

ABSTRACT

Evaluation of fiber enriched composite resin for adhesive tooth restoration

The subject of the present thesis is the capacity of glass fiber to improve mechanical properties of dental resin composites.

Nowadays composite resins reached a fast development even if they still show some limits in term of mechanical properties.

During masticatory cycle there is a slow and repetitive cycling loading, which decreases the strength of particulate filler composite resins (PFCs) that, in case of big restoration, could bring to a fracture of the restored teeth. For this reason, there is an increment in the use of resin composite but in case of large dental tissue loss, prosthetic solution was still preferred. Thus, in recent years, the incorporations of fibers inside composites has been introduced in order to improve properties and clinical application of these materials.

Fiber Reinforced Composite (FRC) can be used in higher stressed areas because have better flexural strength properties than commercial composite. Moreover, thanks to their silane preimpregnation, have better control on the polymerization-shrinkage stress. This could decrease interfacial gap formation and the probability of failure of the restorations.

The present series of experiments aimed to investigate the mechanical properties of fiber reinforced composites and their possible application to direct restorations. In particular, FRC were tested to determine their effect on flexural strength, on the marginal adaptation and the fracture resistance if applied on direct composite restorations of endodontically treated teeth, which represent one of the most critical clinical condition to deal with.

Based on the studies included in this thesis, the following conclusions were drawn:

- The use of glass fiber inserted horizontally within a direct composite restoration didn't show a significant increment in mechanical properties. In particular, flexural strength and fracture toughness test didn't show any increase when horizontal fibers were used.
- The insertion of horizontal glass-fibers seemed to reduce marginal gap after cyclic loading

- Fractographic analysis showed that glass fibers with a buccal-palatal orientation partially deviated fracture, even if it did not prevent catastrophic fracture of the specimens.
- The use of short fiber resin composite for direct restorations of endodontically treated teeth significantly improved fracture resistance if specimens were immediately loaded until fracture.
- Cyclic loading induced a decrement of fracture resistance of direct composite restorations with fibers.
- Fractographic analysis of short glass fiber samples seemed to show more repairable fracture pattern in comparison with commercial direct restoration. However, further studies are necessary to verify the fracture pattern with standardized occlusal loading.

Further studies are needed to evaluate Fiber Reinforced Composite behavior on marginal gap and fracture pattern, considering the anatomy of the occlusal surface and the design of the cavity margin.