



Partially Bonded Restorations

Sarojini Biswal¹, Bhupender Yadav², Abhishek Nagpal^{3*}, Omkar Shetty⁴, Reshu Sanan⁵ and Diksha Singh⁶

^{1,2,3,4,5,6}Department of Prosthodontics, Faculty of Dental Sciences, SGT University, Gurgaon.

Corresponding Author* abhishek_fdsc@sgtuniversity.org

ABSTRACT

Bonded restorations are long-term treatment options that can reinstall the functioning of the teeth and their appearance. One of the major concerns in adhesive dentistry is the protection of healthy enamel. According to the principles of biomimetic, applying minimal preparation methods and adhesive methods is of major importance that leads to the success of the restorations. While it is worldwide accepted that minimal preparation restorative techniques are favored, some controversy still exists over the non-invasive methods. This review tries to cover and describe the partially bonded indirect restoration concept as the traditional restorations have some deleterious effects on periodontal health that are caused by excessive contour and overhanging of the ceramic restoration and to give a new process to assess the quality and lifespan of partial bonded restorations.

Keywords: -adhesive luting, principles of biomimetics, bonded restorations, esthetic, minimally invasive treatment, partial bonded.

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INTRODUCTION

With the development of dental materials over a long time and efforts being made in developing the properties of the materials to imitate the natural tooth structure, it is easier to provide restorations that mainly cover the damaged tooth portion and do not require more surface area for its retention as it is provided by the advanced adhesive systems. However, along with material, it is necessary to apply conservative dental procedures to attain it.

Conservative treatments involve methods that lessen the elimination of sound tooth structure and establish the margin of the restoration at the supragingival level. In an extensively damaged tooth, a direct restorative approach is the utmost conventional approach that limits the restoration's retention and proper contour formation. Indirect partial coverage restorative techniques have lately gained acceptance. It maintains the structure of the tooth along with repairing the damaged parts to enable correction and re-establishing functioning of the tooth with a better appearance. Restorative processes cause a reduction in tooth stability, fracture resistance is reduced and a raise in the diversion of weak cusps. Among direct or indirect techniques mostly in the back tooth region, it has become a difficulty as it includes conditions of biomechanics, anatomy, function, esthetic as well as financial strength [1].

The advantages and disadvantages of direct restorations are checked, also indirect restorations are examined in cases of dental ceramics. For example, Lithium disilicate overlays along with a circumferential adhesive ferrule effect are used in highly damaged vital teeth having thin walls, or in cases of cracked teeth, and also for endodontically treated molars. This treatment ensures lot of advantages that include reducing the trauma to the vital teeth (pulp) and the surrounding tissues and also avoiding the further weakening of the remaining tooth [2].

Using lithium disilicate in addition to the adhesion methods bring about an increasingly conservative, less economic, and better aesthetic way to restore heavily compromised teeth. Partially bonded restorative options are likely also long-lasting restorative choices that rehabilitate the natural properties of the teeth and the aesthetic outlook. According to biomimetic rules, the use of minimally invasive procedures and adhesive technologies is essential for restoration to succeed. The traditional preparation has harmful effects on periodontal conditions due to over-contouring and overhangs of ceramic restoration, hence a new technique was suggested to evaluate the quality as well as durability of restorations with a partial bonding technique [3].

VARIOUS PARTIAL BONDED RESTORATIONS

(1) Porcelain veneers

Enamel translucency provides a better appearance to the teeth, which is a major aspect that has to be covered in restoration treatment options. Every step taken tries to mimic the enamel during the restoration of the tooth with synthetic materials. Dental porcelain is the most thriving dental material to copy the actual look of the teeth. Anterior teeth rehabilitation needs a good cosmetic look including important functions of the actual tooth such as strength, thermal expansion coefficient, impermeable to discoloration by food, stable under immense stress, etc. Porcelain has important properties, along with the great translucency approving it so that it can be used as a veneer, also as a bulk forming tooth material. These are a thin piece of porcelain designed in a way giving a subtle appearance of the teeth [4-5].

This is a classical treatment option in comparison to the full-coverage crown. These veneers can change the colour of the tooth, shape of damaged tooth, or tooth surface structure. Porcelain veneers can change the position of teeth involving closure of spaces between teeth. When tooth is prepared for veneer, the surface on the labial aspect is shortened by 0.3mm - 0.7 mm. The cavity depth is placed at enamel level to obtain good bonding among the veneer and the healthy tooth surface. 1.5mm of incisal clearance is provided to change the tooth length as required. The prep margin ends near the intact tooth structure. The gingival finishing line is placed and designed as a sub gingivally located margin. The finishing line in the proximal aspect is lingually placed to the area of contact providing accessibility for finishing. These veneers are a type of retention less restoration that is hold in place by adhesion only. The durability of the rehabilitation mostly relies on the efficiency of the bonding and the technique used [6].

(2) Non-prep veneers (Lumineers): A different type of veneer, called Lumineers, is a brand of veneer only offered by some dentists and manufactured by a few dental laboratories. Lumineers are thinner, cheaper, and faster to apply. But choosing the right kind of veneer isn't as simple as you might think. Lumineers require less preparation to be applied to the teeth. They are also potentially reversible and they don't last as long as veneers. They're also not as effective at masking severely stained or discolored teeth. They are less expensive treatment compared to traditional veneers. The first appointment will be shorter because it doesn't require trimming or prepping the teeth. Only it is needed to take an impression. The impression is then sent to a dental laboratory. The customized Lumineers get ready in about 2 to 4 weeks. Unlike traditional veneers, there are no temporary veneers are needed for the tooth while the custom Lumineers are being fabricated. Once they're ready, then in a second appointment the Lumineer is bonded to the teeth. Unlike veneers, Lumineers are semipermanent. After application, they can be removed with minimal damage to your teeth. Similar to veneers, Lumineers can make it harder to clean around your gum line. This can increase your risk for gum disease [7]

(3) Partially coverage restorations: Management of the partial restorations varies from the full coverage crown. The damaged part is removed by the restoration while never harming the surrounding sound tooth structure. Weakened tooth form, mainly the cusps have to be protected when the cavity goes beyond 1/3 from the cusp tip towards the groove in the center. The margin of the cusp that is functional is a shoulder margin that covers the cusp by the height of the axial wall by 1 mm.

(3a) Inlay: When decayed tooth surface area is too big to be filled then an inlay can be an alternative way. Inlays cover the central part of the tooth which includes the region between the cusps and are placed enclosed by the hard tissues of the tooth. Inlays do not cover the cusps. Hence, they are shaped accordingly so that they fit perfectly on the teeth which restricts the residue from entering the covered decayed tooth areas to aggravate further decay. Inlays are usually made up of porcelain just like dental crowns so that inlays will be stronger and even more durable as compared to composite fillings.

Onlay

A tooth having decay in the middle and on the side, an Onlay can be used as a treating modality as it can cover one or more cusps of the tooth. In comparison to inlay, onlay can cover more areas, while they are also placed inside the deep tissues of the tooth, onlay also covers part of the biting surface of the tooth. This in turn protects the decayed tooth from a direct chewing load. Onlays are quite similar to inlays but the difference lies in the amount of tooth both cover. Onlays can go over the cusp (or cusps) of the tooth, while inlays can only cover the space between the cusps. Onlays are intermediate between filling a cavity and cutting tooth structure to cap it with a crown. Onlays resemble crowns yet remove less of the healthy tooth structure, making them a less severe option. Onlays are preferred in cases where the cusp of the tooth is compromised making it unfit for inlay or filling, the tooth has a weak structure for regular filling

which may lead to fracture, avoiding unnecessary removal of sound tooth structure to place a full crown.[8]

Indication and contraindications for inlay and onlay:

The deep occlusal or cavities having occlusal and proximal side involved, size 3 or 4 based on the mount-home classification system (where one or more than one cusp along with the axial structural outline is harmed by more than one-third). In root canal-treated teeth where the strength of the tooth structure is decreased and can be restored by an inlay /onlay as a substitute for other filling materials that are unesthetic. Restoration of the crown portion of a tooth that has deep cracks is included in the restoring procedures, the bonding methods reinforce the actual form of the tooth. The vital health of the tooth is never risked. For example-deep vertically diagonal cracks need an alternate treatment.

Such restorations are very difficult to treat, mainly the cementation step. So some contraindications are followed:

1. Depressed patients having bad oral sanitation conditions.
2. Patients having high caries susceptibility.
3. Cases with limited access to the cavity, which can be a problem for preparation, impression, and cementation under the dam.
4. A very small cavity, e.g., an inlay, is comparatively unsuitable for such cases as ceramic material requires a high minimal thickness. A composite material is favored in this case.

Tooth preparation:

Inlay: The teeth are prepared for inlays made up of ceramics is different from the inlays made of metals because axial wall is present with a taper of about 10° and also with a wide isthmus (i.e., more than 2 mm for a molar) with angles that is rounded. The impact points on occlusal surface are placed a way from tooth-material interface. The peripherally placed finish line is supposed to be round quarterly. Inlays are preferred in cases where optimum cavity depth is there with no hurdles from occlusal contacts along with 90° edges that provides better looks. The finish lines are mostly straight finish lines, which is applied for reasons that support mechanically, and easy lab realization.[9]

Onlay:

Onlay needs 1.5 mm occlusal space minimum and the cuspal angles should be rounded while the shoulder margin is given along with a rounded internal angle or a wide chamfer. The preparations have a ceramic thickness of around 1.5 mm to 2.5 mm. The cavity is flat-based if it is deep enough or the cavity can be V-shaped around the central pit to increase the thickness of the restoration to increase mechanical support. In the second appointment, the temporary filling is discarded and the cavity is cleaned with an excavator, a probe, a sound, or an ultrasound insert accompanied by an air-polishing spray. Followed by the try-in, where the rules for prosthetic restorations (proximal contact point, marginal adaptation, shade, anatomical shape) are properly observed. Occlusal contacts are examined after bonding or with a low viscosity silicone to avoid cracking of the element [10].

(3c) Overlay: An overlay is a prosthesis that tends to restore the occlusal cusp integrity of a tooth. It crosses beyond the occlusal table in cervical direction and it has been also called a partial covering crown. The term itself depicts the peripheral limits mainly, which when compared to the classical crown is kept supragingivally.

Steps for the making of a Posterior Overlay:

Grooves on the occlusal are placed of 1mm to 1.5mm in the mock-up. Homogenous reduction is done on the occlusal surface up to 2 mm. Using a hybrid composite build-up is made to protect the immediately formed dentin by sealing and correcting the form of the preparation and removing the undercuts areas. The proximal "boxes" are made at the Butt Joint or have a rounded internal angle shoulder, with the least thickness of 1 mm to a maximal thickness of 1.5 mm. The internal walls are sharp and are also vertically divergent (6-15°) [11].

(3d) Veneerlay: Veneerlay sareone type of overlay restorations. It varies in the size of occlusal coverage, thickness, and peripheral coverage. More conservative in nature for the tissues as it is more dependent on the occlusal table thickness, veneerlay combines two "Anglo-Saxon" terms veneer and overlay. It includes back tooth region Ceramic Bonded Restorations, which restore the vestibular surface and the occlusal table.

Preparation of Veneerlay:

The form of the veneerlay formation should have internal transitions that are rounded, minimum thicknesses are kept as recommended for optimal resistance to occlusal function (i.e., 1.5mm) and vestibular aesthetics of (0.6mm). This was said by Dr. Olivier Etienne in 2019.

Indications and Contraindications for Overlays and Veneerlays: -

Indications

1. Extensive carious lesions leading to coronal decay;
2. Defect in the structure of the teeth i.e., Molar Incisor Hypomineralisation
3. Tooth decayed from all occlusal surfaces due to abrasion;
4. Alteration of vertical height in occlusion in cases having oral diseases while a restoration with a full crown causes more tooth loss.
5. Rectification that is done in the occlusion in cases where various ceramic prostheses are required, while the overlay can subtly blend the forms and also the shades and can effectively hand Lethe points of contact.
6. In Cracked tooth cases, symptoms should be prepared to sustain the tooth vitality. An overlay having an extension cervical away from the occlusal surface is placed.
7. Veneerlay is used in treating erosion or lesions of wear and tear where enamel gets lost and occlusal and vestibular surfaces are affected by dentinal tissues. Veneerlay is fabricated on both molars and premolars, while they are commonly used in modifying smiles which involves premolars.[12]

CONTRAINDICATIONS

There are several cases where a few features contraindicate the repair of teeth with bonded overlays. The features are assessed in the clinical examination or through the patient's case history and radiographs. Some of these features are:

1. Orientation of finish line where the subgingival finish line is not preferred as it does not permit for proper and adequate bonding for a long time as bonding with the dentin is substandard which is average as compared to bonding with enamel whereas the placement of the dam is not possible because of subgingival line.
2. Inadequate cleanliness can decrease the longevity of the overlays.
3. Deficient space for prosthesis like in the case of ceramics, thin prosthetic can be made with lithium disilicate that is reinforced vitreous ceramic or with zirconia (0.7 mm thick).
4. If elevated caries risk is present against the realization of overlays in suitable conditions.

(3e) Table top: Tabletops are onlay restorations, they are also called **occlusal veneers** and are commonly used in cases of wear of a large number of occlusal surfaces of posterior teeth. They are a clinical variety of overlay which is basically a partial bonded restoration that mainly covers the entire cusps. These wear and tear are mostly caused by bruxism which is clenching of the teeth mainly at night during sleep. The excessive forces erode the occlusal surfaces and incisal edges of the teeth, till they are destroyed while damaging the nerve. Before treatment, it is necessary to do a diagnostic wax-up to plan the appropriate height that the tabletops should have, as well as their function and aesthetics.[13]

Principle for preparation for Table Tops:

Intracuspoid Table Tops are used where the cusp is not hampered due to abrasion, preparing the surface with around bur should stop 1 millimeter away from the tip of the cusp and the proximal ridges are the main location of the tabletop. Tabletops (Cuspidial) are used in cases of highly advanced and broad abrasions, the cusp on the palatal aspect is trimmed flat and the cusp on the vestibular aspect is undamaged. Preparation with the round bur should stop at a distance of 1 millimetre from the cusp tip of the vestibular cusp. The buccal cusp form is never altered so it does not hinder the facial look parameters. While preparing the tooth the form should incorporate the cusp on the palatal side to re-establish its actual form. It is located on the proximal ridges.

Fabrication and bonding of partial bonded restorations:**Zirconia:**

The impression is made of heavy and light body silicone. The shade is picked with a shade guide (Vitapan 3D Master). The structure of the restoration is fabricated using CAD/CAM. After the try-in stage, the framework is veneered with a compatible porcelain system having a thickness between 1 mm to 2 mm. An aesthetic try-in of the restorations is made before final staining and glazing are done. After try-in, the restoration is rinsed and air dried and then treated with Ivuclean from (Ivoclar Vivadent) then Ivuclean is left to react with the restoration inner surface for 20 seconds. Again, it is rinsed and dried then the application of Monobond Plus (Silane coupling agent) is done on the whole of the inner surface of restoration and is left to react for 60 seconds. The remaining liquid is air dried. Now the restoration is ready to be cemented. The tooth is then etched for as long as 15 sec with 37% phosphoric acid, then rinsed off. It is then applied with a slim layer of bonding agent and hence polymerized for 15sec.

Finally, a layer of resin cement (Multi-Link N) is applied in luting consistency to the prosthesis. The restoration was seated and extra luting cement is removed. The restoration is supported while the resin

cement is cured. The overall excess cement can be discarded after a spot cure. Light curing is done according to the resin manufacturer's suggestion.

Emax: Steps for impression making and making the restoration are similar as above and are also made with CAD/CAM 3d printing and milling. Steps of bonding, the first step of e.max veneer bonding is etching by Ivoclean within 20 seconds then acid is rinsed out, and the surface of the veneer is air dried. The next step is to apply a thin layer of silane (Monobond Plus) and keep it for 1-2 minutes. Then we apply adhesive to the tooth. If adhesive is non-filled and thin, we can light cure it, if thick and filled (like Opti Bond FL) we keep it on veneer non-polymerized. Now we can lute veneer by utilizing light-cured resin cement.

Clinical failures of adhesive restorations establish strong interest when root-canal treated teeth are considered. It is highly needed to recognize the reasons for failure to avoid them. Various causes of non-success of restoration for vital or non-vital teeth are biological conditions and mechanical reasons, including recurring caries, hypersensitivity caused by erosion and attrition of tooth structure, pathological conditions of pulp, chronic and acute apical periodontitis conditions, tooth, and root fractures also be difficult to restore, chipping of ceramic from the restorations, and loss of retentive and adhesive properties. But these unsuccessful methods can have various clinical implications such as interfering with tooth healing and hence causing resultant maintenance or loss of the tooth [14].

Studies show that the life span of the posterior tooth mostly relies upon the bulk of the natural tooth structure that is remaining and variations in the properties of the dentin over time. So, the efficiency of restorative procedures in conserving sound teeth and reducing root tissue loss is important. Endodontically treated teeth usually need a full-coverage crown restoration was highly considered in the past. Lateral study in 2002 explained that covering the cusps can raise the survival rate by six times of non-vital posterior teeth. So, the full coverage crown is accepted as the ideal treatment for huge cavities for years [15]. But the full coverage crown preparation removes a big bulk of healthy tooth structure from the already compromised teeth that resulted from the pathology and the deep endodontic procedures. Modern studies focus on partial bonded restorations of different types that provide ample healthy tissue protection compared to the classic full-crowns. Partially bonded restorations like the inlays, the onlays, the overlays, and the tabletops are recommended for the rehabilitation of root canal-treated teeth as valid substitutes for classical prosthodontics choices. The durability of the partial bonded restorations is proportional to the remaining tooth structure and effective bonding of the adhesive cement in replacing the damaged structural integrity

CONCLUSION

Partial bonded restorations are a type of minimally invasive treatment. As it can fully enact the properties of the natural tooth form, while also delivering a good aesthetic emergence which is one of the major worries of the needful person. The natural tooth form is much better than any artificial or manufactured material hence effort is always made to retain the most of the natural tooth in any kind of restorative procedure. While saving the natural tooth structure, it is also important to reconstruct the tooth to make sure full mechanical functioning and stability are present while also getting a natural and pleasing cosmetic look. The partial bonded restoration also gives patients relief in expenditure in comparison to conventional full crown restoration, making it a better convincing treatment option.

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