IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

FIBRE REINFORCED COMPOSITE RESIN BRIDGES

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ABSTRACT:

One of the most important aspects of dentistry is replacing lost teeth, particularly in the anterior region. Compared to conventional fixed dental implants or prostheses, fiber-reinforced composite resin bridges provide a more conservative alternative. It is a reversible, minimally invasive procedure that can be finished in a single visit.(1) It became crucial to preserve dental hard tissue when preparing abutments, and advancements in adhesive and FRC technology made it possible to develop the idea of minimally invasive FDPs employing FRC materials that could be used chairside or in a lab.(2)

KEYWORDS: fibre reinforced composite resin, ribbond

INTRODUCTION:

For the treatment of missing teeth, fibre-reinforced composite resin (FRC) bridges have become a viable alternative. With these bridges, only one visit is required for the operation, and the abutment teeth can be preserved with little preparation. A plastic matrix reinforced with tiny, thin fibres makes up FRC. These bridges are made of a composite resin veneering over an FRC substructure layer. FRC bridges are also more aesthetically pleasing and may be made directly or indirectly for a lower price. In addition, FRC bridges offer an alternative to traditional cast metal resin-bonded bridges. Composite materials, porcelain, and acrylic resin were used to construct the FRC bridge's pontic.(3)

Commonly used fibres include glass fibres, carbon fibres, Kevlar fibres, polyethylene fibres, and Vectran fibres. These fibres are embedded within a resin matrix, often composite resin, to create a strong and aesthetic restoration.

Glass fibres:

Known for their good aesthetic properties and ability to improve impact strength of the composite. However, they may not bond as readily to the resin matrix as other fibre types.

Carbon fibres:

Enhance the strength and prevent fatigue fracture of the composite. However, their dark colour can be a drawback in aesthetic applications.

Polyethylene fibres:

Offer good impact strength, modulus of elasticity, and flexural strength. They are also relatively aesthetic, as they are almost invisible within the resin matrix.

Kevlar fibres:

Increase the impact strength of the composite, but they are also unesthetic and have limited use.

Vectran fibres:

A newer generation of fibres that offer good resistance to abrasion and impact, but they can be expensive and difficult to handle. (10)

COMPOSITION OF FRC BRIDGES:

Fibre reinforced composite resin bridges consist of two main components: fibre reinforcement and a resin matrix. These two parts work together to provide strength, durability, and aesthetic appeal.

1.Fibre Reinforcement:

The reinforcing fibres are usually made of glass fibres, though polyethene and occasionally carbon fibres may also be used. Depending on the therapeutic requirement, the fibres might be woven, braided, or placed unidirectionally. Their primary role is to improve the flexural strength and fracture resistance of the bridge, helping it withstands chewing forces.

2. Resin Matrix:

The resin part usually contains materials such as Bis-GMA (bisphenol A-glycidyl methacrylate), UDMA (urethane Di methacrylate), or TEGDMA (Tri ethylene glycol Di methacrylate). This matrix binds the fibres together and helps in shaping and adapting the material to the prepared site in the mouth. It also allows for proper aesthetics and polishability after placement.

3.Coupling Agent:

Silane coupling agents are used to chemically bond the fibres to the resin matrix. This connection strengthens the bridge's mechanical performance and lifespan.

4.Fillers (Optional):

Some systems include fillers such as silica or zirconia particles. These additives improve the composite's wear resistance, surface hardness, and visual appeal.

5.Adhesive System:

An adhesive is applied to the prepared tooth surface to ensure the bridge bonds securely. It ensures micromechanical retention and chemical adhesion between the composite bridge and natural tooth structures.(4)

Clinical Steps for Anterior FRC Bridge Placement

1.Case Selection

Suitable for replacement of anterior teeth, especially in young patients where conventional fixed prostheses or implants may not yet be advisable. Healthy abutment teeth with sufficient enamel for bonding should be present in a few designated scenarios.

2.Tooth Preparation

No-prep technique was used in the case report to preserve enamel. However, optional shallow grooves or sandblasting of the enamel may be used to enhance retention. Surfaces were cleaned and roughened with abrasive disks.

3.Isolation

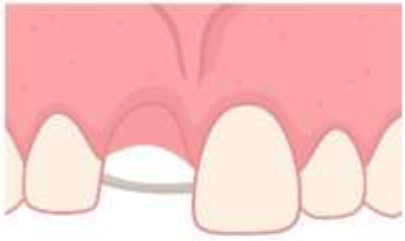
Rubber dam isolation was used to ensure a dry working field and avoid contamination with saliva.

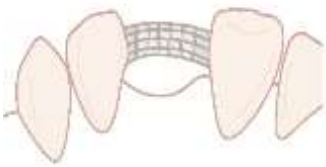
4.Enamel Conditioning

Etching of the enamel with 37% phosphoric acid for 20 seconds. Thorough rinsing with water and gentle drying. Application of bonding agent to etched surfaces and light-curing according to manufacturer's instructions.

5. Fibre Placement

Resin-impregnated glass fibre ribbon (e.g., polyethylene or glass fibre) cut to the appropriate length to extend across the edentulous space and onto the lingual surfaces of adjacent teeth. Using flowable composite resin, the fibre was placed as needed.. The fibre was light-cured to stabilize its placement.





Labial view palatal view

6. Pontic Formation (Tooth Replacement Build-Up)

The pontic was built directly using incremental composite resin layering Every composite layer was carefully designed to closely mimic the structure of the natural tooth. Each increment was light-cured individually to ensure complete polymerization.

Labial view after poetic build up

7.Finishing and Polishing

After building the pontic, the entire bridge was shaped and polished using finishing burs and polishing discs. Occlusion was checked and adjusted to avoid any undue stress on the bridge. Final polishing provided smoothness and aesthetics resembling natural dentition.(5)

Ribbond fibre

Everstick c

Advantages of FRC Bridges:

1.Conservative Preparation

Requires minimal or no tooth reduction, preserving enamel—ideal for young or patients preferring conservative treatment.(6)

2.Aesthetic Appeal

Composite veneering over fibre frameworks allows for superior translucency and colour match to natural teeth(7)

3.Metal-Free and Biocompatible

Avoids potential allergic reactions and eliminates unsightly metal margins.

4.Lightweight and Comfortable

FRC frameworks are significantly lighter than traditional metal-ceramic bridges(8)

5. Chairside Fabrication & Repairability

Can be fabricated in a single visit or lab-processed; easy to repair intraorally if fractured.

6. Cost-Effective

Lower material and lab costs compared to metal or ceramic-based prostheses(8)

Disadvantages of FRC Bridges

1. **Lower Structural Strength**

   Less suitable for long-span or posterior bridges, with reduced fracture resistance compared to metal or zirconia (6)

2. **Technique-Sensitive**

   Requires meticulous bonding, fibre positioning, and isolation for optimal success.

3. **Wear and Discoloration**

   Composite veneer may wear or stain over time, especially in patients with parafunctional habits or high-stain intake (8)

4. **Limited Longevity**

   Long-term clinical data remains limited; may serve better as interim solutions(7)

Indications

1. **Replacement of a single anterior tooth**

   FRC bridges effectively replaces a missing anterior in a growing child, preserving enamel and tissue

2. **Temporary (provisional) restoration**

   it has been reported high survival rates (~95%) when using FRC substructures as temporaries before definitive prostheses.

3. **Conservative treatment for young or anxious patients**

   Suitable when implants are contraindicated or deferred; using a no-prep, chairside method preserves dental structure.

4. **Metal-free restoration requirement**

   Ideal for patients with metal allergies or those prioritizing aesthetics without metal visibility in the anterior region (9)

Contraindications

1. **Large edentulous spans or posterior replacements**

   FRC frameworks have limited flexural strength and are prone to fracture in long span or posterior bridges under high occlusal load

2. **Poor bonding substrate on abutments**

   Adequate enamel (for etch-and-bond) is crucial; inadequate bonding surfaces significantly increase the risk of debonding.

3. **Parafunctional habits (e.g., bruxism)**

   Composite veneer may wear quickly, and FRC frameworks can fail under heavy occlusal forces from grinding/clenching

4. **Insufficient oral hygiene**

   Plaque buildup can lead to gingival inflammation, secondary caries, and bond failure

5. **Maligned or unstable abutments**

   Rotated, tilted, or mobile teeth compromise bridge fit, bonding, and longevity (10)

CONCLUSION

FRC bridges offer a minimally invasive and aesthetic solution for tooth replacement, especially in young patients and anterior regions. With proper case selection and technique, they provide functional and cosmetic benefits, though they are best suited for short-term or interim use.

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