



ORIGINAL ARTICLE

# Porcelain laminate veneers: Clinical survey for evaluation of failure



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## KEYWORDS

Color change;  
Debonding;  
Overlapped design;  
Porcelain laminate veneer;  
Sensitivity;  
Window design

**Abstract Objective:** To investigate the association of the failure of porcelain laminate veneers with factors related to the patient, material, and operator.

**Methods:** This clinical survey involved 29 patients (19 women and 10 men) and their dentists, including undergraduate and postgraduate dental students and dental interns. Two questionnaires were distributed to collect information from participants. All patients were clinically examined. Criteria for failure of the porcelain laminate veneers included color change, cracking, fracture, and/or debonding.

**Results:** A total of 205 porcelain laminate veneers were evaluated. All of the restorations were fabricated from IPS e.max Press and cemented with Variolink Veneer (Ivoclar Vivadent, Schaan, Principality of Liechtenstein) or RelyX veneer cement (3M ESPE, St. Paul, MN, USA). The preparations were generally located in enamel (58.6%), and most veneers had an overlapped design (89.7%). Ten patients (34.48%) showed veneer failure, most often in terms of color change (60%). Overall, 82.8% of patients were satisfied with their restorations.

**Conclusion:** Insufficient clinical skills or operator experience resulted in restoration failure in one-third of patients.

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## 1. Introduction

The demand for treating unaesthetic anterior teeth continues to grow. Available options to restore their aesthetics include

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conservative treatments, such as bleaching and direct composite laminate veneers (Shillingburg et al., 1997), and reliable but aggressive treatments, such as full crown restorations (Peumans et al., 2000; Strassler, 2007). However, crown preparations are associated with some problems, including the extensive removal of the sound tooth structure and irreversible effects on the dental pulp (Peumans et al., 2000).

Calamia (1984) first described the treatment of porcelain with hydrofluoric acid and silane to create an adhesive interface, which serves as the basis for porcelain laminate veneers (Strassler, 2007). These tooth-colored materials can improve the aesthetic outcome of anterior restorations (Roberson et al., 2006). Improvements in adhesive systems and the

development of new-generation porcelain technology have supported the growing demand for treating unaesthetic teeth with porcelain laminate veneers (Christensen, 2008). Studies have shown a 7% failure rate of porcelain laminate veneers, but failure had no direct impact on the clinical success in terms of longevity or durability (Friedman, 1998; Peumans et al., 2000). These restorations are highly esthetic, biocompatible, and resistant to staining and wear (Goldstein and Haywood, 1998).

Porcelain laminate veneer preparation can be a stressful for dentists with insufficient clinical skills or experience. Lack of good procedural knowledge frequently results in failed restorations. Several longitudinal clinical studies have been performed on the performance of porcelain laminate veneers placed by general practitioners or specialists, revealing acceptable results regardless of the type of failure and/or veneer design (Beier et al., 2012; Castelnuovo et al., 2000; Dumfahrt and Schäffer, 2000; Mizrahi, 2007). An evaluation of the clinical performance of veneers placed by undergraduate students in Ireland also revealed satisfactory restorations (Murphy et al., 2005). However, no studies have been performed in Saudi Arabia regarding the performance of porcelain laminate veneers placed by dentists at any level. Case unavailability, the need for time-consuming continuous and close supervision by clinical instructors, and procedural difficulty for students may explain the lack of such reports. The aim of this study was to investigate the association of the failure of porcelain laminate veneers with factors related to the patient, material, and operator.

## 2. Materials and methods

A clinical survey was conducted at the Riyadh Colleges of Dentistry and Pharmacy, Riyadh, Saudi Arabia. The study involved 29 patients (19 women and 10 men) and their dentists (undergraduate and postgraduate dental students and dental interns), who were selected from a convenience sample in which the dentists may have seen more than one patient. Participation was voluntary, all information was confidential, and the patients gave their written informed consent for clinical examination. The study design was reviewed and approved by the institutional ethics committee.

Two questionnaires were distributed to collect information from participants. The patient-specific questionnaire comprised 10 main questions, including eight close-ended and two open-ended questions regarding age, gender, color change, sensitivity before and after treatment, satisfaction with the restoration, and habits (e.g., bruxism, nail biting, and pen biting). They were also asked about their smoking status and whether they consumed coffee, tea, and/or soft drinks. The dentist-specific questionnaire comprised five close-ended and three open-ended questions about the time for porcelain laminate veneer cementation, indications, veneer design, preparation depth, placement of the finish line, impression technique and material, and type of temporary restoration and cement used.

All patients underwent a clinical examination to determine pulp vitality, sensitivity, structural defects (e.g., cracks, fracture, and debonding), color change, marginal pigmentation and adaptation, and suitability of the veneer design. The periodontal status was assessed by the gingival and plaque indices of Loe and Silness (Newman et al., 2001), and gingival

recession was measured (in mm). Periapical and bitewing radiographs were used to check the presence of recurrent caries. Photographs were taken during the clinical examination, and pretreatment and posttreatment photographs were obtained from the dentists.

The criteria for failure of porcelain laminate veneers were color change, cracking, fracture, and/or debonding. Descriptive statistics were obtained for data analysis. The chi-square test or proportional *t*-test was used for statistical analysis at a significance level of 5% ( $P < 0.05$ ). The data were analyzed by using IBM SPSS software (version 16; IBM, Armonk, NY, USA).

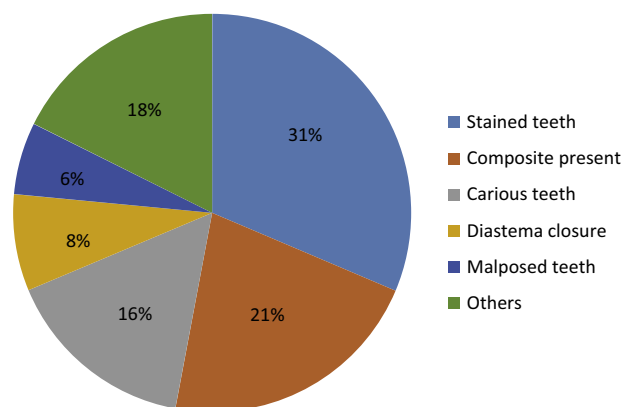
## 3. Results

A total of 205 porcelain laminate veneers fabricated from IPS e.max Press (Ivoclar Vivadent, Schaan, Principality of Liechtenstein) were evaluated. Patients ranged in age from 21 to 49 years (mean = 26 years). The follow-up period after veneer placement ranged from less than 6 months to more than 2 years (< 6 months,  $n = 17$ ; 6–12 months,  $n = 4$ ; 1–1.5 years,  $n = 4$ ; 1.5–2 years,  $n = 3$ ; > 2 years,  $n = 1$ ).

Fig. 1 shows the reasons for the porcelain laminate veneers. Most patients had maxillary restorations (72.4%,  $n = 21$ ); one patient had a mandibular veneer, and seven patients had veneers in both arches. With regard to the veneer design, three patients had a window design and the rest had an overlapped design. The preparation depth was located in the enamel in 58.6%, dentin in 10.3%, and both enamel and dentin in 31.0% of patients. Finish line placement was equigingival (65.5% of patients), supragingival (24.1%), or both supragingival and equigingival (10.3%).

The most common impression technique was the one-step double-mix technique; the washout technique was used in three cases. Polyvinyl siloxane impression material was mainly used; polyether impression material was used in two cases (i.e., implant cases). Acrylic resin temporary restorations fabricated in the laboratory were less widely used; composite with or without acid etch and acrylic resin temporary restorations fabricated in the clinic (success CD) were equally used (31%). Moreover, Variolink Veneer (Ivoclar Vivadent) and RelyX veneer cement (3M ESPE, St. Paul, MN, USA) were used in 65.5% and 34.5% of patients, respectively.

In the clinical examination, bleeding on probing was found in 69% of patients, and 48.3% had plaque on the tooth surface. In addition, 0.5-mm gingival recession was detected in 12 patients (41.4%); the rest showed no sign of gingival recession. One patient had irreversible pulpitis in one tooth after veneer placement; 28 patients had reversible pulpitis, mostly in the veneered teeth.



**Figure 1** Pie diagram of the reasons for porcelain laminate veneers in this study.

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