhesive dentistry.

Patient Consent

Informed consent was obtained from the patient for publication of this case report, including clinical and radiographic images.

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