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Fiber Reinforced Composite Inlay - A Case Report

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Abstract

Demand for esthetic restorative materials has greatly increased. Reinforcement with fibers has been introduced since 1960, but the interest in use of this material is recent. Resins, when associated with reinforcement fibers, present properties which, depending on the clinical indication, approach ceramics.

Restorations with very divergent proximal boxes make it difficult for correct adaptation of matrix and interproximal wedge, thus resulting in failure in the marginal adaptation. This technique of extra oral restoration allows for the optimization of the properties of the material, which can be reflected in a better final clinical performance of the restoration. The properties of the reinforcement fibers showed that its incorporation with composite resin increased its elastic modulus. It was demonstrated that use of fibers to reinforce resins generates high tensile strength and low shear strength, since they are materials with an elastic modulus similar to dentin. This article presents two case reports with a 6 month follow up where in fiber reinforced composite inlays were used to restore teeth with large carious lesions.

Keywords: composite inlay, composite oven, fiber reinforced

Introduction

In recent years, the demand for esthetic restorative materials has greatly increased (1). Restorative techniques aimed for preservation of the dental structure have garnered significant attention in the clinical practice (1). With the improvement and greater development of adhesive restorative materials, modern dentistry has provided various clinical options to re-establish the aesthetic and masticatory function for the patient and professional satisfaction for the Dental Surgeon (2).

Reinforcement with fibers has been introduced since 1960, but the interest in the use of this material is recent (3). Reinforcement fibers of glass, polyethylene, kevlar, carbon, and combinations of fibers can be used (3).

The infrastructure of fiber-reinforced composite is translucent and needs no opaque material, which allows a minimal layer of particulate composite veneering resin and excellent aesthetics. The light-cured fiber-reinforced composite infrastructure has an oxygen inhibited layer, sticky on its outer surface that allows a direct chemical bond with the veneering composite, eliminating the need for mechanical retention that would be required with a metallic structure (4).

Based on their characteristics, indirect resin composites cover today a range of indications, including inlays, onlays, overlays and short-span fixed denture prostheses (FDP) (5).

In situations where large losses of tissue are observed, the indication is to execute indirect restorations to be cemented in an adhesive manner. This treatment involved more than one clinical session and one laboratory step. A composite resin restoration for clinical use can be prepared on a semi-rigid model, in the same clinical session as the preparation and the molding.

Case Report

A 34 year old male patient was referred to the Department of Conservative Dentistry and Endodontics, Manav Rachna Dental College. The mandibular left first molar had a large carious lesion involving more than ¼ intercuspal distances. Although the pulp was vital the remaining tooth structure was considered inadequate for a direct restoration. In the concept of minimally invasive restoration, the treatment of choice was an indirect fiber reinforced composite inlay.

The caries was removed after administration of sufficient anesthesia . All the unsupported enamel was removed. The cavity preparation was modified as the guide lines of tooth preparation to receive an inlay(Figure 1). The impression was made with Affinis Putty (Coltene) and one step/two viscosity technique. The shade was selected using the Spectrphotometer. A direct provisional restoration was placed using temporary cement (Cavit G 3M ESPE). The positive replica of this impression was made using die stone. (6).

The working model was isolated with vaseline(Figure 2) on the area corresponding to the prepared teeth and the sectional matrix was placed (Figure 3). The first increment of resin was placed with the aid of composite instruments for preparation of restoration of composite resin (Ceram.X Duo, Dentsply), incorporating fragments of reinforcement fiber into it (Figure 4). After adaptation (Figure 5) and photopolymerization, the casts were mounted on articulator and occlusal adjustments were made (Figure 6). After this step, the inlay was carefully taken out from the cast (Figure 7) and placed in composite oven for further polymerizing (SIBARI SR 620 – Photopolymerizator, Italy) (Figure 8).

Figure 1-modified cavity

Figure 2-Working model

Figure 3- Matrix placed

Figure 4- restoring with composite resin

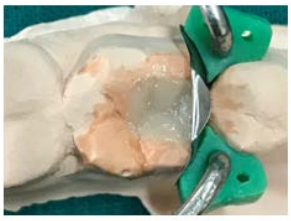

Figure 5- Adaptation of Resin

Figure 6- After occlusal adjustment

Figure 7- Inlay Seperated

Figure 8- Polymerization done

Second visit

During the subsequent visit, the provisional restoration was removed and the cavity was cleansed. The cavity was acid conditioned, the adhesive was applied and light-cured on the tooth and the same adhesive was applied on the silanated internal aspect of composite inlay without being polymerized. The cementation was carried out by applying thin layer of resin luting cement (as per manufacturer guidelines) (ParaCore - Coltene, Switzerland). The resin luting cement was light-cured through the restoration from both, lingual and buccal side of restoration. The finishing and polishing were done using a composite finishing kit (Super snap Shofu, Japan) (Figure 9). An IOPA radiograph was obtained to check the proximal integrity (Figure 10). The patient was asked to maintain proper oral hygiene instructions and was recalled after 3 months to check the integrity of the restoration.

Figure 9- After finishing and polishing

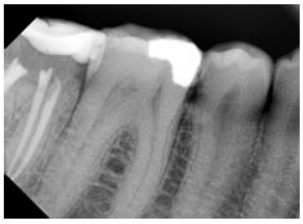

Figure 10- IOPA for proximal integrity

Recall Visit

Patient was recalled after 6 months and an IOPA was taken to check the contact (Figure 11). IOPA showed excellent marginal contact with no signs of marginal leakage (Figure 12).

Figure 11- After 6 month Recall

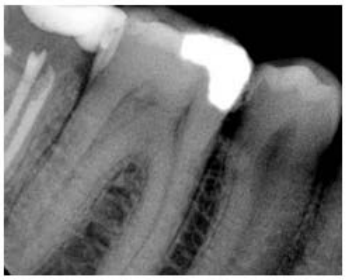

Figure 12- IOPA showing ideal marginal contact

Discussion

Restorations with very divergent proximal boxes make it difficult or impossible to correct adaptation of the matrix and interproximal wedge, which can result in failure in the marginal adaptation of the composite resin and an incorrect for of marginal crest (7). In addition, restorations with a subgingival margin also make correct isolation and moisture control difficult, and can result in failures in the marginal adaptation of the restoration (7).

It must be remembered that a slightly expulsive or even retentive preparation will at some point make the testing, adjustment, and cementation of the piece difficult. On the other hand, if the expulsivity is very high, a loss of the piece's retention can be expected, even with adhesive cementation.

The use of composite resins for the preparation of semi-direct restorations in posterior teeth with extensive loss of dental tissue represents a viable clinical alternative (8). The use of the technique of extraoral restoration allows for the optimization of the properties of the material, which can be reflected in a better final clinical performance of the restoration.

Extensive restorations, when carried out directly, it is necessary for the professional to perform the insertion of the resin and its photopolymerization in layers, to compensate for the polymerization contraction (9). This ends up generating an increase in clinical time, failures in the marginal sealing, and postoperative sensitivity. In the

semi-direct technique, the only polymerization contraction is generated by the resin cement, since the restoration is fully prepared outside the oral medium (9).

The study of the properties of the reinforcement fibers showed that its incorporation with composite resin increased its elastic modulus (3). It was demonstrated that the use of fibers to reinforce the resins generates high tensile strength and low shear strength, since they are materials with an elastic modulus similar to dentin, a factor which improves the distribution of tensions during chewing and proximal wear on the natural teeth (3). The association of composite resin with the fiberglass for reinforcement has been shown to be effective in increasing flexural strength.

Materials consisting of fibers present excellent mechanical properties, and when compared with metals, they offer advantages, because they are not corrosive, they present satisfactory translucency, excellent adhesion, and ease in preparation in clinical or laboratory procedures.

Resin cements have indications and advantages that no other cement has with the capacity to secure pieces in very expulsive preparation or where the clinical crown is too short. The advance preparation, both of the prepared tooth and the piece that will be cemented, is of the utmost importance since the adhesive strength of the cemented restoration is not related only to the properties of the resin cement (10).

Conclusion

It can be concluded that the method of indirect fiber reinforced composite restorations is a recommended procedure and versatile solution in many difficult situations. It is a good alternative to direct composite restorations. With the indirect method, we can offer patients an aesthetic and, above all, durable and functional composite restoration in posterior dental arches.

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