Indirect Aesthetic Adhesive Restoration with Fibre-Reinforced Composite Resin

S. A. M. Corona, P. P. N. S. Garcia, R. G. Palma-Dibb and D.T. Chimello

Abstract: **This paper describes the restoration of an endodontically treated upper first molar with a fibre-reinforced onlay indirect composite resin restoration. The clinical and radiographic examination confirmed that the tooth had suffered considerable loss of structure. Therefore, an indirect restoration was indicated. First, a core was built with resin-modified glass ionomer cement, followed by onlay preparation, mechanical/chemical gingival retraction and impression with addition-cured silicone. After the laboratory phase, the onlay was tried in, followed by adhesive bonding and occlusal adjustment. It can be concluded that fibre-reinforced aesthetic indirect composite resin restoration represented, in the present clinical case, an aesthetic and conservative treatment option. However, the use of fibres should be more extensively studied to verify the real improvement in physical and mechanical properties.**

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Clinical Relevance: **Morphofunctional and aesthetic restoration of a broken-down tooth may be achieved by the use of a fibre-reinforced indirect composite resin system.**

The use of composite resins in posterior teeth has increased considerably in the last decade, and it has been increasingly accepted because of improvements in their physical and mechanical properties.[1] In an attempt to obtain restorative systems with good aesthetics and minimize the adverse effects of polymerization contraction, inlay and onlay aesthetic indirect composite resin systems have been developed.[2] Currently, indirect resins have broad potential clinical application, providing adequate protection to remaining tooth tissues (onlays), relatively conservative cavity preparations (inlays) and improved marginal seal characteristics versus non adhesive restorations.[3,4]

***S. A. M. Corona**, DDS, PhD, Associate Professor, Department of Restorative Dentistry, Ribeirão Preto School of Dentistry, University of São Paulo, Brazil, **P. P. N. S. Garcia**, DDS, PhD, Assistant Professor, Department of Social Dentistry, School of Dentistry, Araraquara, State University of São Paulo, Brazil, **R. G. Palma-Dibb**, DDS, PhD, Associate Professor, and **D.T. Chimello**, DDS, MS. Postgraduate, Department of Restorative Dentistry, Ribeirão Preto School of Dentistry, University of São Paulo, Brazil.*

Parallel to the evolution of restorative systems, there have been improvements in adhesive systems and luting agents,[5] and the concept of using fibre-reinforced composite resins has been introduced.[6] However, it is only recently that the clinical use of fibre-reinforced composites has gained clinical acceptance. The association of composite resin to glass or polyethylene fibres is a procedure that can be accomplished either directly by the dentist or indirectly by the dental technician. Its clinical applications include splinting, fixed prosthesis substructures, bridges, provisional prostheses and inlay/onlay and crown substructures.[7-11]

Many fibre systems are now available on the dental market, with different methods of incorporating the composite resin to the fibre. Some need to be impregnated with resin, whilst others are supplied in pre-impregnated form.[12,13] The pre-impregnated systems provide the operator with a technique containing fewer steps, optimal mechanical properties, homogeneous impregnation with resin and stable handling characteristics. On the other hand, systems that need to be impregnated either by the dentist or the dental technician may show failures in relation to incomplete impregnation of the fibre bundles, which may decrease flexural properties. In addition, manipulation may promote contamination of fibre surfaces and consumes more clinical time. In relation to the architecture and arrangement of the fibres, they can be presented either as unidirectional strands or come braided or woven with a mesh pattern.[4] The unidirectional products possess parallel fibres and show higher flexural strength, this factor being of great importance to the accomplishment of fixed prostheses. Each fibre system offers advantages and disadvantages, so it is of great importance that the professional has a detailed knowledge of these to select the system best suited to each clinical case.

The present work relates the accomplishment of a fibre-reinforced

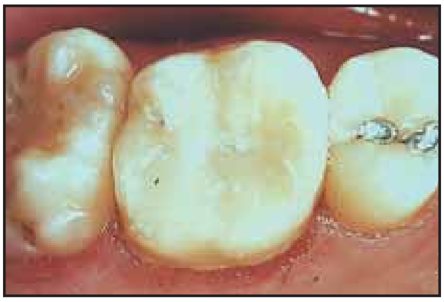

***Figure 1**. Clinical aspect after the accomplishment of the core.*

onlay composite resin restoration, using the *Luc'Star*™ system (Fortaleza, Brazil), with the aim of improving the mechanical properties of the restoration without interfering in its aesthetics.

CASE REPORT

An 18-year-old female patient presented with her upper right first molar which had extensive coronal tooth tissue destruction and had been endodontically treated, based on the clinical radiographic examination. It was observed that the patient presented with low caries risk, a good level of oral hygiene and favourable occlusion, suggesting the indication for a fibre-reinforced indirect composite resin restoration.

A core was built using resin-modified glass ionomer cement *Vitremer*™ (3M ESPE, Dental Products, St. Paul, MN, USA). First, one layer of *Vitremer Primer* was applied on the dentine surface with a microbrush, followed by photopolymerization for 40 seconds. Then, *Vitremer* cement was mixed according to manufacturer's instructions and inserted in a single increment with the aid of a *Centrix*™ syringe (Centrix Inc., CT, USA) (Figure 1). Therefore, the core retention was achieved in part by the remaining cavity walls and in part by the conditioning agent, which predisposed the substrate to the chemical adhesion of the cement. Following that, the onlay preparation was carried out, which covered the palatal cusps, and attempted to preserve a maximum amount of sound dental tissue. The biomechanical principles that rule the indirect cavity preparations were carefully observed, so that the occlusal and axial reductions were approximately 1.5 mm. The cervical finish line had a chamfered form (Figure 2).

After cavity preparation, gingival retraction was carried out prior to the impression, using a mechanical-chemical technique with the aid of a gingival retraction cord (*Ultrapak*™ Cord #00, Ultradent Products, Inc., Utah, USA) saturated with a haemostatic solution of 15.5% ferric sulphate (*Astringedent*™ Tissue Management Kit, Ultradent Products, Inc., Utah, USA). The cord was positioned 0.5–1.0 mm subgingivally and maintained there for 3 minutes. Following that, the cord was carefully removed and the impression was taken.

The impression material used was an addition-cured silicone (*Aquasil*™, Dentsply, Caulk, Milford, USA). The technique used was the simultaneous putty/wash impression technique, associating the putty and the low viscosity material simultaneously (Figure 3).

A provisional restoration was made with *Fermit*™ resin (Ivoclar Vivadent AG, Schaan, Liechtenstein) – a light-cured resin for provisional restorations, and the hybrid composite *Z100*™ (3M ESPE Dental Products, St. Paul, MN, USA) (Figure 4). *Fermit* was inserted into the cavity, so that it formed a layer 2 mm thick approximately, recovering all the cavity walls, without previous acid conditioning or application of adhesive system. This layer was light-cured for 40 seconds. The cavity was filled with *Z100*, according to the incremental technique. *Fermit* constituted the inner surface of the provisional restoration in contact with the tooth, and its rubber-like consistency after polymerization allowed the correct adaptation to the cavity walls. On the other hand, *Z100* provided the restoration with optimal physical properties.

This technique was chosen because the tooth to be restored did not present with pulp vitality and had been endodontically treated. Therefore, in this specific case, there was not the risk of post-operative sensitivity. This technique allowed the placement of the

***Figure 2.** Onlay cavity preparation recovering the palatal cusps.*

***Figure 3.** Impression of preparation.*

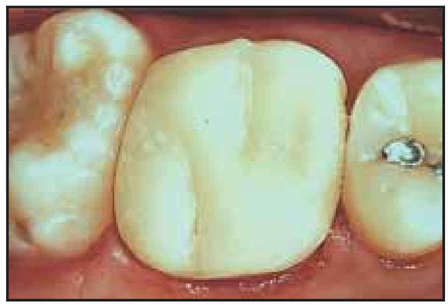

***Figure 4**. Provisional restoration.*

provisional restoration without cementation, owing to its high adaptability to the cavity, while being easily removed with the aid of a sharp instrument. The advantage was the absence of cement remains when the restoration was removed. However, it has been chosen because the provisional restoration would stay in the mouth for a short period (only one week). Paul and Scharer[14] showed considerable decrease in bond strength values to dentine after using various eugenol-containing provisional cements. Therefore, *Fermit* may have beneficial effects on the bond strength values.

After the working model had been obtained, the laboratory phase was performed. First, a layer of light-cured composite resin *Dialog*™ (Schütz

Figure 5. *Insertion of ProTec CEM cement.*

Figure 6. *Final clinical aspect.*

Dental GmbH, Rosbach, Germany), B4 colour, was adapted into the working die cavity in a single increment of approximately 2 mm (maximum thickness). Over this uncured composite resin base layer, the *Luc'Star* fibre was laid. The working model was taken to the *Luc'Star* curing equipment, where the restoration was polymerized under vacuum for 10 minutes with halogen light. The resin *Dialog* was placed on the fibre according to the incremental technique, in increments not thicker than 2 mm. Each increment was photopolymerized with the *Luc'Star* equipment for the time as previously described. The last layer of composite resin onlay received additional polymerization with the *Cure-Lite* (Jeneric/Pentron Inc., Wallingford, CT, USA) light-cure equipment for 5 minutes. The *Cure-Lite* equipment allows both thermically and light-activated polymerization, thus providing the surface composite resin with higher strength and better smoothness.

The onlay restoration was then finished, polished and subjected to internal grit blasting with aluminum oxide particles of 50 mm at 80 psi and 2 mm nozzle distance. 'Scanning movements' were carried out with the aim of treating all the inner surface. One week after the previous clinical session, the provisional restoration was removed from the cavity with the aid of a sharp instrument, and the onlay was tried in to confirm fit and aesthetics before adhesive bond, using the resin-modified glass ionomer cement *ProTec CEM*™ (Ivoclar Vivadent AG, Schaan, Liechtenstein), which presents a dual cure mechanism.

Following try-in, the enamel and dentine cavity surfaces were treated with *ProTec CEM* Conditioner (Ivoclar Vivadent AG, Schaan, Liechtenstein) applied for 15 seconds and then gently air-dried (it was not rinsed).

The resin-modified glass ionomer cement was mixed according to manufacturer's instructions and placed both into the cavity preparation and against the fit surface of the restoration (Figure 5). Gentle pressure was employed when positioning the restoration at the cavity; marginal excess was removed and pressure maintained until the material was set. Final removal of any minor excess was accomplished with the aid of dental floss (proximal surfaces) and a sharp probe (buccal and lingual surfaces). The occlusion was checked with ultra-fine carbon marker and adjusted with a 30-blade finishing bur (Figure 6). Although some studies reported lower mechanical properties to resin-modified glass ionomer cements as compared to resin lutes,[15] they have been shown to provide indirect restorations with satisfactory clinical durability and protection against recurrent caries.[16]

CONCLUSION

Indirect aesthetic fibre-reinforced composite resin adhesive restorations in posterior teeth may provide the patient with a good restoration in terms of aesthetics and cost-effectiveness, thus constituting a favourable treatment option when compared to metal restorations or prosthetic tooth replacement procedures. However, the use of fibres should be more extensively studied to verify if their inclusion in inlays/onlays restorations could really offer an improvement in their physical and mechanical properties.

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