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RESEARCH ARTICLE

LAMINATE : A CONSERVATIVE APPROACH IN SHAPING A SMILE

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ABSTRACT

Laminate veneers are considered highly functional and esthetically indirect restorations that treat unaesthetic anterior teeth with minimally invasive preparation. The more improvement in ceramic material, adhesive luting cement and preparation techniques offer many options for clinicians. The success of veneer cases depends on proper case selection, resolution of initial esthetic issues, patients satisfaction and good integration of a restoration with surrounding tooth and soft tissue. These can be achieved through more focusing on the recent trends in ceramic materials and techniques based on adhesive dentistry, minimal tooth preparation technique which preserve the tooth structure and offer better results.

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INTRODUCTION

Perfect smile is a beautiful thing that a person can wear as it influences our personality. Patients are concerned about the esthetics and better smile so conservative treatment that are able to modify the shape, size and color of teeth and that provide the result that the patients expect should always be the first therapeutic option (Belser, 1997; Radz, 2011 and Rotoli, 2013). Traditionally, the most durable aesthetic correction of anterior teeth is done by preparation of full crown .But this procedure is invasive and involves removal of large amount of sound teeth and also leads to adverse effects on pulp and periodontal tissue. Laminate veneer are alternative to full coverage restoration to improve the esthetic of anterior teeth. With latest adhesive technologies ceramic veneer have made a remarkable impact. Natural and convincing results are immediately accepted by the clientele in esthetic dentistry. Clinical performance of esthetic veneers in ceramic materials have been excellent. Over a period of time, as materials and techniques have evolved, veneers have become most esthetic, predictable and minimally invasive modalities of treatment (Radz, 2011). The esthetic and mechanical qualities and biocompatibility of porcelain, preservation of tooth structure, durability and reliability of treatment and improved strength of bonding made veneer a recommended treatment for dentist (Highton, 2011). Ceramic laminate veneers have given long term aesthetic maintenance with minimum failure rates compared to other methods (Donovan, 2008; Soares, 2005; Giordano, 2010 Peumans, 2004). The causes of failure may be due to improper case selection like patients with deep bite, selection of un-erupted tooth, abnormal articulation, excessive loss of dental and periodontal soft tissue, excessive dentin reduction and improper application of resin luting cement (Walls, 1995 and Della Bona, 2008). However planning each step like case selection, shade selection, tooth preparation, provisionalization, cementation and patients maintenance is important for long term success of porcelain veneers.

History

- 1928 - The concept of veneering anterior teeth with laminates was introduced by Dr Charles Pincus (Pincus, 2002).
- 1955 - The acid etching technique discovered by Bunacore provided a simple method of increasing adhesion to enamel surface for acrylic materials (Buonocore, 1995).
- 1970-1980 – Composite resin laminate veneer evolved. They were directly bonded to teeth.
- 1975 - Rochette first proposed the use of bonded ceramic restorations in the anterior teeth (Rochette, 1975).
- 1991 - Feinman and Friedman carried out key work for augmenting restorative dentistry with porcelain laminate veneers (Friedman, 1991).

Indications

- Stained teeth
- Hypo calcification
- Fractured Teeth
- Multiple Diastemas
- Lingually positioned teeth
- Peg laterals
- Malpositioned teeth not requiring orthodontic treatment

Contraindications

- Insufficient tooth substrate (enamel)
- Excessive interdental spacing
- Labial version
- Parafunctional habits (clenching, bruxism)
- Moderate to severe malposition or crowding

Classification

Based on microstructure

- Glass based systems (mainly silica)
- Glass based systems with fillers usually crystalline
- Low to moderate leucite containing feldspathic glass
- High leucite containing glass e.g. Glass ceramics
- Lithium disilicate glass ceramics
- Crystalline based systems with glass fillers
- Polycrystalline solids

Based on type

- Feldspathic porcelain
- Leucite reinforced porcelain
- Aluminous porcelain
- Glass infiltrated alumina
- Glass infiltrated zirconia
- Glass ceramics

Based on processing technique

- Glass based powder/liquid systems
- Pressable blocks of glass based systems
- Computer aided design/ Computer assessed manufacturing (CAD/CAM) systems

Feldspathic porcelain veneers: Feldspathic veneers are created by layering glass based (silicon dioxide) powder and liquid materials. Silicon dioxide contains various amounts of alumina. These aluminum silicates contain potassium and sodium and are referred as feldspars. The composition of feldspars is primarily of silicon oxide (60%-64%) and aluminum oxide (20%-23%). They are typically modified in different ways to create glass that can be used in dental restorations (Giordano, 2010; Conrad, 2007 and Culp, 2010). Therefore, the porcelain veneer consists of fluorapatite crystals in an aluminum-silicate glass which could be layered on the core to create the final morphology and shade of the restoration. The optical properties of the veneering porcelain is due to the fluorapatite crystals. Feldspathic porcelain gives good aesthetic value and shows high translucency, just like natural dentition. The mechanical properties of Feldspathic porcelain are low. The veneering porcelains are susceptible to fracture under mechanical stress due to the nature of the glass matrix materials and the absence of core material. Hence, a good bond combined with a stiffer tooth substructure (enamel) is required to reinforce the restoration (McLaren, 2010). The use of feldspathic veneers is increased due to requirement of less invasive treatment and higher level of aesthetics. With this material, it is possible to have a thickness of less than 0.5mm, with or without enamel preparation. The ideal conditions for the bond between the veneer and the substrate are the presence of a rate of 50% or more of the enamel remaining on the tooth; 50% or more of the bonded substrate being enamel; and 70% or more of the margin being in enamel (McLaren, 2010 and Della Bona, 2008). The production of feldspathic veneer is done by means of sculpturing powder/liquid. The aesthetic value exhibited in these restorations is a result of this technique. Therefore, it depends on the ceramist's ability to build depth of anatomy, colour and translucency into restoration.

Figure 1. Feldspathic porcelain veneer

Glass based ceramics: Glass ceramics are best suited for use as dental restorative materials specially for anterior restorations. They have improved physical and mechanical properties which includes increased fracture resistance, improved thermal shock resistance and resistance to erosion. Improvement in properties depends on the interaction of the crystals and glassy matrix, as well as on the size and the amount of crystals. Stronger materials are produced by finer crystals. They may be opaque or translucent, depending on the chemical composition and percent crystallinity (Pini, 2012). The strength of glassy ceramics is achieved by adding fillers which are uniformly dispersed throughout the glass, such as aluminum, magnesium, zirconia, leucite and lithium disilicate. For esthetic veneers, ceramics reinforced by leucite and lithium disilicate are commonly indicated for their optical properties and because they are acid sensitive. The glass matrix is infiltrated by micron size crystals of leucite and lithium disilicate, creating a highly filled glass matrix (Pini, 2012; Giordino, 2010 and Conrad, 2007). The flexural strength depends on the shape and volume of these crystals. Even with high crystalline content, this material can be translucent. This is due to relatively low refractive index of the crystals. Both leucite and lithium disilicate are fabricated through a combination of lost-wax and heat-pressed techniques. The pressed ceramics are less porous and can have a higher crystalline content because the ingots are manufactured from nonporous glass by applying heat treatment which transforms

some glass into crystals. This procedure can produce well controlled and homogeneous materials.

Figure 2. Glass Based Ceramic

Machineable (CAD/CAM) Ceramics: Computer aided design/computer aided manufacturing may make the production of veneers easier. The restorations done by CAD/CAM have a natural appearance because the ceramic blocks have a translucent quality that emulates enamel and they are available in a wide range of shades (Davidowitz, 2011 and Seydler, 2011). The chances of success are almost as high as those with conventional veneers. The quality is consistent because prefabricated ceramic blocks are free from internal defects and the computer program is designed to produce shapes that will stand up to wear (Davidowitz, 2011). In addition to have a wide range of shades CAD/CAM veneers have a natural appearance. Internal defects and voids of prefabricated ceramic blocks are not found, therefore, the quality of final restoration is consistent. Limitations of CAD/CAM are high cost and need for extra training.

Figure 3. Machineable Ceramic

Techniques

Preparation of Teeth: Removal of various amount tooth structure may be advisable for tooth preparation (Fradeani, 2005 and Calamia, 1985). Enamel reduction is needed to enhance the bond strength of the resin composite to the tooth surface. The aprismatic surface of mature unprepared enamel is removed, which offers only a minor retention capacity (Peumans, 2000). Care should be taken to maintain the preparation completely in enamel since the better the adhesion between the veneer and the prepared tooth, the better is the stress distribution in the system-enamel-composite ceramic. For porcelain laminate veneers, three types of preparation forms have been described, namely, Window, overlapped and feathered preparations. The least invasive preparation with maximal preservation of enamel is advisable as there is no consensus on which preparation type is more resistant to fracture. The main objective of the technique is to maintain the entire contour in intact enamel. The types of preparation differ at the incisal region of the tooth. At the cervical third, the gingival margin of the veneer must be located at the same level as the gingival crest or slightly subgingival for the anterior teeth. At the incisal third, the preparation may be modified. The options include the window preparation which is the most conservative and maintains enamel in incisal third, which results in a visible line between enamel, resin and ceramic. The other possibility is the feather preparation, which recovers the incisal of the tooth, maintaining its format. The critical points of this technique are the difficulty in positioning the ceramic restoration at the moment of its cementation and in matching the optical properties of the remaining incisal structure (Della Bona, 2009). To obtain adequate color properties at the incisal third of the laminate veneers, the preparation needs to allow a thickness of ceramic of 1.5-2.0 mm and this is possible with the overlap preparation. At the proximal region, the preparation must follow the papilla and extend until interproximal contact.

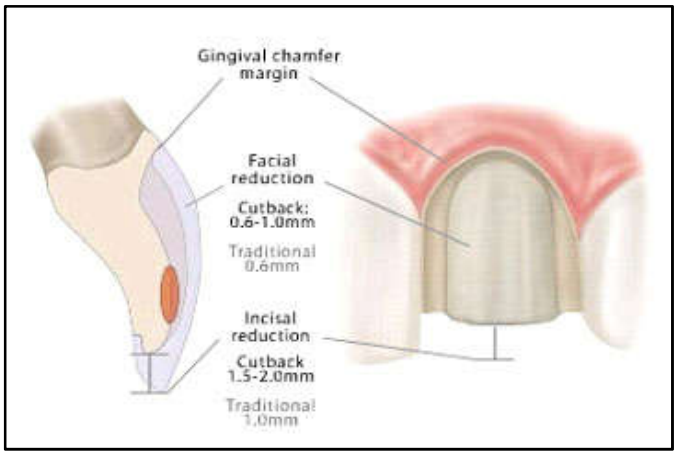


Figure 4. Preparation of Tooth Surface

Substrate treatment: The ceramic veneer technique includes the bonding of a thin porcelain laminate to tooth surface, enamel and / or dentin, using adhesive techniques and a luting composite to change the colour, form and/or position of anterior teeth. The success of the porcelain veneer is largely determined by the strength and durability of the bond formed between the three different components of the bonded veneer complex : tooth surface, the porcelain veneer and the luting composite (Peumans, 2000). The enamel surface must be conditioned with phosphoric acid (37%). This procedure increases the surface energy of the structure leading to a perfect wetting of the surface with the bond. While the etching of enamel with phosphoric acid leads to frosty surface which is a sign of successful procedure. This is because of its inorganic composition and perfect etchability. It is difficult to obtain the correct dryness or wetness of the surface, which is elementary for a successful bond.

Substrate Treatment Ceramic: An essential step for clinical success is effective etching of the ceramic surface. Alteration of the surface topography by etching will lead to changes in the surface area and in the wetting behavior of the porcelain.

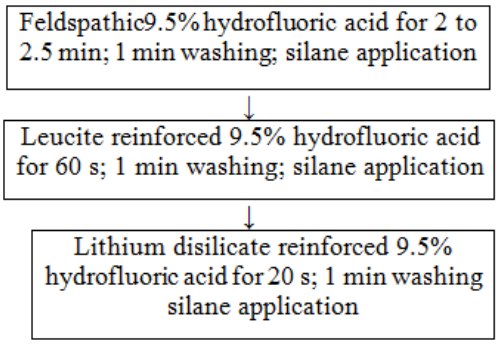
This may also change the ceramic surface energy and its adhesive potential to resin. Unique topographic changes after etching procedures are produced due to differences in ceramic composition (Della Bona, 2002). Acid conditioning with hydrofluoric acid is efficient in removing superficial defects and rounding off the remaining flaw tips. This reduces the stress concentration and increases the overall strength. Chemical link between the luting resin composite and porcelain is provided by silanization of etched porcelain with a bifunctional coupling agent. A silane group at one end chemically bonds to hydrolysed silicon dioxide at the ceramic surface and a methacrylate group at the other end copolymerizes with the adhesive resin. Single-component systems contain silane in alcohol or acetone and require prior acidification of the ceramic surface with hydrofluoric acid to activate the chemical reaction. With two-component silane solutions, the silane is mixed with an aqueous acid solution to hydrolyze the silane, so that it can react directly with the ceramic surface.

Luting Cements: The cementation of the indirect restorations determines the clinical success of laminate veneers (Flow Chart 1). The resin cements have good retention and resistance to fracture. Luting cements are versatile materials that can achieve excellent aesthetic results. They are recommended for cementation of veneers, inlays, onlays and ad all-ceramic restorations and fiber posts, for their adhesion capacity with the tooth, as with restorative materials, such as ceramics and composite resin. The resin cements have good retention and resistance to fracture, but the adhesive cementation technique is sensitive and associated with a high incidence of postoperative sensitivity (Udo, 2007; Radovic, 2008 and Kumboglu, 2004). Luting cements can be classified into two subgroups: (1) cements associated with the use of conventional or self-etching adhesives and (2) self adhesive cements which do not need any prior conditioning of the tooth structure.

Advantages of Ceramic Veneers

Porcelain presents a number of advantages over other veneering materials and acts as an excellent replacement for unesthetic tooth substance

- **Conservative approach:** Laminate veneer preparations are much more conservative of tooth preparation as compared to either porcelain fused to metal or all porcelain full coverage restorations.
- **Bond strength:** Bonding to enamel surface of etched porcelain is much better than any other veneering system.
- **Colour:** Porcelain offers better colour control, natural look, translucency and colour stability.
- **Strength:** High shearing and tensile strength is developed by porcelain veneer restorations when veneer is luted to enamel.
- **Resistance to abrasion:** Very high wear and abrasion resistance is seen in porcelain as compared to composite resins.
- **Periodontal health:** Highly glazed porcelain surface resists plaque accumulation as compared to any other veneer system and helps in maintaining periodontal health.
- **Resistance to fluid absorption:** Compared to other veneering material, porcelain absorbs lesser degree of fluid.
- **Esthetics:** Compared to other veneer material, porcelain offers much better esthetics as it enables control of colour and surface texture.



Flowchart 1. Ceramic surface treatment proto

Figure 5 & 6. Placement of Ceramic veneer

Disadvantages of Ceramic Veneers

- **Time:** Veneering procedure is highly technique sensitive to technique and time consuming. Also, it requires multiple visits.
- **Cost:** Due to involvement of laboratory and additional chairside time, additional cost is incurred. The cost also depends on the difficulty level of case, the time required, level of skill and planning involved.
- **Colour:** Once the veneer is luted to the enamel surface, it is difficult to modify colour. Also, precise shade matching is difficult.
- **Fragility:** During try-in and cementation stages, it is difficult to manipulate venners as they are extremely fragile.
- **Repair:** Once veneers are luted to enamel, repairs are difficult to make.
- **Technique sensitive:** Fabrication of veneers is an indirect process which requires accurate impression making and high quality laboratory work.

DISCUSSION

Porcelain veneers enable the dentist to change the appearance, size, colour, spacing and to some extent, the positioning of the teeth. Teeth preparation may not be required in many veneering procedures. Also, anesthesia is also not required. The facial expression is the most important feature that greets the observers eye and any deformity in that is likely to have an adverse effect on it. Porcelain laminate veneers offer a conservative approach to restoring anterior teeth thus contributing to a captivating smile with an even row of natural, gleaming white teeth. The incorporation of ceramic veneers has resulted in restorations with improved strength, durability, periodontal health preservation, marginal integrity, wear resistance, colour matching and stability. Therefore, porcelain veneers are an important development in the dental armamentarium and has contributed immensely in patient's dental esthetics.

Conclusion

The clinical success of laminate veneers depends on both the suitable indications of the patient and the correct application of the materials and techniques available for that, in accordance with the necessity and goals of the esthetic treatment. Ceramic laminate veneers are one of the best methods of conservative anterior esthetic restorations. It offers advantages like colour stability, translucency, high strength, resistance to abrasion and enhanced bond strength.

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