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# Conservative Posterior Indirect Bonded Restoration Using Morphologically Driven Preparation Technique – A Case Series

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**Abstract**

A huge cultural and methodological revolution in restorative dentistry has been sparked by the introduction of adhesive methods. Anatomical, functional, biomechanical, aesthetic, and economical factors all play a role in the difficult task of adhesive dentistry in the posterior quadrant when choosing between direct and indirect restorative techniques. Consequently, when creating innovative cavity designs, a few structural and geometric factors must be considered in order to mimic biology. All adhesively cemented restorations, whether they are made in accordance with the more modern ideas of adhesive crown, occlusal veneer, overlay veneer, extended wrap overlay, or extra overlay, can benefit from the application of these preparatory guidelines. The purpose of this case series is to illustrate different morphologically driven cavity designs that are based on the geometry and structure of the tooth in order to enhance adhesion quality, make tooth structure more accessible, and maximize aesthetic integration, all of which enable a more seamless integration of the restoration with the tooth.

**Keywords**: Bio-emulation, Height of contour, Endodontically treated tooth, Lithium disilicate Endocrown, Minimally invasive dentistry, Immediate dentin sealing

## Introduction

A huge cultural and methodological shift has occurred in restorative dentistry as a result of the introduction of adhesive methods. With improvements in adhesive materials and techniques, it is possible to restore teeth with lesions going beyond the traditional extent without the need for full coverage restorations. The tooth preparation design of these newer restorations can avoid loss of unnecessary tooth structure, helping teeth retain their original strength and resistance to occlusal forces during function.

However, choice of the restoration must be made with caution in the posterior quadrant when choosing between direct and indirect restorative techniques since it involves an interplay of biomechanical, anatomical, functional and cosmetic factors. As a result, specific structural and geometric parameters, with a thorough knowledge of area specific force dynamics of individual teeth, should be taken into account while creating new cavity designs that mimic biology[1]. These preparatory guidelines can be applied successfully for any adhesively cemented restorations, whether they follow more modern concepts like overlay, occlusal veneer, long wrap overlay, or adhesive crowns, or more conventional ones like inlays, onlays, and overlays[2].

The goal of this case series is to show different morphologically driven cavity designs we used based on the geometry and structure of the tooth in order to increase adhesion quality, avoid extensive tooth preparation that could result in complications like

tooth structure loss and dentin exposures, and to improve aesthetic integration that allowed for a better integration between the tooth and restoration.

**Case 1**

A 43-year-old female visited the Department of Conservative Dentistry and Endodontics with the primary complaint of food lodgement in the area of the left upper back tooth. Upon clinical examination, a carious lesion was seen on the Mesial and Distal proximal surface of the right maxillary first premolar. The cold test was used to determine the pulp vitality , and the pulp was determined to be vital and normal. Radiographic evaluation showed radiolucency involving the enamel and dentin on the Mesial and Distal proximal surface with normal periapical appearance.

The intended course of action was to fabricate an indirect bonded restoration to restore the Mesial and Disto-proximal surface with the palatal cusp. Caries excavation with a no.2 carbide bur was done and tooth preparation was started. A flat taper fissure bur (TF-13) was used to shape the interproximal box into a shoulder margin on the distal surface with a thickness of 1 mm[Figure 1a]. For the purpose of preventing stress concentration, the internal walls were prepared with rounded angles with a 6° divergence. Occlusal reduction of the tooth with a clearance level of 1.5mm was done after considering the morphology of the cusp[Figure 1b]. Finally, axial wall preparation was performed on the buccal and lingual surfaces by placing a chamfer margin. Thus the cavity was prepared and finished using newly updated morphology-driven preparation techniques. This was followed by immediate dentin sealing (IDS) and application of a flowable micro hybrid composite (Tetric N-Flow, Ivoclar Vivadent).A definitive impression was taken using an addition silicone impression material (Zhermack Elite HD +) . The onlay fabrication was done with a pressed lithium disilicate glass ceramic material(IPS e.max, Ivoclar Vivadent)[Figure 1d and 1e]. Cementation of indirect restoration was done using a dual-cure luting resin. (3M™ RelyX™ U200 Auto mix).

**Case 2**

A 29-year-old male visited the Department of Conservative Dentistry and Endodontics with the complaint of food lodgement in the area of the left lower back tooth . Clinical examination revealed a distal proximal carious lesion extending to the distobuccal cusp on the proximal surface of the left mandibular first molar[Figure 2a]. Cold test was used to determine the pulp vitality, the pulp was determined to be normal. It was determined that a distal proximal preparation along with capping of the distobuccal cusp of the mandibular molar would be required. After discussing the treatment options with the patient, we finally decided on a ceramic inlay restoration with cusp capping of the distobuccal cusp. The preparation methods and the restoration's final optimization was completed similar to case 1. The tooth was reduced occlusally with clearance level of 1.5mm after considering the morphology of cusp[Figure 2b]. Finally, axial wall was prepared by placing a chamfer and shoulder margin on the buccal and lingual surface. After immediate dentin sealing an impression was made and sent to the laboratory for fabrication of a pressed lithium disilicate restoration(IPS e.max, Ivoclar Vivadent). In the next appointment, Ceramic Inlay was tried and cementation was done using a dual-cure luting resin[Figure 2c and 2d]. (3M™ RelyX™ U200 Auto mix)

**Case 3**

A 35-year-old male patient, referred to our department reported with the complaint of pain in the area of the lower right back tooth. Clinical examination revealed a carious first mandibular right molar with deep caries and tooth structure loss. History, clinical examination and radiographic examination revealed a diagnosis of symptomatic irreversible pulpitis and root canal treatment was initiated. At the end of the endodontic therapy, while planning for a post endodontic restoration, the remaining tooth structure had only 2mm of cervical margin and 1mm of interocclusal clearance. The pulp chamber depth was 4mm and the walls of the chamber were thin[Figure 3a]. Based on the thickness of the wall and the quantity of tooth structure that remained, a lithium disilicate ceramic endocrown post-endodontic restoration was recommended. We explained this to the patient and after his consent, commenced with the tooth preparation. Prior to any intervention, the shade was chosen, which produced the A2 shade. Using resin-modified glassionomer cement(Gc Fuji Ii 2 Lc), the orifices of the canal were sealed. The tooth preparation followed the contour of the tooth. A butt joint margin on the lingual surface, a hollow chamfer margin on the



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buccal surface, and a centre retentive cavity with a depth of 4 mm from the pulp chamber roof to the intracoronal cavosurface margin were all incorporated in the preparation to achieve an interocclusal clearance of 2mm[Figure 3c].

The finish lines were positioned supragingivally. After sealing the dentin, flowable resin composite (Tetric N-Flow, Ivoclar Vivadent) undercuts in the cavity were blocked[Figure 3b]. A polyvinyl siloxane impression(Zhermack Elite HD +) was created using the putty wash procedure and forwarded to the lab for the fabrication of a prosthesis. A temporary cement was used to create and cement a provisional acrylic resin restoration. Prior to cementing the restoration, shade selection of the prosthesis and the marginal integrity were evaluated after receiving it[Figure 3d]. The intaglio surface was etched with 10% hydrofluoric acid (IPS Ceramic Etching , Ivoclar Vivadent) for 30 seconds before being washed with water. After that, coat of silane was applied for one minute .

The prepared tooth was isolated and etched with 37% phosphoric acid (3M, ESPE, USA) for 20 seconds before being rinsed with water . On the endocrown's intaglio surface, dual cure resin cement(3M™ RelyX™ U200 Auto mix) was used, and it was bonded adhesively onto the tooth surface[Figure 3e and 3f]. A light cure was performed to make it easier to remove any extra cement, then all surfaces were given a 40-second cure. No occlusal discrepancy was noted.

**Discussion:**

It has been shown that keeping the original, healthy tooth structure preserves the tooth's resistance form by enhancing the biomechanics and stress distribution of the tooth[3]. Certain structural and geometric properties control the morphology-driven method, which optimises the tooth preparation for various indirect restorations.

According to Bazos and Magne, when designing the preparation, it is important to take into account , bio emulation criteria such as the sigmoid nature of the dentin , and the orientation of the enamel rods with regards to the axial and proximal surfaces.

In case 1, maxillary premolar preparation was done in consideration with the enamel being convex and the dentin being concave. The height of the buccal and palatal axial walls in maxillary teeth is in the cervical third, and they are inclined and converge in a coronal manner. Therefore, using sharp-cut borders would result in the enamel prisms being sectioned along their long axis in an oblique manner, which would make them less suitable for bonding[4].

Dietschi et al[5] and Veneziani et al have suggested using a hollow ground or concave bevel to prepare the enamel rods transversal to their long axis, giving it a more desirable substrate for bonding. Additionally, the dentin's concavity is situated coronally to the height of the contour, at the middle third. In this situation, a shoulder margin would expose extra dentin .Longitudinally, making the substrate less suitable for bonding. Instead of exposing the dentin concavity, a hollow ground bevel margin would accurately cut only the convexity of the enamel.

In case 2 ,the preparation which was done in the Mandibular molar teeth, appear to have enamel that was convex despite the dentin on the lingual side being more rectilinear and the height of the contour which occurs more occlusally, according to structural considerations. As a result, a chamfer and shoulder margin on the buccal and the lingual surface were appropriate[2]. Hence , the rounded shoulder margin was given. Any inclined or bevelled plane is not recommended since it would shift the margin more apically and the thickness of the cervical enamel would be reduced[6], which is necessary for bonding. Additionally, this shoulder preparation provides the restoration with appropriate thickness and improved fracture resistance.

Regarding material choices, according to Kois et al[7], found that lithium disilicate ceramic outperformed composite restorations in terms of fracture resistance and had a decreased probability of catastrophic failures. Additionally, the axial wall's hollow ground or concave bevel preparation aids in preserving the bulk of the ceramic material. In the aforementioned cases, IDS was done before taking impressions for indirect restoration. During provisionalization freshly cut dentin will be suitable substrate for bonding and helps to shield the dentin from bacterial leakage and sensitivity [8][9]. This procedure had been demonstrated to increase the bond strength.

When compared to traditional, post and core-retained restorations, endocrowns are a more favourable option because of their minimal preparatory requirements. Its preparation method, occlusal thickness, and modulus



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of elasticity are only a few of the variables that contribute to this favourable result. In order to make a conventional crown retentive, a "ferrule" must be present. However, in order to prepare the crown, sound enamel and dentin must also be removed, which would be critical for good bonding.

The thickness in conventional restorations varies between 1.5-2 mm, whereas in case report 3 it is 4 mm , thus offering greater occlusal stress loading. In this case , the fabricated Endo crown was a lithium disilicate ceramic material which had an advantage over the other materials due to its adhesive, esthetic, mechanical interlocking with the resin cement. When Altier et al. evaluated the fracture resistance of three distinct endocrowns composed of indirect resin composite and lithium disilicate ceramic, they came to the conclusion that the fracture strength of the ceramic endocrown was greater than that of the indirect composites.[10]

**Conclusion:**

The restoration's marginal integrity and aesthetics are enhanced by the morphologically driven preparation technique, which also strengthens the bond by enhancing the quality of the bonding substrate and increases the resistance by preserving dentin and enamel. Although it is important to preserve the thickness of the restoration during fabrication , was difficult in the current cases. It was found that full-coverage restorations works better for teeth with a missing functional cusp than partial coverage ones.[11]

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**Figure Legends:**

Figure 1: (a) preoperative images , (b) and (c) after preparation , (d) and (e) final restoration

Figure 2: (a) preoperative images , (b) after preparation , (c) and (d) final restoration ,

Figure 3: (a) after root canal completion , (b) and (c) tooth preparation , (d) Endocrown , (e) and (f) after endocrown cementation.



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