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Enhancing Structural Integrity of Endodontically Treated Teeth Using Resin-Reinforced Polyethylene Fibers

ABSTRACT

Endodontically treated teeth often present with compromised structural integrity due to extensive loss of tooth structure. Traditional post-and-core systems, while providing retention, may introduce stress concentrations leading to root fractures. This article explores the application of resin-reinforced polyethylene fibers, specifically Ribbond, as an alternative approach to reinforce endodontic buildups, aiming to distribute functional stresses more evenly and enhance fracture resistance.

INTRODUCTION

The restoration of endodontically treated teeth poses a significant challenge, primarily due to the substantial loss of coronal and radicular tooth structure. Conventional restoration methods, such as cast metal posts or prefabricated fiber posts, have been associated with stress concentrations at the post-dentin interface, potentially leading to catastrophic failures. The quest for materials and techniques that mimic the natural tooth's biomechanical properties has led to the exploration of fiber-reinforced composites (FRCs) in dental restorations.

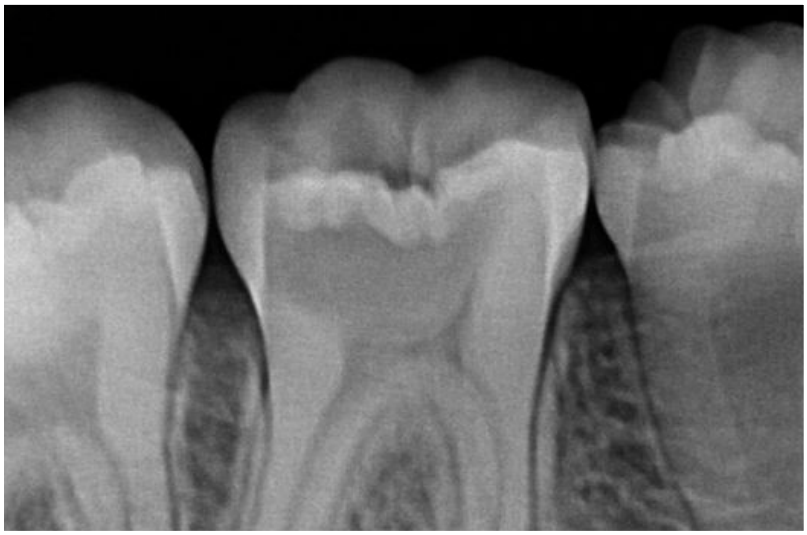
MATERIAL PROPERTIES OF POLYETHYLENE FIBERS

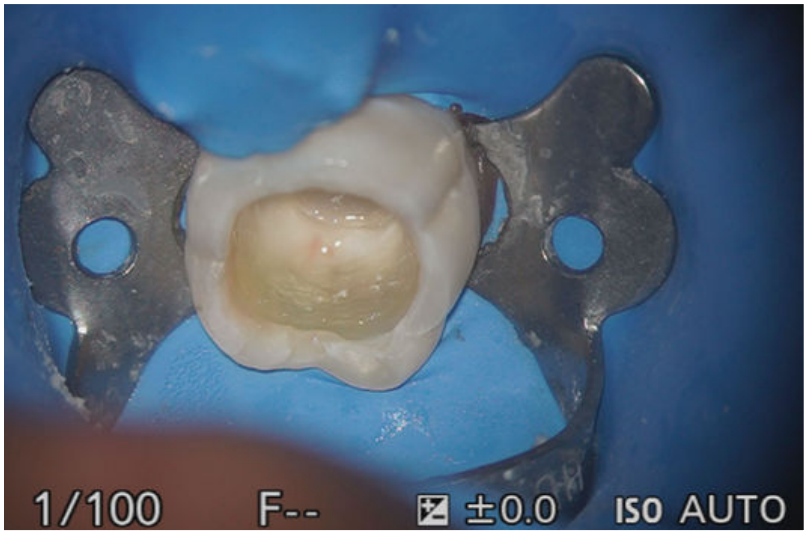
Polyethylene fibers, like Ribbond, are characterized by their ultra-high molecular weight and a unique leno-weave pattern, which imparts high tensile strength and resistance to crack propagation. When embedded within a resin matrix, these fibers can effectively distribute occlusal forces, reducing the likelihood of fracture initiation and propagation. The adaptability of Ribbond allows it to conform to the internal anatomy of the tooth, providing a customized reinforcement that aligns with the tooth's natural stress distribution pathways.

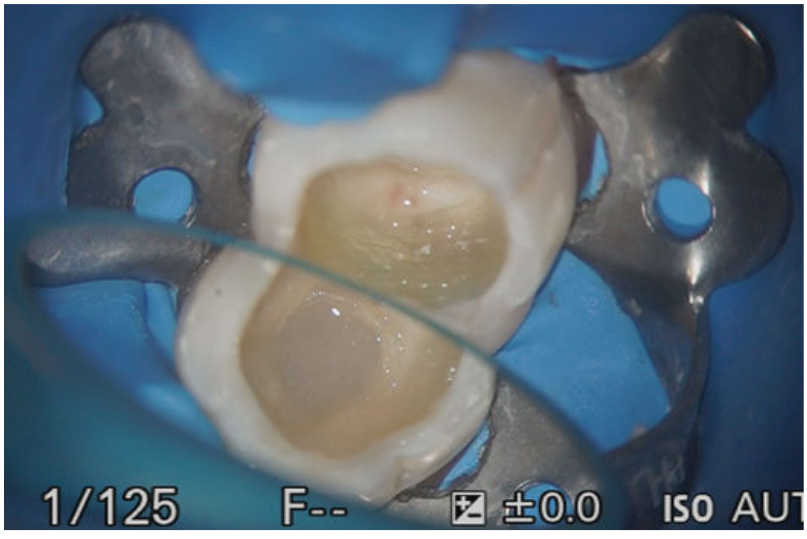
CLINICAL APPLICATION AND TECHNIQUE

The clinical application of Ribbond in endodontic buildups involves the following steps:

1. **Chamber Preparation**: After obturation, the chamber is prepared ideally by micro abrasion using 27 µm particles of Al2O3. A second generation bonding system such as SE Protect from Kuraray (selectively Etched enamel using 35% phosphoric acid for 15-30 seconds) or OptiBond FL from Kerr (total etch technique on both dentin and enamel) is subsequently used to prepare the dentin.
2. **Fiber Placement**: A suitable length of Ribbond is cut, wetted with an adhesive resin, and inserted into the chamber. The fiber is adapted to the chamber walls, ensuring intimate contact and optimal stress distribution.
3. **Composite Build-Up**: A flowable or packable composite resin is used to encapsulate the minimize polymerization shrinkage and ensure complete polymerization ***ribbond.com***







4. **Final Restoration**: The reinforced core can then be prepared to receive a full-coverage crown or other definitive restorations, depending on the clinical scenario.

EVIDENCE FROM LITERATURE

Several studies have evaluated the efficacy of polyethylene fiber reinforcement in endodontic restorations:

- A systematic review and meta-analysis concluded that fiber-reinforced composites, including those utilizing Ribbond, significantly enhance the fracture resistance of endodontically treated teeth compared to non-reinforced restorations .
- An in vitro study demonstrated that the incorporation of Ribbond fibers in composite restorations increased the fracture resistance of teeth with MOD cavities, suggesting a potential benefit in structurally compromised teeth ***PubMed Central+3ribbond.com+3BioMed Central+3***
- Clinical reports have indicated that direct fiber-reinforced composite resin restorations exhibit satisfactory performance over extended periods, with reduced incidence of catastrophic failures ***ribbond.com***

EVIDENCE FROM LITERATURE

The use of Ribbond fibers in endodontic buildups offers several advantages:

- **Biomechanical Compatibility**: The modulus of elasticity of polyethylene fibers closely resembles that of dentin, promoting harmonious stress distribution and reducing the risk of root fractures.
- **Conservation of Tooth Structure**: Unlike rigid post systems that may require extensive canal preparation, Ribbond allows for a more conservative approach, preserving remaining tooth structure.
- **Versatility**: Ribbond can be used in various clinical scenarios, including as an internal reinforcement for composite cores, splinting mobile teeth, and fabricating provisional bridges.

CONCLUSION

The integration of resin-reinforced polyethylene fibers, such as Ribbond, into endodontic buildups represents a promising approach to enhance the structural integrity of restored teeth. By distributing functional stresses more evenly and mimicking the natural biomechanical properties of dentin, this technique may reduce the incidence of restorative failures and prolong the lifespan of endodontically treated teeth. Further clinical studies are warranted to validate these findings and establish standardized protocols for their application.

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