Indirect Posterior Composite Restorations
by Dr. Samir Karimov

Abstract

Indirect posterior composite restorations have brought about a wonderful age where ideal form, marginal adaption, and proximal contact and contour are all achievable goals. The use of post-cure heat, however, has remained ineffective in enhancing the clinical performance of these restorations. As new curing techniques and technologies develop, indirect posterior composite restorations continue to see improvement and promise, both in their mechanical characteristics and the longevity of their clinical performances.

Educational objectives

- Understand the advancements that composite materials have made over the years.
- Discuss the benefits of newer generation indirect composites.
- Review a case presentation involving indirect composite techniques.
- Discuss the clinical and the esthetic benefits of modern-day alloy-free restorations.
- Reinforce the importance of quality preparation work in order to achieve exceptional outcomes.

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Introduction

In the modern world where nearly everyone has access to the Internet, the awareness and interest in esthetic and cosmetic dentistry has grown, both for the patient and the dentist. For the purpose of this article, esthetics include health, balance, beauty and harmony. The goal of esthetic dentistry has always been to achieve a result that, to the patient, appears natural-looking and beautiful, while on the clinical side, it maintains function and structural integrity—without exposing the smile to metals like gold or amalgam.

Patients often look for less-invasive and conservative treatments that will enhance the esthetics of their smile. It could easily be argued that patients do not often think about the longevity and endurance of a restoration. As dentists, we are tasked with striking a balance that will please the patient and allow us to feel the pride of knowing we provided a dental treatment that will stand up to the test of time.

Needless to say, alternatives to metal alloys that satisfy patient’s esthetic expectations have come a long way. Until fairly recently, the composite materials available were deficient in comparison to the biological and physiochemical properties found in gold and amalgam. The first generation of composite resins experienced factors like low wear resistance to abrasion, polymerization shrinkage, varying flexural strength, elasticity, limited color options and the high incidence of fracture.

Subsequent generations, however, have shown more promise. The filler size, shape, composition of the formulas and their concentrations have drastically improved the aforementioned factors. Now as researchers experiment with different light, heat and pressure, along with more advanced techniques like the use of vacuums or the introduction of nitrogen during post-curing, dentistry is seeing a vastly improved material esthetically, physically and mechanically. The importance of the curing process cannot be understated. The removal of oxygen through a vacuum, or the use of nitrogen, has shown to remove entrapped pockets, which affect the opacity of restorative materials. With the use of these advanced curing techniques, we are seeing greater opalescence much more similar to natural tooth structure than ever before.

Clinically, the benefits are tangible to patients, who are seeing and feeling the reinforcement, conservation of tooth structure, the marginal precision and the resistance to wear. This is an exciting time to be doing esthetic dentistry.

Case report

A 31-year-old man was referred due to the appearance of #24–27 (#2–5), which had been restored with old composite material and metallic posts (Fig. 1). The clinical examination revealed an old composite with secondary caries that presented open margins with recurrent decay.

The clinical protocol uses the indirect restorative technique, which requires two appointments. At the first appointment, shade selection and a photographic comparison were performed before treatment because an elevated value or the selection of an improper shade could result from selecting the shade after tooth dehydration.

After the removal of old fillings, metallic posts and secondary caries, I did simple preparation, removing weak tissue, covering the weakened cusps, and cleaning...
the dentin’s surface with glycine powder. We then rounded all internal angles and edges, and flared all proximal walls 5° to 15° with no undercuts. Isthmus width should be at least 2mm, with a depth of at least 1.5mm. Sharp cavosurface margins and the gingival margins we prepared to a 90° cavosurface line angle with no feather-edge preparation.

A rubber dam was placed. Before taking the impression, remember to seal the dentin tubules with a hybrid layer. The cavity preparation was cleaned using 2 percent chlorhexidine. A total-etch technique was subsequently employed for 15 seconds on the dentin and 30 seconds on the enamel, using a 37 percent phosphoric acid. After abundant rinsing, the excess water was suctioned.

The priming agent (hydrophilic monomer) was applied to the dentin with a gentle brushing motion for at least 20 seconds. The dentin surface was suctioned again to eliminate the solvent from the priming solution. The primer was covered with a thin adhesive layer and light-cured for 20 seconds.

Then, with a flow, I completed the buildup in the four teeth to create an immediate dentin sealing (Fig. 2). Immediate dental sealing (previous hybridization) is traditionally performed with indirect restorations. After the removal of the dam, I took the impression with a hydrophilic vinyl polysiloxane impression material in one step, using two viscosities. The temporary material was applied and the patient received postoperative care instructions. Onlays and inlay were performed in the dental laboratory from indirect composite resin (Fig. 3). The restorations were done using just one dentine (A3 shade) and one enamel (A2 shade) and brown stains (Fig. 4).

Dentists will see more and more options become available as materials continue to evolve and improve. With newer tools and newer techniques, the freedom to restore every tooth in the most functional and appropriate way will become everyday realities in every practice.

The temporary material was applied and the patient received postoperative care instructions. Onlays and inlay were performed in the dental laboratory from indirect composite resin (Fig. 3). The restorations were done using just one dentine (A3 shade) and one enamel (A2 shade) and brown stains (Fig. 4).
The laboratory procedure demonstrates how a lab-processed composite resin is utilized to blend the natural tooth color with the restorative material.

At the second appointment, new isolation with a rubber dam was performed. After removal of the provisionals, the restorations were checked to the marginal and contact areas (Figs. 5 & 6). The cavity preparation was cleaned using 2 percent chlorhexidine. The preparation was rinsed thoroughly to eliminate all the abrasive particles.

Here, the total-etch technique was used for its ability to reduce the risk of micro-leakage while enhancing bond strength to both the dentin and enamel. The preparation was then etched again (37 percent phosphoric acid) for a 30-second buildup and enamel (Fig. 7).

Bonding was then done (primer and adhesive) over the enamel and the buildup (Fig. 8). The bonding was polymerized, and then with a heated composite (55°C), the onlay was luted. After removing uncured excess, I polymerized the onlay for 180 seconds on each surface (Fig. 9, see p. 108). To keep an oxygen-inhibited layer from forming, a thin layer of glycerin was applied to all of the margins.

The restoration was polymerized for 60 seconds from the all surfaces respectively. The restorations were cemented one by one (Fig. 10, see p. 108).

The final polishing was performed with rubber points, polishing discs, polishing cups and composite resin polishing paste (Fig. 11, see p. 108). The proximal surface was smoothed with polishing paste and plastic finishing strips.

After the removal of the dam, I could see the details of the composite restorations (Figs. 12-14, see p. 108 & 109).

**Clinical advantages of indirect composite restoration**

The advantages of these types of restorations are numerous. While most would say the advantages are primarily esthetic, it would be unfair to count out the clinical advantages, especially given the
advancements in materials and techniques over the years.

The tight bond to the natural tooth structure nearly mimics the tooth’s original strength. Also, with a composite restoration, less of the tooth has to be removed. This is important when considering the longevity of the tooth’s structure.

The less that is removed during a restoration means a higher integrity, leaving the tooth less likely to crack or break. This could save the patient from needing a crown later. Other benefits include healthier gums, as composite onlays can be placed above the gumline.

**Discussion**

The onlay indirect restorations have wide acceptance because they are able to restore the esthetic and at the same time protect the vulnerable areas of dental structure. On the effect of cavity design, the onlay design was more efficacious in protecting the tooth structures than the inlay design.

Adhesive technology has greatly increased the application of composite materials, both for direct and indirect restorations in the posterior. No matter how advanced the materials become, the correct preparation of the dental structure remains vital for the success of indirect restorative treatment. In the case reported, immediate dentin sealing was performed. This technique had many advantages, including being able to better control bacterial contamination and tooth sensitivity. Tooth sensitivity is reduced after the immediate dentin sealing, and the use of anesthesia during the deliver appointment is unnecessary.

Despite the advantages, it is important to question the bond strength with this technique. Luckily, research has proved that the immediate dentin sealing technique provided a bond strength similar to that of the direct composite. What made this possible, in part, was the application of phosphoric acid as a cleaning agent before cementation. This greatly strengthens the bond of onlay and heated composite.
The heat polymerization also improves the marginal adaptation. Any experienced shrinkage of the onlay will occur before cementation, and the only clinically important shrinkage will occur in the thin cement layer. The ideal outcome is reached when there is a good marriage between a proper evaluation and a strict selection of techniques and materials. A patient’s satisfaction with the esthetic outcome and long-term clinical success and longevity do not have to be mutually exclusive.

Until recently, esthetic posterior composite materials and techniques were deficient in their biological and physiochemical properties when compared to gold and amalgam.

Conclusion
This case illustrated an esthetically pleasing result for the patient while still providing a lasting restoration via indirect composite. What allowed for this final restoration to be functional, durable and visually sound was proper planning and considering the requisites of the treatment. Following the proper and recommended bonding procedures is critical to the success of cases like this one.

Dentists will see more and more options become available as materials continue to evolve and improve. With newer tools and newer techniques, the freedom to restore every tooth in the most functional and appropriate way will become everyday realities in every practice.

The author wishes to thank Dr. Ziya Hesenov (Azerbaijan, Baku) for the lab work.

Author Bio
Dr. Samir Karimov maintains a private practice in Baku, Azerbaijan. He graduated from the Azerbaijan Medical University Faculty of Dentistry.
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1. How many visits are needed for onlays to be properly applied?
   A) 1
   B) 2
   C) 3
   D) 4

2. Which of the following can be used as indirect restorations?
   A) Gold
   B) Ceramics
   C) Composites
   D) All the above

3. What is the minimum isthmus width in an indirect restoration?
   A) 1mm
   B) 2mm
   C) 3mm
   D) 4mm

4. All internal angles should be...
   A) Squared
   B) Sharpened
   C) Rounded
   D) Flattened

5. While etching enamel, what percentage phosphoric acid should be used?
   A) 45.5 percent
   B) 88.8 percent
   C) 24.5 percent
   D) 37.5 percent

6. In this discussion, which of the following was used in the onlay fixation?
   A) Glass-ionomer cement
   B) Preheated composite
   C) Silico phosphate cement
   D) Zinc-oxide eugenol

7. To what degree should cavosurface margins and gingival margins be prepared?
   A) 90º
   B) 45º
   C) 120º
   D) 60º

8. To what degree range should proximal walls be flared?
   A) 10-15º
   B) 20-30º
   C) 30-35º
   D) 5-15º

9. How many seconds should each tooth be polymerized after removing excess composite material?
   A) 60
   B) 20
   C) 180
   D) 90

10. To what temperature °C should composite be heated to lute the onlay?
    A) 20º C
    B) 70º C
    C) 55º C
    D) 30º C

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Indirect Posterior Composite Restorations

by Dr. Samir Karimov

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Comments (positive or negative): ______________________________________________________________________________________

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