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Review Article

Porcelain Laminate Veneers: A Conservative Approach For Pleasing Esthetics- An Overview

Arbaz Sajjad[1], Wan Zaripah Wan Bakar[2], Dasmawati Mohamad[3], T.P. Kannan[4]

[1] *PhD Researcher(Biomaterials), Programme-Prosthodontics, School of Dental Sciences (PPSG),UniversitiSains Malaysia (Health Campus)*
[2] *Senior Lecturer and Consultant Prosthodontist, School of Dental Sciences (PPSG),UniversitiSains Malaysia (Health Campus)*
[3]*Elective Programme Chairperson, Lecturer in Dental Materials, School of Dental Sciences (PPSG),UniversitiSains Malaysia (Health Campus*
[4] *School of Dental Sciences (PPSG),UniversitiSains Malaysia (Health Campus) kubangKerian, Malaysia*

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ABSTRACT

The demand for all ceramic restorations has increased by leaps and bounds in the past two to three decades. As esthetically pleasing restorations of young fractured malformed or discolored teeth has been a perplexing problem for dentists, in the past few years a conservative approach to improve the esthetic appearance has led widespread use of veneering systems. The development of newer materials, technology and the esthetic desire of the common public have made porcelain laminate veneers a sought-after entity. As we are in the new era of resin bonded porcelain, emphasis will be upon newer information regarding materialsand fabrication techniques.The current literature was reviewed to search for the most relevant parameters determining the proper case selection, clinical limitations, fabrication techniques and long-term success of porcelain veneers.

INTRODUCTION

The demand for tooth colored restorations and a more attractive smile has now passed the boundaries of exclusive practitioners, specialists & the esthetic centers all over the world. As esthetically pleasing restorations of young fractured malformed or discolored teeth has been a perplexing problem for dentists, in the past few years a conservative approach to improve the esthetic appearance has led widespread use of veneering systems.

It seems to be Dr. Charles Pincus who first used temporary thin veneers to enhance movie stars appearances for close-ups in the movie industry in the 1930s [1]. Bonded pellicular ceramic coverage of anterior teeth was only described in the early 1980s [2] integrating the adhesion principles developed earlier by Buonocore and Bowen, but it was Rochette in France who, in 1975, first proposed the use of bonded ceramic restorations in the anterior dentition [3].

A veneer is a layer of tooth colored material that is applied to a tooth for esthetically restoring localized or generalized defects or intrinsic discolorations. Porcelain laminate veneers (PLVs), also known as porcelain facets, Horn-type facets or ceramic facets. PLV restorations have a unique position in today's dental practice.

* Corresponding author**: Dr. Arbaz Sajjad, Biomaterials Department, School of Dental Sciences (PPSG), UniversitiSains Malaysia (Health Campus), kubangKerian, Kelantan-16150, Malaysia, Phone: +60176291814, Email: arbaz@student.usm.my**

Increased awareness of veneers and their potential has sparked a lot of improvement regarding the technical and material aspects.

Dental laboratories have become proficient at making both fired and pressed versions of ceramic veneers. Perfect smiles improve the self-confidence, personality, social life and have psychological effect on improving self-image with enhanced self-esteem of the patient. As we are in the new era of resin bonded porcelain, emphasis will be upon newer information regarding methods and techniques.

HISTORY

Surprisingly, the method of fabrication has not evolved too much since 1980, although the potential of bonded ceramics is well known, due to their ability to fulfill the biomimetic principle.

Porcelain as a material for veneering was first reported by Horn and became popular in North America & Europe[2].

Then in, a)1930s- Dr Charles Pincus first used temporary thin veneers to improve the appearance of movie stars on close up[1].b)1955-Bunocore- introduced acid etch technique to increase adhesion of acrylic filling material to enamel[4].c)1958-Bowen introduced BIS-GMA[5].d)1970s - Faunce and Myers described the bonding of prefabricated resin veneers, using adhesion of the resin cement to enamel after etching[6].e)1970's - "Mastique Veneer System" by Dentsply (preformed factory processed plastic laminates). Relatively easy to place on the tooth- kit with a moderate selection of different shapes and sizes that needed to be shaped to fit the selected teeth. They were technique sensitive, and there is high marginal discoloration. f)1975- Rochette in France described a technique for making porcelain restorations for fractured incisors without operative interference [3]. The ceramic block was baked in the laboratory on a 24- Karat gold matrix cast. A resin was bonded to the saline- treated porcelain block & etched enamel. g) 1983- In North America, essential developments in adhesive technology were carried out by Horn [2], Calamia[7-8], Christensen[9-10], Garber & Goldstien[11].h) 1985- Toulati *et al*., through their work were responsible for the popularity of porcelain laminates in Europe[12].i) 1991- Feinman & Friedman [13] did key work for augmenting restorative dentistry with PLVs.

METHODS

An electronic search of publications was made using the electronic databases ScienceDirect® and PubMed® through our institutional membership access. The inclusion criterion were abstract or full-text articles-clinical trials, case reports, reviews or systematic reviews. The keywords were selected listing the following four combinations: (1) laminate veneer, (2) porcelain veneer, (3) porcelain laminate veneer (4) dental ceramic. Total of 147citations were identified and 29 articles meeting the inclusion criteria were included in the review.

Indications:

Three principal groups of indications are distinguished:

•Tooth discoloration resistant to bleaching procedures (type I),

•The need for major morphologic modification in anterior teeth (type II), and

•Extensive restoration of compromised anterior teeth (type III).

Type I: Teeth resistant to bleaching:

Examples of type I indications-Include excessively discolored teeth as a result of tetracycline stains (degrees III and IV according to Jordon & Boksman[14]; type I-A

and anterior teeth with severely attrited or eroded incisal edges that ultimately result in the exposure of the underlying dentin, type I-B.

a) Type IA: Tetracycline discoloration:

The occurrence of type IA indications has been reduced recently due to novel approaches in night guard vital bleaching. These patients can even be treated by bleaching beneath existing porcelain veneers. Type I situations, are the most difficult to treat in terms of color depth as they require minimal tooth preparation. This makes it a challenge for the ceramist to effectively mask the underlying discoloration as well as create the illusion of a PLVs within the contours of the adjacent natural teeth[15].

In teeth of older individuals, the incorporation of custom characterization such as deep coloration, craze lines and spots can facilitate the blending of the veneers among the natural adjacent teeth, in spite of the thinness of the ceramic.

b) Type IB: Teeth unresponsive to external and internal bleaching:

This category includes, for example, teeth with exposed dentin and pulp less teeth. Veneered incisors demonstrate a stress distribution that cannot be differentiated from that within intact incisors under load. This is the essence of biomimetics when restorations behave functionally as natural teeth regarding strain and stress transfer, unlike teeth treated with extensive composite restorations[16].

1. Type II: Major morphologic modifications:

This group of indications consists of patients with very high expectations and there are three subcategories-

a) Type IIA: Conoid teeth:

Conoid teeth naturally present an ideal configuration for the use of porcelain veneers. The required tooth preparation is minimal; only a light marginal chamfer is needed for the dental technician to fabricate an accurate ceramic piece[17-19].

b) Type II B: Closure of diastemas and interdental black triangles:

Interdental black triangles are common sequelae of orthodontic alignment of crowded incisors or periodontal disease. On the other hand, indirect porcelain laminates can overcome these problems, provided that specific tooth preparation is performed. Opened cervical embrasures present the same dilemma as diastemas, may also be corrected with the rational, nonsurgical approach using interdental "mini-wings" [16,17].

c) Type II C: Augmentation of incisal length and prominence:

To increase the inciso-gingival height of incisors, direct bonded composite resins can be placed, but it is now an established fact that these resins succumb to early fatigue resulting in chipping and wear if used to augment incisal edges [20,21].

Consequently, PLVs can be proposed to ensure a more predictable result. A significant concern might be raised through the marked anterior guidance that is created when restoring incisal length and prominence. As there seems to be an association between the absence of anterior guidance (i.e. open bite) and temporomandibular disorders, "a key element in the development of harmonious occlusion is therefore the incisal guidance,' the steepness of which appears not to be important for neuromuscular harmony" [14,17,22].

2. Type III: Extensive restoration in the adult:

Extensive coronal fractures (type IIIA), extensive loss of enamel (type IIIB) and malformations (type IIIC) are indications for this type of bonded porcelain restoration.

a) Type III A: Extensive coronal fracture:

PLVs act as a bandage and allow the vitality to be maintained in teeth with considerable coronal fracture.

Wall*et al.*, demonstrated that up to 2 mm of incisal edge span of ceramics could be created on mandibular incisors without affecting the ultimate coronal strength [20].

b) Type III B: Extensive loss of enamel:

Extensive tooth abrasion is typically found in people of older age groups; of the maxillary teeth, the anterior teeth often exhibit the most wear. However, tooth surface loss is a growing problem in younger individuals [23].

c) Type IIIC: Generalized congenital and acquired malformations:

Examples- Generalized enamel dysplasia. It may be treated successfully and conservatively with PLVs if the dentino- enamel junction has not been altered [16]. Generalized enamel dysplasia must be distinguished from amelogenesis imperfecta. The latter requires prudence: most frequently a full-coverage prosthetic procedure remains the treatment of choice.

CONTRAINDICATIONS

1. Insufficient enamel: There should be enamel around the whole periphery of the laminate, not only for adhesion but, more importantly, to seal the veneer to the tooth surface. In addition, there should be sufficient enamel available for bonding, because bonding to dentin is generally much less retentive than to enamel. If the tooth or teeth are composed predominantly of dentin and cementum, crowing may well be the treatment of choice [24].

2. Enamel etch ability: It has been observed that deciduous teeth and teeth that have been subjected to excessively fluoridation may be difficult to etch. Thereby, requiring alternative measures to be successfully bonded to PLVs.

3. Oral Habits: Patients with certain tooth to tooth habit patterns, such as bruxism, or tooth-to-foreign-objects habits may not be ideal candidates for veneers. The shear stress generated is too great for the porcelain to tolerate resulting in failure [25].

ADVANTAGES

1. Shade: There are two advantages to be mentioned here. First, is that porcelain offers better shade control giving the sense of a natural look and second it demonstrates long term stability of the chosen shade.

2. Bond strength: The bond between the etched PLVs, the resin luting agent and the underlying prepared enamel is much stronger than any other veneering system.

3. Abrasion resistance: Despite their fragility, once the PLVs are luted into place and bonded to the enamel they demonstrate high shear and tensile strengths. This is evident by the fact that if for some reason PLVs need to be removed, they cannot be dislodged from the teeth and need be ground away using rotary diamond points. Porcelain can therefore be used to increase the length of any given tooth by wrapping it over the incisal edge, both because of its exceptional bond strength to enamel and because, the adhesive and cohesive strengths of porcelain are very high.

4. Resistance to Absorption: Porcelain absorbs fluids to a lesser extent than any other commercially available resin veneering systems.

5. Periodontal health: The highly glazed PLVs reduces the incidence of bacterial plaque accumulation when compared with direct bonded composite veneers thereby, preventing potential periodontal problems.

6. Esthetics: The esthetics achieved with PLVs is more superior to any other veneering material because of the realistic shade control and surface texture possibilities. Porcelain can be stained both externally and internally and has a fluorescence similar to vital tooth.

Also, the PLV surface is more receptive to texture alterations in order to mimic the surface texture of the adjacent teeth.

DISADVANTAGES

1. Time: The placement of PLVsis operator and technique sensitive issue. Therefore, it requires careful planning and practice along with the know-how and ideal manipulation of the luting agents. Thus, it can be safely assumed that this procedure consumes substantial time.
2. Repair: If during service the PLVs crack or chip- off repairs are often difficult or impossible to execute.
3. Technique-sensitive: The traditional process of fabricating veneers is an indirect one, requiring at least two patient visits which involve impression making, and laboratory costs.
4. Color: It is not possible to modify the shade previously selected if the patient expresses the desire for the same once the PLVsare permanently luted into place.
5. Tooth preparation: Some tooth preparation within the enamel may be required in order to prevent potential problems that may arise from ensuing over-contouring of the PLVs.
6. Fragility: The veneers are relatively fragile and need to be handled with great care.

Choice of fabrication technique:

1. Ceramic fired over refractory die: It is the oldest" and most widespread method for fabricating a porcelain piece. The main advantages of this technique are as follows: • No special equipment is required. • Extremely sophisticated effects of color and translucency can be obtained through a full thickness layering technique. • Traditional feldspathic porcelains can be used; when combined with hydrofluoric acid etching and silanization, they show extremely reliable bonding to resins."

These advantages are also found in the platinum foil technique, which is the closest alternative to the refractory die technique but requires less effort in cast making. In addition, data from the early 1990s, repeatedly showed the superior marginal fidelity of platinum foil veneers [26]. These results have lost their relevance since the introduction of improved refractory materials (eg. Ducera-Lay, Ducera)and use of smaller individual dies[27].

2. Cast glass-ceramic restorations (DICOR® Castable Ceramic, Dentsply, York; PA)

They were first developed for all-ceramic crowns. This material demonstrates some unique physico- mechanical attributes. However, the high labor costs and limited esthetics have prevented this system from further development.

3. Pressed ceramic (IPSEmpress®,IPSe.max® Press, Ivoclar Vivadent AG, Schaan; LI)

This type of reinforced pressable ceramic is either used to fabricate an entire restoration or only the core which is veneered later in a traditional manner. The latter option allows for esthetic characterization during additional ceramic layering. The room for esthetic improvements, however, is a bit limited when compared to full-thickness layering that can be applied with the refractory die technique[28].

4. Slip cast ceramics (ln-Ceram®Spinell, ln-Ceram® Alumina, Vita Zahnfabrik, Bad Säckingen; Germany)

Slip casting method of fabrication usually produces restorations with enhanced intrinsic mechanical properties compared to other ceramic systems. This technology was originally intended for full coverage restorations but was later adapted to PLVs by substituting alumina with spinel ($MgAI_2O_6$). However,

due to its high crystallinity and resulting enhanced molecular density, traditional method of improving bonding by hydrofluoric acid etching became ineffective. Similarly, bonding of ln-Ceram alumina to a resin luting agent, requires tribo-chemical silica coating or use of a special resin monomer[28].

5. Machinable ceramics:

The combination of advancements in dental materials as well as in computer technology has made computer‐assisted design/computer‐assisted manufacturing (CAD/CAM) fabricated PLV restorations possible in dental clinics[29]. All CAD/CAM systems consist of three components: (1) A digitization tool/scanner that transforms the geometry into digital data that can be processed by the computer. (2) Software that processes data and depending on the application, produces a data set for the product to be fabricated. (3) A fabrication science that converts the data records into the physical restoration. Since its introduction in the early 1980s, it has evolved in three directions depending on the type of the production line, (a) chair-side production, e.g. Cerec™ System (Sirona® Dental GmbH; Salzburg, Österreich), (b) laboratory production, e.g., inEos X5 scanner and inLab MC XL milling unit (Sirona® Dental GmbH; Salzburg, Österreich), and (c) centralized fabrication in a production center, e.g. Nobel Procera™ (Nobel Biocare®, Zürich Switzerland)[29].

All-ceramic restorations designed and milled chair- side, eliminate the need for traditional impressions and temporaries, and the patient leaves the appointment in about an hour with a final restoration in place [30]. The chances of success are, as high as traditionally fabricated veneers; 98.8% of patients describe their CAD/CAM-produced solution as successful[31-32].

CONCLUSION

The demand for all ceramic restorations has increased by leaps and bounds in the past twenty years. The developments of newer materials, technology and the esthetic desire of the common public have made porcelain laminate veneers a sought-after entity. As the demand and subsequent incorporation of PLVs in a restorative treatment plan rises, the average dental operator finds him/herself weighing cautiously the restoration esthetics with the available material limitations. Debonding, fracture and microleakage are some of the disheartening moments in an otherwise popular & successful present which the PLVs have enjoyed.

The overuse of PLVs should be avoided. Patients presenting with multiple diastemas, severely overlapping teeth, edge to edge occlusal relationship and bruxers should be considered for alternative treatment modalities rather than indiscriminately restoring them with porcelain laminate veneers.

However, it does not mean that these are absolute contraindications. With the understanding of tooth crown biomechanics and the progress of dentin adhesives, bonded ceramic restorations present an extended spectrum of indications for anterior teeth. To prevent short-term failures, the new generations of PLVs require accurate knowledge of the stress distribution within the tooth-restoration complex. Aside from careful patient selection, by giving meticulous attention to veneer preparation, production and final luting, longevity of the restoration can be improved.

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