Review Article

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Veneers: A Perfect Solution To Imperfect Teeth

Abstract:

Background: Porcelain laminate veneer is one of the most conservative and aesthetically pleasing methods we may use to restore the human dentition and enhance the appearance of an anterior tooth. In 1928, C.L. Pincus introduced the Hollywood Veneer. He used thin porcelain veneers to make movie stars teeth more aesthetically pleasing. Over the past few decades, laminate veneers have developed into one of the most widely used restorative procedures in esthetic dentistry. They are considered as the primary option to enhance the esthetics of anterior teeth and consequently quality of life. This purpose of this article is to review the literature and highlight crucial factors for the long-term effectiveness of porcelain veneers, including case selection, tooth preparation, provisionalization, cementation, and patient maintenance.

Key-words: Advancements, CAD-CAM machining, Laminate, Provisionalization, Veneer

Introduction:

Porcelain laminate veneer is one of the most conservative and aesthetically pleasing methods we may use to restore the human dentition and enhance the appearance of an anterior tooth.[1] They are considered as the primary option to enhance the esthetics of anterior teeth and consequently quality of life.[2] In 1928, C.L. Pincus introduced the Hollywood Veneer.[3] He used thin porcelain veneers to make movie stars teeth more aesthetically pleasing. Unfortunately, he had to use denture adhesive to secure the veneers. Innovative chances to repair stained or misaligned teeth were made possible by the invention of bis-GMA and composite resin restorative materials. The composite resin laminate veneer, with or without a facing, evolved between the middle of the 1970s and the beginning of the 1980s. In the beginning, a process known as "bonding" was used to add composite resin directly to a tooth's facial surface to repair cracked, discoloured, and malformed permanent incisors.[4] Veneers were a recommended therapy for the dentist and a treatment that many patients wanted due to the aesthetic, mechanical, and biocompatibility of the porcelain, preservation of the tooth structure, longevity, and dependability of the procedure, and greater strength of bonding.[5

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Indications:

- Intrinsic discolouration[6]
- Diastema
- Chipped tooth
- Worn dentition
- Malaligned teeth
- Excessively discoloured teeth
- Hypocalcification
- Peg laterals
- Lingually positioned tooth

[1]SMESA JWALITHACLARE,
[2]SUDHEER ARUNACHALAM,
[3]G. SNEHA, [4]SUSMITA MONDAL
[1-4]Department of Prosthodontics and Crown & Bridge, Sree Sai Dental College and Research Institute, Srikakulam

Address for Correspondence: Dr. Mesa Jwalithaclare PG Student,
Department of Prosthodontics and Crown & Bridge, Sree Sai Dental College and Research Institute, Srikakulam, Andhra Pradesh,
E-mail : jwalithaclare123@gmail.com

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Contraindications:

- Patients who exhibit tooth wear as a result of bruxism.
- Short clinical crown.
- Teeth with insufficient or inadequate enamel for sufficient retention (severe abrasion)
- Existing large restorations or endodontically treated teeth with little remaining tooth structure.
- Patients with oral habits causing excessive stress on the restoration. (nail biting)

Case selection for Porcelain Laminate Veneers:

- In patients getting veneers, a static and dynamic occlusal connection is of utmost importance. The incisal tips should be positioned such that they do not make contact with the opposing dentition in the relaxed state since the fracture at the incisal margins is the typical mode of failure. A good foundation for the restoration, like for any other restoration, is provided by a healthy periodontium.
- Mouth breathers are considered as poor candidates for veneers.
- Before beginning treatment, it is important to assess the degree of tooth discolouration, the size of any pre-existing caries lesions, and any restorations that may have been placed. The teeth are again a poor option for veneers because they lack enamel or have a big repair that prevents them from providing a sufficient surface for bonding.
- Patient's attitude and motivation to maintenance makes the treatment more successful.
- In order to prevent shear stress on the ceramics following the cementation of veneers, oral habits advise correcting nail biting prior to treatment

All ceramic systems used are

- Conventional ceramics
- Castable ceramics
- Machinable ceramics.
- Pressable ceramics.
- Infiltrated ceramics

Tooth Preparation:

Two major principles governs tooth preparation

- Preparation must be conservative and
- Retention is solely by adhesion rather than tooth preparation

Types of preparation:

Three different types of preparation include:

Type 1: Contact lens preparation in which the preparation does not cover the incisal edges.(Fig 1 a)

Type 2: Classic or conventional preparation, which is commonly used by the practitioers. Here, the preparation covers the incisal edge and terminates lingually.(Fig 1 b)

Type 3: Wrap around preparation, which is almost similar to that of full coverage preparations, which is indicated for extensive color and contour (Fig 1 c)

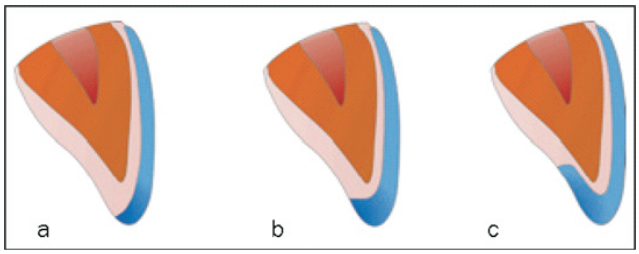

Fig 1- Tooth preparations a) Type 1 b) Type-2 c) Type -3

Procedure:

Facial reduction: Some teeth allow less reduction at the gingival finish line to a standard of 0.3 mm and the reduction at the incisal half and incisal edge to a standard of 0.5 mm because the amount of enamel reduces at the cementoenamel junction. (Fig 2). The precise depth orientation grooves will be created by two diamond cutting burs with diameters of 1.6 mm and 1.0 mm, and the remaining tooth structure will be removed by round-ended tapered diamond. A slight chamfer finish line is established by the tip of the diamond. (Fig 3)

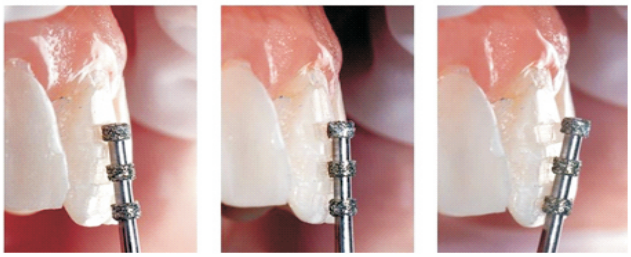

Fig 2-The bur should be used on three different inclinations (cervical, middle, and incisal thirds) following the anatomy of the labial surface

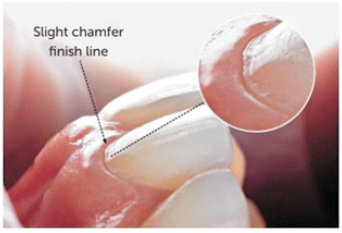

Fig 3- A slight chamfer finish line at the gingival level obtained at the end of the preparation.

Proximal reduction: With the round end tapered diamond, proximal extension is essentially a continuation of facial reduction. By keeping the bur parallel to the long axis of the teeth, an uneven finish line is prevented and enough reduction at the line angle is advised.

Incisal reduction: The incisal finish line can be placed using one of two methods. the first approach, in which we finish preparing at the incisal edge, and the second technique, in which the porcelain slightly reduces the incisal edges and overlaps them. The wrap-around preparation will place the veneers in compression and produce superior outcomes since porcelain is stronger in compression than in tension. In the incisal edge, 0.5 mm deep orientation grooves are made using multiwheel diamond burs, and the remaining tooth structure is removed using round end tapered diamond.

Lingual reduction: Round end tapered diamonds are used to create lingual finish lines by holding the bur parallel to the lingual surface and creating a slight chamfer of 0.5-mm-deep . The lingual finish line also depends on the patient's occlusion and the thickness of the teeth. Finishing is done in further

Provisional Restoration : Laminates may not require provisional restorations since the proximal connections are preserved and the dentin is not exposed. However, if the patient's proximal contacts are severed, it may be vital for them to continue their social engagements. The two provisionalization techniques are the direct method, which uses composite resin with central spot etching (Fig. 4), and the indirect method, which uses autopolymerizing acrylic resin after the cast production.8

Fig 4-Spot etching for temporization

Basic Laboratory Technique:

Platinum foil backing Refractory models

Direct castings CAD-CAM Machining

After fabrication, hydrofluoric acid is sprayed to the fitting surface, providing bonding strength by partially dissolving the porcelain's glassy matrix. The correct etching causes a foggy appearance and to prevent contamination and to preserve the bonding strength, the etched veneers are not repositioned on the master cast.[9]

Methods of strengthening porcelain:

Etched porcelain

Various methods to reinforce dental porcelain have been developed due to its innate fragility. The most well-known example of a porcelain strengthening technique that allows porcelain to be utilised in dental restorations is certainly the porcelain fused to metal restoration. Along with a precise fit, the metal framework offers a mechanism to stop porcelain from breaking under tensile forces. Additional types of porcelain core are frequently utilised as well as the more modern magnesium-alumina spinel.

The inner surface of the porcelain is gently etched in this unique treatment method for both porcelain reinforcing and retention. The bonding resin that is used to cement the porcelain restorations in place flows into the micro-defects of the etched porcelain on the restoration side and the etched enamel on the tooth side, joining the two together. The polymerized resin offers significant retention while also preventing the porcelain from breaking under tensile stresses. One explanation for the clinical success of resin attaching etched porcelain to teeth is the resin's natural polymerization shrinkage feature, which stresses the thin porcelain in a way that increases the risk of crack initiation and propagation.

The Effects of Solution and Time on Etching:

In a four-group experiment, Hsu et al. tested the resin-to-porcelain binding strength of this retentive etching pattern. In this experiment, all porcelain samples were coated with a composite resin by placing small, cylindrical celluloid capsules over the flat porcelain surfaces and filling the capsules with a powdered liquid composite resin. The shear bond strength of the composite resin samples was assessed using a testing equipment after they had been exposed to light for seven days in water. [10]

The impact of the silane-bonding agent in contrast to that of the etched porcelain was seen when the four groups were compared. The results of this experiment demonstrate that the retention is mostly caused by etching the porcelain. However, the bond strength appears to be greatly increased when silane-bonding promoter and porcelain etching are combined. In comparison to binding strengths found in earlier studies, the group using porcelain etching and silane pretreatment

achieved a value of 3,500 psi. This bond also surpasses the resin enamel bond strength.

A gap between the porcelain and resin was present in the non-etched porcelain groups, and it was most likely caused by the resin's contraction during polymerization. The gap was reduced after the silane treatment, possibly as a result of enhanced chemical attraction.

No gap was noticed in the silane-treated, etched porcelain groups, and it seemed that the resin had filled in all of the porcelain's defects. Evidently, the silane-treated rough etched surface created a surface attraction, causing the resin to thoroughly wet it. The strongest binding strengths appear to have been created by resin's successful adaption to etched porcelain.

The retention of the resin is aided by both the silane and the etched porcelain surface. Silane was utilised by Newbury and Pameijer to bond a porcelain tooth to composite resin. According to the research by Hsu et al., etching the porcelain is a crucial component in achieving effective retention with the resin. Thus, the silane treatment followed by etching provided the highest bond strength.

2.Polymerization

A strong bond between the tooth and porcelain can only be achieved with complete polymerization of the composite resin. The transmission of light and its penetration through the porcelain into the composite resin are necessary for the polymerization of light activated composite resin. The thickness and opacity of the porcelain, as well as the opacity of the composite resin that was utilised, can all have an impact on this light transmission, but these two are the most crucial. Systems that initiate polymerization both chemically and photochemically have a substantially stronger connection with thick porcelain than systems that only initiate polymerization through light. When the light must pass through more than 3 mm of porcelain, the effectiveness of visible light polymerization is significantly reduced.

Longevity of Porcelain Restorations

In contrast to some direct composite resins, etched porcelain restorations are not susceptible to surface wear, roughness, or discolouration. However, the durability of these restorations largely depends on how well they adhere to the underlying tooth tissue. By exposing the restoration to the possibility of deformation and fracture, a poor resin to porcelain connection (or deterioration of the bond over time) would lead to early failure of the restoration.In clinical usage, therefore, obtaining optimal porcelain to resin bond strength is of utmost importance for durability.

Try in:

A retraction cord is used to prevent sulcular moisture or bleeding during the dry try-in for marginal fit, during which each veneer is tested for marginal correctness on the dry tooth surface. The evaluation of proximal fit involves a wet try-in procedure where the etched surface is treated with water-soluble glycerin to reduce vertical dislodgment. If the colour is appropriate, resin cement is tried in for colour matching, and cementing proceeds without issue. It is advised to use resin cement that is darker or roughly the same degree if the veneers are lighter than the required colour. One component of light opaque resin cement and ten parts of light translucent resin cement are advised if it is darker than the desired colour.

Cementation:

Rada RE, Jankowski BJ. Porcelain laminate veneer

Provisionalisation using visible light curing resin.

Quintessence

Int 1991;22:291-3

1. Apply silane-coupling agent to the internal surface of all porcelain laminate veneers according to the manufactures instruction.
2. If the tooth surface has been contaminated pumice the labial and lingual tooth surface again.
3. Place matrix strips between the first teeth to be restored and the adjacent teeth.
4. Etch the enamel and dentine for 15 seconds with 37% phosphoric acid
5. Wash with water and or water / air spray for a minimum of 10 seconds, for gel or liquid etchants.[11]
6. Air dry. Repeat the etching process, rewash the enamel if it is not frosty white. Repeat if necessary.
7. Place new matrix strips between all interproximal areas.
8. Rewet the dentin with a cotton pellet.
9. Apply bonding agent to the internal surface of the porcelain laminate veneers according to the manufactures instructios.
10. Apply preselected shade of luting cement to the internal surface of the porcelain laminate veneer.
11. Place dentin/enamel bonding agent onto the tooth according to the manufactures instruction.
12. Carefully place the porcelain laminate veneers onto the teeth and fully seat to place.
13. Hold the porcelain laminate veneer in place and cure the incisal tip form a labial direction for 10 seconds.

14. Remove excess luting cement with a brush moistened with bonding agent
15. Cure the remaining luting cement from the buccal, lingual and incisal directions according to manufactures instructions.
16. Reomve the matrix strips.
17. Remove excess flash with composite resin carving instruments.

Recent Advances:

Over the years there have been various advancements in laminates and veneers in dentistry.[12] The recent advancements are:

- Stacked/feldspathic teeth veneers
- Thick monochromatic teeth veneers
- Teeth veneers with reinforced leucite
- Lithium disilicate teeth veneers
- Minimally or no prep veneers
- lumineers
- Durathin veneers
- vivaneers
- Da Vinci veneers
- MAC veneers
- Zirconia veneers

Discussion:

- **Hui K.K.K, B. Williams, E.H.Davis stated** that window type of preparation was the strongest when compared with overlapped or feathered design.[13]
- **Hignton Ron et al stated** that gingival tooth preparation is essential to control stress distribution and provide the best potential for periodontal health. [14]
- **H. Serdar Çötert et al** conducted a clinical study on "The Effect of Various Preparation Designs on the Survival of Porcelain Laminate Veneers."The following conclusions were drawn from this clinical study:

- The total survival rate was greatly increased by the presence of an overlapped incisal edge.[15]
- The overall survival rate was greatly improved by supragingival preparation.
- The total survival rate was greatly increased by intact enamel as the surrounding tissue.
- The proximal chamfer preparation type improved the capacity to bond to healthy tooth material.

- In patients with bruxism, the likelihood of fractures and debonding in porcelain laminate veneers increases significantly. Patients with it have a nearly 3-fold increased chance of debonding.[16]
- Hunt claimed that porcelain veneers created directly on the refractory die will fit better and be less prone to distortion during firing.[17]
- **Chnar Zidan** in his study "Phosphoric acid concentration: enamel surface loss and bonding strength" concluded that **:**

- The acid concentration affected the enamel surface loss. The maximum loss was in the 20% to 50% range.
- Long-term water storage did not weaken the bonding strength of the enamel that had been etched with low H3PO4 concentrations. [18]
- The tag length had little to no impact on proper bonding, depending on where the resin-etched enamel bond fractured.
- From a biological perspective, it is desirable to utilise modest doses of acid that result in less enamel degradation while securing a strong binding.

Conclusion:

A minimally invasive approach for the treatment of discoloured and malformed teeth is veneers. The secret to successful therapy is achieving balance between the facial and oral cavity structures.[19] A great alternative to a conservative approach for the teeth has emerged as a result of recent developments in veneers and laminates in dentistry. It has good aesthetics since it closely resembles natural teeth. Patients generally accept its insertion because it is a minimally invasive technique. The need for laminates in dentistry has increased as a result of recent developments with exceptional biocompatibility, high strength, durability, and stain resistance. They do, however, have some drawbacks, including high cost, the inability to treat malaligned teeth, and the requirement for replacement every few years due to shrinkage, which must be taken into consideration for any future advancements made to enhance the quality of the treatment and the patient's aesthetics. In today's dental practice, porcelain laminate veneer restoration holds a unique position.[20] There have been many technical innovations as a result of increased general awareness of veneers and their possibilities, and there have also been significant advancements in both the technical and material elements.

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