Case Report

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Indirect Composite Inlays Restoration: A Case Report

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Abstract

The evolution of esthetic dentistry perseveres through innovations in bonding agents, restorative materials, and conservative preparation techniques. The utility of direct composite restorations in posterior teeth is confined to relatively small cavities owing to polymerization stresses. An esthetic alternative to ceramics when it comes to posterior teeth in indirect composite. Since their first application, numerous advancements have been made in adhesive dentistry. In 1980s, indirect resin composites were introduced with Touati and Mormann developing the first generation of indirect resins composite. Further, improvements in structure, composition and polymerization techniques led to the introduction of a second-generation of indirect resin composites. These include Artglass (Heraeus–Kulzer), Belleglass HP (Kerr), Targis (Ivoclar), Columbus (Cendreset Matrux) and Sinfony (ESPE). Indirect resin composites offer optimal esthetic performance, enhanced mechanical properties and reparability. These characteristics allow them to be used in a wide range of clinical applications, such as inlays, onlays, crowns, veneering material and also fixed dentures prostheses. This paper presents the two case reports of patients, treated with indirect composite inlays.

Keywords: Esthetic dentistry; Indirect composite restorations; Inlays.

Introduction

Composite resins are used in clinical practice on a daily basis. Initially they were used in direct restorations. However, Touati and Mormann introduced the first generation of indirect resin composites for posterior inlays and onlays in 1980s. Later, in 1990, a second-generation indirect resins composite was developed with differences in composition, structure, polymerization technique and filler reinforcement to enhance their mechanical and optical properties. Microhybrid fillers having a diameter of 0.04–1 μm^2 were used. In order to improve elasticity and strength and to reduce the organic resin matrix, their filler content was made much higher than first generation of indirect resin composites, resulting in reduced polymerization shrinkage. In order to allow a higher degree of conversion of indirect resin composites, different polymerization techniques combining light, heat, vacuum or pressure were utilized.[1,2] All these measures led to enhancement of the properties of second-generation indirect resin composites.

It is important to note that indirect composites are superior to direct composite resins since the bulk of polymerization shrinkage takes place outside the oral cavity leading to lesser stress at tooth restoration margin which results in less microleakage, less marginal breakdown, less postoperative sensitivity and less marginal staining. Moreover, it is easier to achieve ideal proximal contacts and anatomic morphology using indirect restorations.

In spite of having mechanical properties inferior to those of ceramics, in some clinical situations, indirect resin composites can supplement and complement ceramic restorations: for example, in coronal restoration of dental implants. Since ceramics have a high modulus of elasticity and absorb less of the masticatory energy, a substantial amount of this force is transferred to the implant and periosseous structure, thus reducing the longevity of restoration. The materials of choice in such situations and polymers as they absorb relatively more of this occlusal force. Therefore, stress absorbing materials like indirect resin composites are recommended for patients with poor periodontal structures who require occlusal coverage.[3] Compared to ceramic materials, indirect resin composites exhibit better stress distribution, repairability, lower cost and ease of handling.[4]

Now-a-days, patients are more inclined towards tooth-coloured restorations, and here too, indirect resin composites prove more advantageous than other materials like cast gold restorations. Owing to their characteristics, indirect resins composites cover a large span of indications including inlays, onlays, overlays, short-span fixed denture prostheses (FDP), veneering material of FDS's and removable dentures and as a repair material for a variety of restorations.

This paper aims to review some of the applications of these materials and discuss clinical cases to illustrate the scope of utilizations of indirect resin composites.

Clinical Presentation

Case A

A 21-year-old male reported to the Department of Conservative Dentistry and Endodontics, Buddha Institute of Dental Sciences and Hospital (Patna, Bihar) with the chief complaint of food lodgments and sensitivity due to cold in lower right posterior tooth region. On clinical examination, Class I caries were seen on the occlusal and buccal surfaces of tooth 47 (Fig. 1). The preoperative IOPA radiograph revealed of large radiolucency involving the enamel and dentin in 47. Pulp was vital on performing pulp vitality test. So, the diagnosis was reversible pulpitis and we went for conservative restoration, i.e. indirect resin composites inlay with cusp capping.

Fig. 1: Preoperative photograph.

Clinical Procedure

Cavity preparation was done in accordance with preparation guidelines for inlay restorations: no sharp angles; no wide isthmus; slightly flared walls 8–10; no chamfer preparation; and a minimum preparation depth of 1.5 mm. The extension of caries from a primary groove towards the mesio-buccal cusp tip was more than two-thirds of the distance. Therefore, cusp capping was indicated. Areas prepared closer than 0.5 mm to the pulp should be lined with calcium hydroxide, and undercuts were filled with appropriate liner or base (Fig. 2).

Fig. 2: Cavity was prepared.

Immediately following preparation, dentin must be protected with a hybrid layer.[5] A total-etch technique was subsequently applied for 15 seconds using 37% phosphoric acid gel (Gel Etchant, Kerr/Sybron, Orange, CA). The cavity was rinsed and slightly air dried. A thin layer of primer (Opti Bond FL Primer, Kerr/Sybron, Orange, CA) was applied with a brush on the preparation surfaces for 30 sec, then dried for 10 sec. The primer was covered with a thin adhesive layer (Opti Bond FL, Kerr/Sybron, Orange, CA) and light cured for 20 sec.

Prior to taking the impression, it is necessary to seal the dentin tubules with a hybrid layer to protect pulp from the invasion and advancement of microorganisms and to reduce sensitivity during temporization. Then impression was taken using polyvinylsiloxane impression material for upper and lower arch (Fig. 3). Shade matching was done by VITA classical shade guide under normal light.

Fig. 3: Impression was taken.

Laboratory Procedure

Two models prepared from impression (Fig. 4), one was for inlay fabrication and the other for fitting and occlusal adjustments and mounted on dies to facilitate the layering process. A die spacer (Ivoclar Vivadent) was applied into cavity and dried for 2 to 3 minutes (Fig. 5).

Fig. 4: Models was prepared.

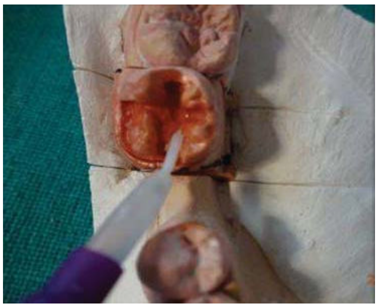

Fig. 5: Die spacer was applied.

As a first step buildup procedure, a layer of translucent composite resin (SR Adoro-Ivoclar Vivadent) was applied (Fig. 6a), exceeding the magins. This layer is called the "connective layer," and it must be thin to limit polymerization shrinkage, thus ensuring perfect adhesion between composite layers to the stone. If the initial layer is too thick, the polymerization retraction stresses may result in the detachment of the material from the stone. The layer should be translucent to enhance light transmission especially at the margins and light cured (Fig. 6b).

Fig. 6a: Connective layer was applied.

Fig. 6b: Light cured.

Composite build up was done by incremental technique. Using light-cured stains, characterization can be added to stimulate natural optical properties and each layer was light cured for 30 sec. Thereafter, the composite finished and polished (Fig. 7).

Fig. 7: Composite finishing and polishing done.

The inlay remains on the stone model and was cured in the oven (coltene) for 20 minutes at 80 psi. Inlay removal from the master model was done by ultrasonic technique (Fig. 8).

Fig. 8: Inlay was removed with the help of ultrasonic technique.

Then the inlay was checked for fit on an articulator and areas of interference were removed (Fig. 9).

Fig. 9: Fitting of the cured inlay was checked.

After fitting and adjustment, high points were eliminated (Fig. 10) and occlusal adjustment done (Fig. 11).

Fig. 10: High points were eliminated.

Fig. 11: Occlusal adjustment.

The inner surfaces of the inlay were sandblasted with 50 μm aluminum oxide at lower pressure (60 psi) (Fig. 12). Silicone cups and pumice were used for definitive polishing (Fig. 13). To achieve optimal luster, a diamond paste is recommended.[6]

Fig. 12: Sandblasting was done.

Fig. 13: Finishing and polishing done.

Cementation

Provisional restoration was removed and the teeth were isolated. Hold the cured inlay with micro brush to prevent contamination (Fig. 14).

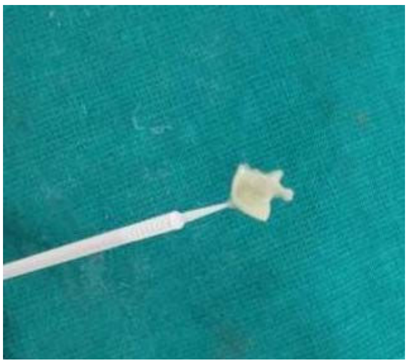

Fig. 14: Holding the inlay with microbrush.

The inlay was tried in, and the contact points were adjusted and then etched with phosphoric acid to remove the impurities. Now bonding agent was applied. A total-etch procedure using 37% phosphoric acid gel was performed.[7] The cavity is rinsed and slightly dried and 2 or 3 layers of bonding agent was applied. The dual-cure composite resin (Variolink-N) was used as a cementation material. The color was determined and the dual-cure luting resin was prepared.[8] A high-viscosity catalyst is recommended for inlay cementation in order to avoid an excessively fluid composite material which is more difficult to handle and remove. Afterwards, the cavity was partially filled with the composite resin and the inlay was placed, and the excess resin removed while taking special care of the margins. Light curing of the resin was done for 40 seconds on the occlusal, facial, and lingual surfaces. Following the cementation of inlays, the occlusion was adjusted. Silicon cups and diamond paste were used for definitive polish and finishing of the restorations. If the layering is properly respected, a satisfactory esthetic result can be achieved (Fig. 15).

Fig. 15: Final fitted restoration.

Case B

A female patient come to the department with the chief complaint of food lodgement and wants to replace the restoration in 36 (Fig. 16).

Fig. 16: Preoperative photograph of second case.

In consultation with the patient, it was planned to have the conservative restoration of the teeth 36 with IRC inlay. The same procedure was repeated (Fig. 17–19) and satisfactory results was obtained (Fig. 20).

Fig. 17: Mounted dies.

Fig. 18: Composite finishing and polishing done.

Fig. 19: Inlay was cemented.

Fig. 20: Final fitted restoration.

Discussion

There are several clinical cases where indirect resin composites can be used to replace metal-ceramic restorations. Fractures on existing metal-ceramic restorations are a common finding in bruxing patients. Lack of adequate intraoral reparability and need for replacement of such restorations often prove to be time consuming and put financial burden on the patient.

Another advantage offered by indirect resin composites is the variety of color combinations for teeth and gingiva, which emboldens the clinician to obtain an optimal white and pink esthetic outcome.

According to an *in vitro* study conducted by Magne et al.,[9] indirect inlays proved the treatment of choice for extended restorations, including cusp coverage in vital teeth. Indirect resin composites possess good mechanical properties, greater capacity to distribute tensions in a more homogeneous way than ceramics[4] and reduced risk during try-in. Mandikos et al.[10] proposed that regardless of their wear and hardness differences, indirect resin comosites can perform satisfactorily under clinically induced conditions of wear. Moreover, they are cheaper than ceramics and several researches have reported their good success rate.[11,12]

A commonly reported disadvantage is their unpredictable color stability and translucency. However, several *in vitro* trials reported these color changes to be in the clinically acceptable range.[13]

As mentioned earlier, the use of indirect composite resins for a wide range of applications has been on the rise, especially due to their improved mechanical properties, convenient handling, favorable esthetics and abrasion similar to natural hard tissues. Indirect resin composites are being used with increasing frequency as a viable alternative to porcelain and direct composite, with promising clinical results.[11,12,14] Dukic et al.[11] observed 71 indirect resin composite restorations on permanent premolars after 36 months in use. They concluded that indirect resin composites restorations were a good treatment option for severely damaged teeth. Jongsma et al.[14] evaluated forty-five patients with 86 indirect resin composites crowns and 5 onlays after 3 years of clinical performance. However, clinical trials for all their applications are not yet enough. The inference was that indirect resin composites restorations exhibit 91.6% survival rate and 84.8% success rate.

Traditionally BISGMA & TEGDMA are used as monomers and contain hydoxyl group which makes them more water soluble and gives greater tendency towards discoloration. For the present case report SR Adoro was used which is microfilled composite resin system. Adoro system conversely, consists of aromatic aliphatic UDMA which has no hydroxyl group making it less susceptible to water absorption and solubility. These restorations are cured at 104°C, which impacts excellent surface quality and enhances overall properties of the material. Indirect composite inlay were luted to the tooth structure by Variolink which provides high-bond strength and long-term color stability for high-quality esthetics.

SR Adoro has the advantage of having larger filler particles, which are combined with microfillers using splinter polymers thus allowing the favourable properties of microfillers to be incorporated into a composite material and imparting non-sticky nature, good surface finish, homogeneous and soft consistency.

Conclusion

Indirect resin composites seem to be an excellent alternative for restorations in selected clinical cases where ceramic restoration is not possible.

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