ORIGINAL RESEARCH

Assessment of effect of liners on the shear bond strength of veneered zirconia block

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ABSTRACT

Background: The porcelain-fused-to-metal systems have been extensively used in fixed partial dentures and still represents the gold standard. The present study was conducted to assess effect of liners on the shear bond strength of veneered zirconia block. **Materials & Methods:** 40 samples were fabricated from VITA zirconia discs. Samples were divided into 4 groups with 10 samples each. Group I is the control group, group II is lithium disilicate glass–ceramic liner group, group III is silicon dioxide based liner, and group IV is glass–ceramic interlayer group. SBS of samples was recorded using universal testing machine.Samples were further analyzed for fractographic behavior using SEM. **Results:** The mean shear bond strength in group I was 21.5 Mpa, in group II was 60.2 Mpa, in group III was 60.5 Mpa and in group IV was 34.2 Mpa. The difference was significant (P< 0.05). **Conclusion:** Themaximum shear bond strength was obtained for lithium disilicate liner. Maximum adhesive failures were found with lithium disilicate liner.

Key words: Porcelain, shear bond strength, liner

INTRODUCTION

The porcelain-fused-to-metal systems have been extensively used in fixed partial dentures and still represents the gold standard. The advantages of the PFM systems are to combine the fracture resistance of the metal substructure with the aesthetic property of the porcelain.[1] However, recently the increasing demand for aesthetic restorations as well as the questionable biocompatibility of some dental metal alloys has accelerated the development and improvement of metal-free restorations.[2]All ceramic dental restorations composed of porcelain veneer on a zirconia substructure are nowadays being commonly used as an alternative to metal ceramic restorations.Chipping and fracturing of layered porcelain (lithium disilicate) applied to zirconia frameworks continue to be a problem with a reported incidence between 0%- 30%. Type of fracture can be adhesive or cohesive.[3]

Zirconia surface can be layered with two commercially available glass ceramic that is feldspathic porcelain or feldspathic porcelain with leucite crystal. Use of interlayer liquid suspension of ceramics as liner between zirconia substructure and veneered porcelain can enhance bond strength to great extension.[4]

Bond strength evaluation of layered porcelain over zirconia substructure can be done using shear bond strength test, three and four points flexure, tensile and microtensile bond test. Shear bond tests have been reported as one of the most established bond strength tests in literature.[5] SBS measurements showed that veneering porcelain on zirconia with lithium disilicate glass–ceramic liner fired at 85°C (vitali850) had the highest mean SBS.[6]The present study was conducted to assess effect of liners on the shear bond strength of veneered zirconia block.

MATERIALS & METHODS

The present study consisted of 40 samples were fabricated from VITA zirconia discs. Samples were divided into 4 groups with 10 samples each. Group I is the control group, group II is lithium disilicate glass–ceramic liner group, group III is silicon dioxide based liner, and group IV is glass–ceramic interlayer group. SBS of samples was recorded using universal

testing machine.Samples were further analyzed for fractographic behavior using SEM.Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I: Distribution of specimens

Groups	Group I	Group II	Group III	Group IV
Method	Control	lithium disilicate glass–ceramic liner	silicon dioxide based liner	glass–ceramic interlayer
Number	10	10	10	10

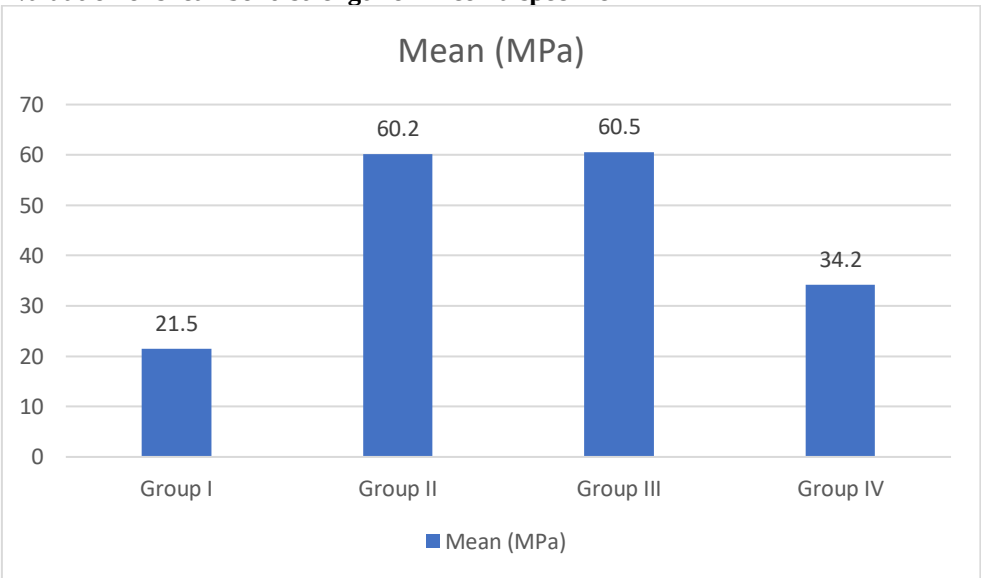
Table I shows distribution of specimens in 4 groups. Each group had 10 specimens.

Table II: Evaluation of shear bond strength of zirconia specimen

Groups	Mean (MPa)	P value
Group I	21.5	0.01
Group II	60.2	
Group III	60.5	
Group IV	34.2	

Table II, graph I shows that mean shear bond strength in group I was 21.5 Mpa, in group II was 60.2 Mpa, in group III was 60.5 Mpa and in group IV was 34.2 Mpa. The difference was significant (P< 0.05).

Graph I: Evaluation of shear bond strength of zirconia specimen



DISCUSSION

Liners can have a significant effect on the shear bond strength of veneered zirconia blocks.[7] The purpose of using liners is to enhance the bonding between the veneering material and the zirconia block, which can improve the overall strength and durability of the restoration.[8]There are several types of liners that can be used, including silica-based and phosphate-based liners. Silica-based liners typically contain a high percentage of silica, which can improve the bond strength of the veneering material to the zirconia block.[9] Phosphate-based liners, on the other hand, contain phosphoric acid, which can chemically bond to the zirconia surface and improve the adhesion of the veneering material.[10]It is important to note, however, that the type of liner used and the application technique can also affect the bond strength. Therefore, it is recommended to follow the manufacturer's instructions and consult with a dental professional for proper selection and application of the liner.[11,12]The present study was conducted to assess effect of liners on the shear bond strength of veneered zirconia block.

We found that mean shear bond strength in group I was 21.5 Mpa, in group II was 60.2 Mpa, in group III was 60.5 Mpa and in group IV was 34.2 Mpa. Yadav et al[13]evaluated the effect of lithium disilicate glass–ceramic liner, silicon dioxide based liner, and glass–ceramic interlayer on the shear bond strength (SBS) of a commercially available veneered zirconia block and to study fractographic behavior of the samples using universal testing machine, scanning electron microscope (SEM).60 samples were fabricated from VITA (vita zahnfabrik. Bad sackingen, Germany) zirconia discs. Samples were divided into 4 groups with 15 samples each. First is the control group, second is lithium disilicate glass–ceramic liner group, third is silicon dioxide based liner, and fourth is

glass–ceramic interlayer group. SBS of samples was recorded using universal testing machine. Samples were further analyzed for fractographic behavior using SEM.The intergroup comparison of mean SBS (Mpa) was done using the post hoc Bonferroni test. The mean SBS (Mpa) was significantly more among lithium disilicate and glass–ceramic interlayer groups in comparison to silicon dioxide-based liner group. Al-Dohan etal[14]demonstrated that most of the studies that performed macro shear bond test showed that most fractures occurred in the veneering layer (cohesive failure). The SBS of veneering ceramics was higher than SBS between core and veneering ceramics, and the failure mode observed was mainly combined as adhesive at the interface and cohesive in the veneering ceramic.

Fischer et al[15] concluded that the bond strength between zirconia and the veneering ceramic was higher than the cohesive strength of the veneering ceramic. In other words, the weakest link was not the interface but the veneering ceramic itself.Choi et al[16] stated that the SBS test has some disadvantages such as high standard deviations, occurrence of nonuniform interfacial stresses, and the influence from specimen geometry. Therefore, the standardization of specimen preparation, cross-sectional surface area, and rate of loading application are important for improving the clinical usefulness of SBS test.

Cheng et al[17]evaluated the influence of the parameters of blasting on the shear bond strength between zirconia and pressed veneer ceramics.Zirconia was blasted with different alumina particle size subjected to two types of applied pressures. Heat-pressed and layered veneer ceramic blocks were served as an experimental group and control group, respectively.The results indicated that the surface roughness was increased significantly with increasing particle size of alumina and blasting pressure. The alumina particle size had statistically significant influence on shear strength of heat-pressed groups. Among heat-pressed ceramic specimens, the highest and lowest shear strength could be obtained when 50 μm of alumina was used at pressure of 0.3 MPa and 110 μm of alumina was used at 0.5 MPa, respectively. The negligible effect of thermal cycle on shear strength of heat-pressed groups can be seen.

The limitation the study is small sample size.

CONCLUSION

Authors found that themaximum shear bond strength was obtained for lithium disilicate liner. Maximum adhesive failures were found with lithium disilicate liner.

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