Fracture Strength of Laminate Veneers Using Different Restorative Materials and Techniques
(A Comparative in vitro Study)

A thesis

submitted to the council of the College of Dentistry at the University of Baghdad, in partial fulfillment of the requirements for the degree of Master of Science in Conservative Dentistry

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2014 A.D **1435 A.H**

Abstract

Esthetic correction represents one of the clinical conditions that required the use of laminate veneers in the premolars region. The purpose of this study was to evaluate the fracture strength of the laminate veneers in maxillary first premolars, fabricated from either composite (direct and indirect techniques) or ceramic CAD/CAM blocks.

Fifty extracted human maxillary premolar teeth with two separated roots were selected. Teeth were divided randomly into one control group and four experimental groups of ten teeth each: Group A: Restored with direct composite veneer fabricated directly on the tooth using nanohybrid composite material (Filtek Z250 XT, 3M ESPE), Group B: Restored with indirect composite veneers fabricated on stone die using nanohybrid composite material (Filtek Z250 Xt, 3M ESPE), Group C: Restored with lithium disilicate ceramic CAD/CAM blocks (IPS e. max CAD, Ivoclar Vivadent) and Group D: Restored with resin nano ceramic CAD/CAM blocks (Lava Ultimate Restorative, 3M ESPE), laminate veneers in the last two groups (C and D) were milled by CAD/CAM technology (CEREC inLab 4.02, milling system, Sirona). Standard preparations (intra enamel) were made for all teeth in experimental groups using Ceramic Veneer Set burs specially designed for laminate veneer preparation. Indirect laminate veneers were cemented with the light-cured luting cement Relyx Veneer Cement (3M ESPE, Germany) and all specimens were stored in distilled water at 37°C for 2 weeks. For mechanical testing, specimens were supported by a mounting jig with 45˚to the long axis of the teeth. The load was applied on the occlusal part of the veneer and the specimens were loaded to fracture using Instron universal testing machine. Results were analyzed with one-way ANOVA and LSD tests. Specimens in experimental groups were examined by stereomicroscope at a magnification of 20x to evaluate the mode of failure.

ANOVA test revealed statistically highly significant differences among the five groups ($P<0.01$). The results showed a mean of fracture strength of (420.8 N ± 53.5) for control group, (336.8 N ± 71.19) for direct composite veneers, (272.8 N ± 35.27)

for indirect composite veneers, (226.6 N ± 60.58) for IPS e.max CAD veneers and (271.8 N ± 68.79) for Lava Ultimate Restorative veneers.

Control group recorded higher mean of fracture strength in comparison to the experimental groups with statistically highly significant difference. Direct composite veneer showed higher mean of fracture strength with statistically significant difference in comparison to indirect composite veneers and Lava Ultimate Restorative veneers (Group B and D). On the other hand the difference between direct composite veneers (Group A) and IPS e.max CAD veneers (Group C) was statistically highly significant. Meanwhile, statistically non-significant difference was found among the three indirectly restored groups (B, C, and D). Failure analysis showed predominantly fracture of laminate veneers in Group A, B and D, while debonding was seen only in Group C.

In conclusion all veneers used in this study can be considered as acceptable treatment in the premolars region for patients with normal biting force, but its use for the patient with parafunction should be carefully evaluated. Direct composite veneer is the most favorable technique in term of fracture strength for laminate veneer restoration in premolars, while lithium disilicate CAD/CAM laminate veneers were least likely to fracture and most likely to completely debond.