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Fiber reinforced composite restoration - A Case Report

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Abstract

The aesthetic aspect of dental care has become increasingly important in the last several years, and many new materials and techniques have appeared. Interlig® is a reinforced composite material with glass fibers, with a range of applications temporary periodontal or orthodontic immobilization, for emergency treatment of teeth lost due to periodontitis, pre-surgical splinting, for the reinforcement structure of fixed prosthesis, for making intraradicular cores. This case report is an attempt to enlighten the clinical aspects of reinforced composite restorations.

Keywords: Fibers, Polymerization, Shrinkage.

Introduction

The aesthetic aspect of dental care has become increasingly important in the last several years, and many new materials and techniques have appeared. One of these— the composite resin.

Direct composite restorations are commonly used to restore cavities in both anterior and posterior teeth. Clinical performance of composite restorations has improved along with the development of filling material properties.

After many significant material improvements restorative composite still suffers lack of mechanical properties and problems related to polymerization shrinkage.

Clinical studies have shown that direct fillings fail predominantly because of occlusal wear or secondary caries. However, fracture of restorative composite is also reported as a common reason for replacement. Due the failures of this kind, it is still controversial, whether restorative composites should be used in large high-

stress bearing applications such as in direct posterior restorations. The relatively high brittleness and low fracture toughness of current composites still hinder their use in these large stress-bearing restorations.

Studies have been undertaken to evaluate and improve restorative composite resin against wear and lower the polymerization shrinkage. Attempts have been made to change type of filler or filler size and their salinization, by changing the polymerization kinetics of resins and to influence the degree of monomer conversion. Reinforcing the resin with glass fibres, with fiber-reinforced composite (FRC) substructure, whiskers, particulate ceramic fillers (dense and porous) and optimization of filler content are among the methods that have been studied. Some other aspects relating to indirect laboratory made composites have been investigated by using post-curing to enhance composite strength and toughness.[1] Recently, short fiber reinforced composite has been introduced as a dental restorative composite resin. The composite resin is intended to be used in high stress bearing areas especially in molars. The results of the laboratory mechanical tests revealed substantial improvements in the load bearing capacity, the flexural strength and fracture toughness of dental composite resin reinforced with short E-glass fiber fillers in comparison with conventional particulate filler restorative composite resin. The short fiber composite resin has also revealed control of the polymerization shrinkage stress by fiber orientation and, thus, marginal microleakage was reduced compared with conventional particulate filler restorative composite resins. It is suggested that short fiber composite resin could be used to fulfill the requirements for the ideal posterior restorations. The short fiber composite is intended to be used as bulk substructure material which will be covered by a layer of particulate filler composite.[2]

Dental fiber-reinforced composites (FRCs) have been studied and developed since the 1960, although breakthroughs in the research happened in the early 1990s. Manmade high aspect ratio fillers of fibers have been used since ancient times to reinforce bricks and buildings. Modern FRCs have diverse applications such as the airspace industry, sport industry, and car industry, where high static and dynamic strength and fracture toughness, especially in relation to weight, are desired properties. Dental and medical devices are typically subjected to repeated loading cycles by the masticatory system or by the weight of the body during physical exercise. FRCs are typically designed to have the highest possible reinforcing efficiency against the direction of stress, and with this in mind, they often represent an anisotropic material in terms of their mechanical properties. Additionally, some other clinically important properties such as optical, surface, chemical, and physical, thermal, and polymerization contraction are related to the direction and alignment of fibers in the FRC.[3] From the point of view of materials science, FRCs are a material group of choice for dental and medical needs.

At the moment FRCs are used in fixed prosthodontics, restorative dentistry, periodontology and orthodontics in various applications. Dental reconstructive devices have been made for hundreds of years from materials such as metal, and in the twentieth century also from synthetic inorganic and organic materials, including ceramics and resin-based materials. This has been happening through the development of biomaterials since they were first established as a scientific discipline, and it has been strongly related to the development and way of using materials in dentistry. The structural designs of elements in natural materials are to a large extent based on fibrous materials. Fibrous materials provide high tensile strength

to the structure, typically in the direction of the fibers. The dental treatment approach, which beneficially utilizes the versatile properties of FRCs, is called the "dynamic treatment approach," where the restorative and prosthetic treatment starts with minimal intervention and, only if needed, heavier and more destructive conventional prosthodontic treatments will be used later in the patient's life.

There is no relevant data in literature about use of reinforcement composite restorations. So this case report is an attempt to enlighten the clinical aspects of reinforced composite restorations.

Case report

A 35-year-old female patient reported with a chief complaint of decayed tooth in lower right back teeth region since last 6 months. She was asymptomatic. The medical history of the patient was non-contributory. The teeth was not mobile.

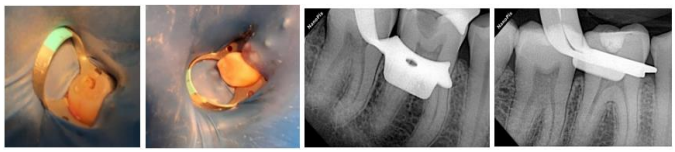
Pulp vitality test with electric pulp tester (EPT) showed that 36 was vital.

Thermal tests with heated Gutta-percha (GP) and pencil ice sticks gave a positive response.

Reinforced Composite restoraration was planned. The treatment plan was discussed with the patient and consent was taken.

Restorative procedure

Concerning the method of isolation, the use of rubber dam or simply cotton rolls and aspiration, will be determined according to a predetermine scheme of randomization. Prepared the large cavity then etchant is applied. Bonding agent is placed according to the manufacture instructions. Composite resin was placed on the bottom of cavity prior placing the interlig impregnated reinforcing glass fibre material (Angelus) and above that composite resin was placed again. The composite material was light cured according to an incremental technique. Occlusion is carefully adjusted with articulating paper. Finishing and polishing procedures were carried out at same visit after occlusal adjustment.



(Reinforced Fibre Composite Restoration)

Evaluation

The restoration was evaluated after 1 month, 3 month and 6 month follow up by the same operator. The restoration was evaluated according to the following characteristics marginal adaptation, post-operative sensitivity, pulpal pain and secondary caries. Photographs and X-ray records were used. The results showed there is no marginal leakage, no pulpal symptom, no post-operative sensitivity, no secondary caries and no fractured restoration.

Discussion

Interlig® is a reinforced composite material with glass fibers, for use in the clinic, with a range of applications: temporary periodontal or orthodontic immobilization, for emergency treatment of teeth lost due to periodontitis, pre-surgical splinting, for the reinforcement structure of fixed prosthesis, either mediate or immediate, for making intraradicular cores, for space retaining in primary or permanent dentition, for reinforcement of acrylic structure (provisional, total prostheses), for reinforcement of large restorations of composite resin. Interlig® glass fibers are intertwined, which facilitates the use by the dentist. Their maleability is superior than that of the polyethylene fibers.

The glass fibers are impregnated with light-cured composite resin, and for this reason, no other type of adhesive or resin is needed to impregnate them. Pre-impregnation facilitates handling and improves bonding

between the glass fibers and the composite resin. The fibers are pre-impregnated with an unfilled resin matrix, using an immersion process with controlled time and temperature, in order to guarantee complete absorption and, consequently, guaranteeing the better mechanical performance of the product.

Ever stick glass fiber reinforcements have been developed to provide solutions for modern, patient-friendly dentistry. ever Stick fiber reinforcements are made of silanated glass fibers in thermoplastic polymer and light curing resin matrix.

This product address the advantages of minimally invasive dentistry where the patient´s own healthy tooth tissue is saved for as long as clinically possible. The bond strength is the best future of Ever stick GC fuji reinforcement material.[5]

Ribbond mitigates the harmful effect of C-factor. Shrinkage of the composite against the tooth is dramatically reduced preventing gap formation, leakage and sensitivity.[6] Published research articles confirm that incorporating ribbond into composite restorations provides the following benefits

- Increased micro-tensile bond strength
- Mitigating the harmful effect of c-factor
- Minimizes polymerization and decreases shrinkage and leakage
- Bridging cracks on pulpal floor
- Increased fracture toughness
- Stress distribution and energy absorption mechanism
- Fail-safe design
- Relieves causes of symptoms of split tooth syndrome

E-splint is Esthetic fiber material. Medical grade polyethylene fibers are weaved into tight structural threads. This mainly indicated in reinforcement of large restorations.

Conclusion

The clinical performance of combination of bulk short interlig fiber composite substructure and surface layer of particulate filler composite is highly successful.

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