Review Article

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Minimally Invasive Esthetic Prosthodontics

Jay Dutt Tiwari[1*] Prachi Jain[2] Abhinandan Soni[3] Akanksha Zutshi[4] Vaibhav Juneja[5] Sonika Yadav[6]

[1]Senior Resident, Department of Dental Surgery, Moti Lal Nehru Medical College, Allahabad, Uttar Pradesh, India.
[2]Senior Resident, Department of Prosthodontics, Pandit Bhagwat Dayal Sharma, PGIDS, Rohtak, Haryana, India.
[3]Intern, Pandit Bhagwat Dayal Sharma, PGIDS, Rohtak, Haryana, India.
[4]Senior Lecturer, Department of Oral and Maxillofacial Surgery, National Dental College, Derabassi, Punjab, India.
[5]Private Consultant, Klinik Dentika, 284, Q1 Block, Sector 49, South city 2, Gurgaon, Haryana, India.
[6]Senior Resident, Department of Dental Surgery, Moti Lal Nehru Medical College, Allahabad, Uttar Pradesh, India.

ABSTRACT

Background: The restoration of unaesthetic anterior teeth has always been a challenge to a dentist. With the increased demand and patient awareness, use of veneers to restore unaesthetic teeth has increased. They offer a conservative and durable treatment modality. In this article, an insight has been given on indications, contraindications, advantages, disadvantages and steps of fabrication along with the recent advances.

Keywords: Dentistry, Esthetics, Veneers.

INTRODUCTION

It is said that "You are not fully dressed without a smile". Beauty of smile and aesthetics of anterior teeth are considered synonymous. Any alteration in morphology, contour or colour particularly in relation to anterior teeth needs careful intervention of prosthodontic procedures. Earlier, the treatment of beautification involved invasive procedures like full crowns. But these days, minimally invasive procedures are gaining popularity. In this context, veneer as a permanent esthetic restoration overcomes the limitations of the other treatment modalities like bleaching, microabrasion, recontouring etc.

Veneer according to Sturdevant[1] is defined as a layer of tooth coloured material that is applied to a tooth to restore localized or generalized defects and intrinsic discolourations[1].They were introduced in 1928 by Dr Charles Pincus, a Californian dentist[2].

INDICATIONS[3,4]

Any discolouration resulting from flourosis, non vitality, tetracycline staining (Figure 1) and discoloured root filled teeth (Figure 2) where strengthening is not required can be treated with veneers. They can be used to treat mild malalignment of teeth and for closure of diastema (Figure 3). Veneers can also be used as an intermediate restoration for the correction of cosmetic or minor functional needs in children's teeth such as spacing between teeth, rotated or lingually inclined incisors. In such cases, crown preparation cannot be done due to large immature pulp.

CONTRAINDICATIONS[3,4]

Teeth with significant loss of tooth structure due to wear, decay or fracture, and those with poor quality enamel or insufficient sound enamel are poor candidates for veneer as sufficient enamel is required not only for adhesion but also to seal the veneer to the tooth surface (Figure 4 and 5). In parafunctional habits (bruxism), edge to edge occlusion and habits like nail or pencil biting, veneer should not be given as in such cases there will be excessive stress on the restoration. In moderate to severe malposition or crowding, if veneer as a treatment modality is planned, excessive tooth reduction will be needed to correct the condition which would result in significant loss

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*Correspondence Dr. Jay Dutt Tiwari.
Department of Dental Surgery, Moti Lal Nehru Medical College, Allahabad, Uttar Pradesh, India.
Email: Not Disclosed

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Fig. 1: Tetracyclined stained teeth

Fig. 2: Staining in right central incisor due to non vitality

Fig. 3: Diastema

of enamel and hence poor bonding. Therefore, other treatment options like crowns or orthodontic treatment should be planned in such cases (Figure 6).

Thus, judicious care in its placement is required. Repairs are difficult once veneers are luted to the enamel. Also precise shade matching is difficult. As fabrication of veneers is an indirect process,

Fig. 4: Excessive tooth structure loss in left central incisor

Fig. 5: Amelogenesis imperfecta

Fig. 6: Severe crowding of anterior teeth

ADVANTAGES[3,5]

Porcelain veneer restorations are fragile but once they are luted to enamel they exhibit excellent compressive, tensile and shear strengths. Highly glazed porcelain surface resists plaque accumulation thus maintaining periodontal health. The aesthetics with porcelain is considerably better, owing to the ability to control not only the surface colour but also the internal coloration as well as other factors so critical in creating a natural effect such as surface texture, shape and fluorescence. The overall result is considerably more stable and aesthetic restoration. Porcelain is both abrasion resistant and colour stable. In addition, porcelain has excellent resistance to fluid absorption.

DISADVANTAGES[3,5]

The process of fabrication of veneer is a highly technique sensitive procedure and thus time consuming. They are extremely fragile and difficult to manipulate during try-in and cementation stages. accurate impression making and high quality laboratory work is required.

MATERIAL SELECTION[6,7]

For correct ceramic choice, Fons Font et al recommended that the patient can be divided in terms of whether they are to be subjected to functional loading or not as:

1. ***Type I patients***: In these patients, the facets are not exposed to functional loading and are referred to as simple esthetic facets. These patients can be further sub grouped as type I-A patient where the substrate teeth present no color alterations. The only objective here is to apply veneer for shape modifying purposes. The other subcategory is type I-B patients who present with facets that will not bear functional loading but which show moderate to severe alterations in dental colour that must be effectively masked by the restoration. In these situations both the porcelain and cement must

present various degrees of opacity in order to hide the colour

2. ***Type II patients:*** The facets in these patients are exposed to loading, and are referred to as functional esthetic facets. In these cases the existence of functional loading in both the mandibular static position and during excursive movements requires the use of a material with great resistance to fracture.

FABRICATION TECHNIQUES

The laboratory techniques for fabrication of porcelain veneers include refractory investment technique, platinum foil technique, pressed porcelain veneers and CAD/CAM technique. The first two methods are not used these days because of their technique sensitive procedures. Thus, these days veneers are either fabricated by pressed technique or CAD/CAM technique.

In pressed porcelain veneers technique[6], veneers can be made by utilizing a technique similar to the lost wax technique. Waxing up of the tooth is done to a desired contour and invested followed by burnout procedure. Thereafter, an ingot of glass ceramic of the chosen shade is plasticized at 920 degree C at which they become highly viscous liquid and pressed into the investment mold under vaccum and pressure. This method results in a very dense ceramic material having high flexural and compressive strength.

In CAD/CAM technology[8,9], with the assistance of a scanner, three-dimensional data is produced on the basis of the master die. This data is processed by means of dental design software. After the CAD-process the data is sent to a special milling device which mills the ceramic block to fabricate veneers. Veneers made using this technology are easier to fabricate and present with good mechanical strength because they are manufactured under precise controlled conditions diminishing potential inaccuracies resulting from manual fabrication procedures.

PREPARATION DESIGN FOR PORCELAIN VENEERS

A key element for the success of porcelain veneers is the carefully controlled but appropriate tooth reduction. Various factors which influence the amount of tooth preparation for a porcelain veneer are expectations of patients, midline position, lip position and fullness, incisal edge position, desired teeth shapes and contours, occlusion, desired colours[10]. In general, four basic preparation designs have been described for the veneer preparation (Window, feather, incisal overlap and butt joint design). The latter two designs are the most frequently used designs as window and feather design are associated with inherent disadvantages of weakening the enamel at the incisal edge.

Incisal overlap: In this design, the incisal edge is reduced and the veneer preparation extends onto the palatal tooth surface with light palatal chamfer 0.5 mm wide, terminating 1mm far away from central contact points, not involving the palatal concavity (Figure 7). This provides a positive seat of the veneer during luting. This design is given in cases where it is necessary to lengthen the tooth, where part of the palatal surface need to be protected , incisal thickness is too thin to support the veneer or when the incisal edge is poor aesthetically due to minor chipping

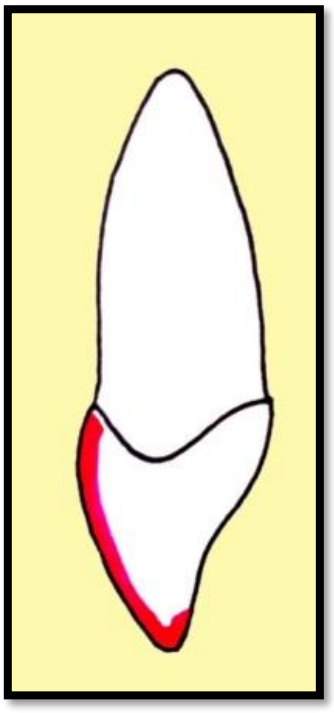

Fig. 7: Incisal overlap design

Butt joint: It is created by cutting the incisal surface i.e. edge flat without forming the palatal chamfer (Figure 8). It is given for moderate crown fracture that involves incisal one third and in severe wear as

it limits the extension of the ceramic and reduce the amount of stress at tooth/veneer interface.

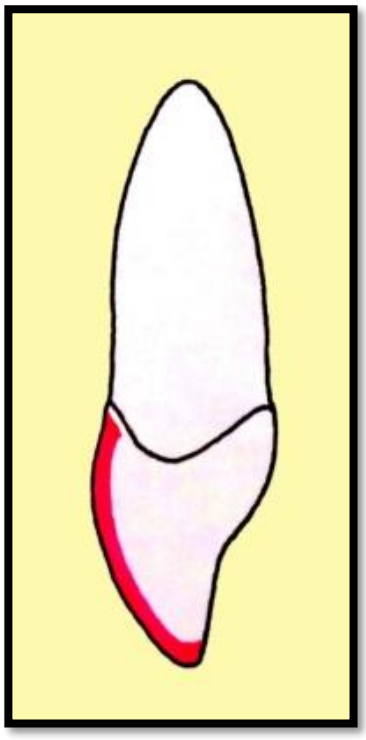

Fig. 8: Butt joint design

CEMENTATION TECHNIQUE

First the intaglio surface of veneer is treated with hydrofluoric acid as the microporosities formed due to etching tend to increase the surface area for bonding and lead to a micro mechanical interlocking of the resin composite. The period of acid conditioning varies according to the ceramic material[11,12].

CERAMIC	CONDITIONING
Feldspathic	9.5% HF for 2 to 2.5 min, 1 min washing, silane application
Leucite reinforced	9.5% HF for 60 sec, 1 min washing, silane application
Lithium disilicate reinforced	9.5% HF for 20 sec, 1 min washing, silane application

Thereafter, silane coupling agent is applied on the veneer surface**.** These are bi-functional molecules capable of bonding to the hydroxyl groups on ceramic surfaces and copolymerizing with the organic portion of the resin cement or adhesive. Silane primers contain a silane agent (Usually gamma-methacryloxypropyl-trimethoxy silane), a weak acid and high amounts of solvents. Application of silane agent increases the bond strength.

Then, acid etching of the tooth is done with 37% phosphoric acid for 30 seconds. The etchant must reach the entire periphery of the preparation where a tight seal is critical to the long term success of the restoration. At this stage, care must be taken to avoid contamination with saliva. Then it is rinsed with copius amount of water for 20 seconds.. After drying, surface is checked for the frosted appearance which is a sign of successful etching. A bonding agent is then applied onto the surface. It is then gently air dispersed into a thin layer and polymerized.

For cementation, a light cure luting composite resin cement is preferred as it allows a longer working time compared with dual cure or chemically cured resins. This makes it easy to remove the excess composite prior to curing and shortens the finishing time. Also, the colour stability is superior.

But, it is important that enough light transmittance throughout the porcelain veneer should be there to polymerize the light curing luting composite. This light transmittance is affected by the thickness of the porcelain veneer. Therefore, dual cured luting resins should be used in cases when the thickness of the ceramic is more than 0.7mm as their light cure resins do not reach their maximum hardness in such cases. Example: Rely X™ by 3M ESPE, Variolink Veneer by Ivoclar Vivadent, Choice™ 2 light cure cement by Bisco, Panavia™ dual cured cement, Insure Universal Cementation System™ from Cosmedent.

CAUSES OF FAILURE OF VENEERS

Failure of laminate veneers can be associated with

1. **Case selection:** This is the most important step affecting the success of the restoration. Suitable indication must be present for successful veneer placement.

2. **Tooth preparation:** Preparation extending into dentin is less retentive as compared to preparation limited to enamel.

3. **Laboratory processes:** Incorrect choice of ceramic material and improper fabrication technique can lead to weaker restoration resulting in failure.

4. **Try in and handling**: As veneers are extremely fragile before cementation, improper handling can result in breakage of veneer.

5. **Choice of cement**: Choice between light cured, dual cured and chemically cured resin cement must be made depending on the case requirement. If the thickness is more, dual cured cement must be preferred as light cure cement do not reach their maximum hardness.

6. **Bonding procedures:** Failure to isolate and curing for insufficient time can lead to weaker bond resulting in failure.

PREVENTION OF FAILURE

During veneer fabrication

Proper case selection should be done. To avoid inaccuracies proper steps of tooth preparation and impression making should be followed. For cementation of veneers, steps should be followed in terms of etching time and isolation.

After cementation

Patient should be instructed to avoid coloured food, tea, or coffee during initial 72-96 hours and use a soft toothbrush with rounded bristles, and to floss daily. They should avoid biting habits like nail biting, pencil chewing and biting on hard objects/food with restored teeth. No mechanical intervention like scaling or polishing should be carried out in the absence of gingival inflammation or plaque. Hand held instruments like curette or scaler should be used in a gentle tactile movement only when required.

RECENT ADVANCES

Preparation less veneers[13]: These are also called ultrathin porcelain veneers. They involve minimal or no removal of any tooth structure. Veneer thickness can be as thin as 0.2 to 0.3 mm and hence they can be bonded directly onto the surface of the tooth without any need of preparation. Their thickness is similar to the thickness of a contact lens (Fig. 9). Examples include lumineers by DenMat Holdings, Vivaneers by Glidewell Laboratories, Durathin veneers by Experience Dental Studio and MAC veneers by Microdental laboratory.

Fig 9: Thickness of ultrathin veneer.

These veneers offer the advantage of conservating the tooth structure with no need of providing a provisional restoration, ease of impression making procedure as tissue management is not required and result in longer lasting restoration due to enamel bonding but care should be taken before placement of these veneers as they can lead to bulky appearance and periodontal problems if overcontoured.

Componeer by Coltene[14]: These are prefabricated composite veneers manufactured from highly filled nano-hybrid-composite which ensures excellent homogeneity and stability of the enamel-shells. The extremely thin veneer coatings as thin as 0.3 mm cervically and 0.6-1 mm in the incisal edge allow a high level of conservation of tooth substance. The shiny and naturally designed surface adds a look of vitality to the restoration. Moreover, these veneers have been shown to exhibit bond strength similar to the porcelain veneer. They are easy and efficient to use and only one session is required. They show quality dental restorations with excellent aesthetic results. They offer optimum customization in terms of choice of colour, shape and structure and are very economical for patient .

CONCLUSION

The use of veneers to solve esthetic and/or functional problems has shown to be a valid treatment option especially in the anterior esthetic zone. The techniques employed to fabricate veneers

offer satisfactory, predicatble and long lasting results.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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