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Shear Bond Strength of Composite Veneers and Acrylic Veneer Bonded to Ni–Cr Alloy: A Laboratory Study

Manish Katyayan · Preeti Katyayan · K. Ravishankar

Abstract A growing number of composite materials are being used as an alternative for veneering cast restorations. The objective of this investigation was to evaluate and compare the shear bond strength of UDMA based composite, restorative composite, and heat cure acrylic when veneered to Ni–Cr alloy and to evaluate the type of bond failure. Three different veneering materials were used: heat cure acrylic, UDMA based composite and a restorative composite. 10 samples were fabricated, each with heat cure acrylic and restorative composite and 20 samples were fabricated with UDMA based composite; thus, the total number of samples amounted to 40. All the samples were subject to shear bond stress fracture tests and observed for the type of bond failure. The greatest mean shear bond strength was recorded in relation to the UDMA based composite material when thermal conducting paste was used during the curing (10.51 MPa). The mean bond strength values of UDMA based composite without thermal conducting paste (8.92 MPa), heat cured acrylic veneering material (4.24 MPa) and restorative composite material (5.03 MPa) were significantly different from each other ($p > 0.05$). Samples veneered with heat cure acrylic veneering material and restorative composite material showed adhesive failure. Samples prepared with UDMA based composite veneering composite showed cohesive or predominantly cohesive failure. UDMA based composite veneering material when used with heat protection paste exceeds the shear bond strength requirement as suggested by Matsumura et al. (>10 MPa). A statistically significant association between the test groups and the type of failure was observed.

Keywords Veneering composite · Shear bond strength · Bond failure

Introduction

Clinicians and patients have always sought restorations that closely resemble natural teeth. This esthetic demand has risen through the years and is achieved in many instances by veneering the metal base of a restoration with resin or porcelain. Resin has been used as a veneering material since the early 1940s. Clinicians have encountered problems with these early generation methyl methacrylate resins, such as marginal percolation, discoloration, low abrasion resistance and poor dimensional stability. The problems continued even after the introduction of a number of techniques to improve metal–resin bonding [1–3].

Porcelain facings do not wear, they have good color stability and marginal leakage is not a problem, yet they have their limitations such as brittleness, abrasion of opposing teeth, subject to crack propagation and difference in coefficient of thermal expansion between metal and porcelain. To overcome the drawbacks of these materials, laboratory cured veneers have been introduced as an alternative veneering material to porcelain and acrylic resin. They are microfilled composite resins based on the

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Bis GMA and UDMA resin systems. These materials vary in their composition and physical properties. Principle variations in chemical composition are monomer composition and concentration of filler particles [1–3].

These new generation light and heat cured, highly filled laboratory composites contain approximately 66% inorganic fillers, and 33% resin matrix by volume, whereas former generation composite resins contained 33% inorganic fillers. In addition to a change in the size and distribution of the filler particles, significantly improved physical and mechanical properties have improved these new composites [1].

The advantages of these resins to name a few are excellent esthetics, color stability, abrasion resistance similar to tooth structure, biocompatibility, reparability and compatibility with dental casting alloys. These laboratory composites have been used for various applications such as fixed partial dentures subject to flexing forces, veneered crowns, custom denture teeth, veneers on complete cast overdentures, pontics for resin bonded fixed prosthesis, custom labial veneers and repairs for fixed partial dentures [2].

Bonding of laboratory polymerized composite resins to metal has traditionally been provided by mechanical retention such as beads, mesh and loops. The chemical bonding resin veneers eliminate the need for these bulkier macroretentive features and the pooling of opaquing material around retention beads is eliminated [4].

Over the last decade, a major breakthrough was made in the development of new metal–resin bonding techniques that result in a chemical bonding between resin and the metal. These techniques usually involve some pretreatment of the alloy surface with chemical agents [1]. These include electrolytic etching, chemical etchants, and silica coating. The availability of resin based adhesive primers for base metals capable of chemically bonding to casting dental alloys has simplified the procedures for surface preparation of base metal alloys [5].

A strong and stable bond between veneering material and metal framework considerably assists in the esthetic appearance and clinical longevity of a restoration, which has to withstand a combination of mechanical, chemical and thermal stresses [6]. There can be various types of bond failures between veneer and base metal alloy due to these stresses. It has been shown that temperature increase during manufacturing can cause stresses between framework and veneer, which may induce cracking and chipping of the composite, especially in highly loaded posterior areas [7].

It has been claimed that a newly developed heat protection paste increases the fracture resistance of composite veneering. This paste is meant to be applied to the unveneered metal surfaces to achieve a thermally absorbing (cooling effect), which is expected to minimize the tension at the interface between the metal and the UDMA based veneering composite [7].

So this study was conducted with the aim of evaluating the shear bond strength and type of bond failure that can occur in case of Ni–Cr cast restorations veneered with either UDMA based composite, restorative composite, or heat cure acrylic.

Subjects and Methods

A machined circular stainless steel standard die was prepared (diameter—6 mm, thickness—2 mm).

An addition silicone (Reprosil Vinyl Polysiloxane Impression Material Dentsply USA) mold of standard die was prepared. Using the silicone mold, forty disc shaped patterns were prepared with inlay wax (Hindustan inlay wax, Hindustan Dental Products, India). A straight sprue was incorporated in the opposing flat surface of the wax pattern. It helped in the future stabilization of disc in the embedding resin for mounting in universal testing machine.

Specimens were invested in a ring-shaped mold with an investment material (Powder Bellasun, Bego, Germany and liquid BegoSol, Bego, Germany). The wax patterns were cast from a crown and bridge Ni–Cr alloy (Bellabond plus, Bego, Germany) using an induction casting machine.

The samples were separated using carborundum discs and the flat alloy surfaces of the discs were sanded with abrasive paper (silicone carbide abrasive paper no. 600) under water irrigation.

Grouping of Samples

All the 40 samples were randomly divided into four groups of 10 samples each.

  Group 1: Heat cure acrylic (10 samples)
  Group 2: UDMA based composite with thermal conducting paste (10 samples)
  Group 3: UDMA based composite without thermal conducting paste (10 samples)
  Group 4: Restorative composite resin (10 samples)

Group 1

The alloy specimen were air-abraded with 50 μm grit Aluminium oxide. Inlay wax pattern of 4 mm diameter and 4 mm height was made on the prepared surface of the alloy and was invested in dental plaster. After dewaxing, the metal adhesive primer (Alloy Primer, Kuraray Medical Inc., Okayama, Japan) was applied to the alloy adherent surface with a disposable brush and left for drying. Separating medium (DPI Heat Cure Cold Mould Seal, Mumbai,

India) was applied to the remaining surfaces of plaster mould. Packing was done using heat cure acrylic veneering material (DPI Tooth Moulding Powder and DPI Heat Cure liquid, Mumbai, India) and after 24 h of bench curing, the curing process was carried out. After curing, the samples were recovered.

Group 2

After sandblasting, the residues were removed by tapping it off. SR Link, a metal-composite bonding agent that provides a covalent bond between the metal framework and SR Adoro composite resin, was applied immediately after having tapped off the residue. A clean disposable brush was used to apply SR Link and allowed to react for 3 min. Precaution was taken not to soak the alloy surfaces in SR Link.

A circular adhesive tape with a 4-mm diameter internal hole was positioned on the center of the alloy surface to determine the bonding surface. The desired amount of opaquer paste (SR Adoro Opaquer, Ivoclar Vivadent, AG Schaan\Liechtenstein) was removed from the syringe and applied after slightly spreading out on a mixing pad using a disposable brush. Precuring was carried out for 20 s, using the Quick curing light (Quick, Ivoclar Vivadent, AG Schaan\Liechtenstein). Second opaquer layer was applied in such a way to completely cover the first layer and pre-cured for 20 s with the Quick light curing unit. After pre-curing, the samples were polymerized directly in the Lumamat 100 (program 2/11 min). A disposable sponge was used to thoroughly remove the inhibition layer formed during the curing. It was made sure that the surface of the opaquer had a silky mat finish.

A transparent plastic cylindrical tube with an internal diameter of 4 mm was positioned perpendicularly to the alloy surface to build up the veneering portion of the specimen. The dentin veneering resin (SR Adoro Dentin, Ivoclar Vivadent, AG Schaan\Liechtenstein) was applied to each specimen and photo-polymerized using the Quick curing light (Fig. 1). After precuring, the transparent plastic cylindrical tube was removed.

SR Gel is a glycerine-based masking gel that is impervious to oxygen. The gel is applied to the restorations before final polymerization/tempering to minimize the formation of an inhibition layer on the surface of veneering composite. Consequently, the gel ensures complete curing of restoration surfaces.

SR Gel was applied on the entire veneering surface in a fully covering yet not inappropriately thick to prevent an inhibition layer. After applying SR Gel, all exposed alloy parts of the specimen were covered homogenously with thermal conducting paste (SR Adoro Thermo Guard). It is a diethylene glycol/water based paste. This paste is applied to all exposed metal parts before final polymerization/
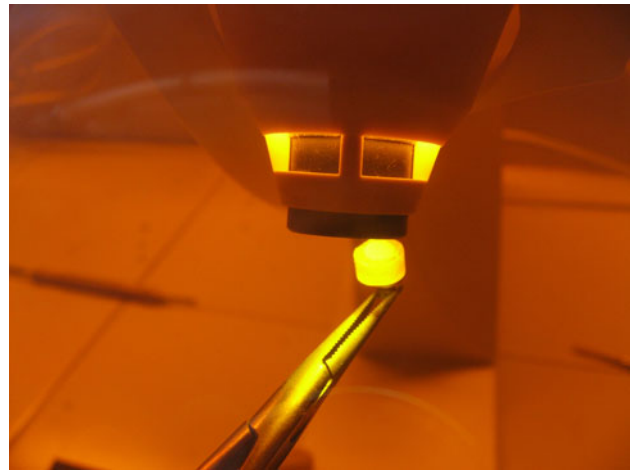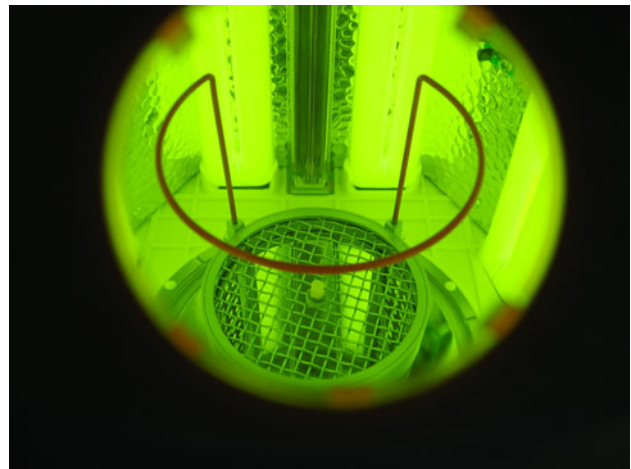

Fig. 1 Precuring of group 2 sample

Fig. 2 Final curing in special curing chamber

tempering, providing a thermally absorbing (cooling) effect, thereby minimizing the internal tension at the interface between metal and veneering resin.

The final curing was carried out using a special curing chamber (Lumamat 100, Ivoclar Vivadent, AG Schaan\Liechtenstein) (Fig. 2). A 22 min curing cycle (SR Adoro Tempering program P3) was carried out as per the manufacturer's instructions, which included precuring for 10 min, tempering at approx 104°C/219°F for 7 min and cooling for 5 min. After completion of the polymerization/ tempering procedure, SR Gel and the thermal conducting paste was completely removed from the specimen using a steam blaster.

Group 3

The veneering composite blocks were prepared on the alloy surfaces using Adoro veneering composite following the

same procedure as group 2 except that the thermal conducting paste was not used to cover the unveneered surface of the specimen during the final curing procedures.

Group 4

The alloy surfaces were etched using HF acid (10% conc), which was followed by the application of metal adhesive primer (Alloy Primer, Kuraray Medical Inc., Okayama, Japan) using a sponge and left for drying. A transparent plastic cylindrical tube with an internal diameter of 4 mm was positioned perpendicularly to the alloy surface to build up the veneering portion of the restorative composite. The restorative composite resin (Filtek Z350, 3 M ESPE St. Paul, USA) was applied to each specimen and photopolymerized using LED curing unit (Apoza Enterprise co. Ltd, Taiwan).

All the 40 specimen divided in four groups, after the application of veneering materials, were embedded in an acrylic resin mold (Fig. 3). The specimens were immersed in water and incubated at 37°C for 24 h. A shear testing jig was used to mount the samples in a universal testing machine. A stainless steel wire loop was used to apply a shearing force to the veneering material at the alloy interface (Fig. 4). The specimens were loaded to failure and shear bond strength was measured with a universal testing machine at crosshead speed of 0.5 mm/min (Instron Universal Testing Machine, Model No 4467). The load to cause bond failure was recorded for each specimen.
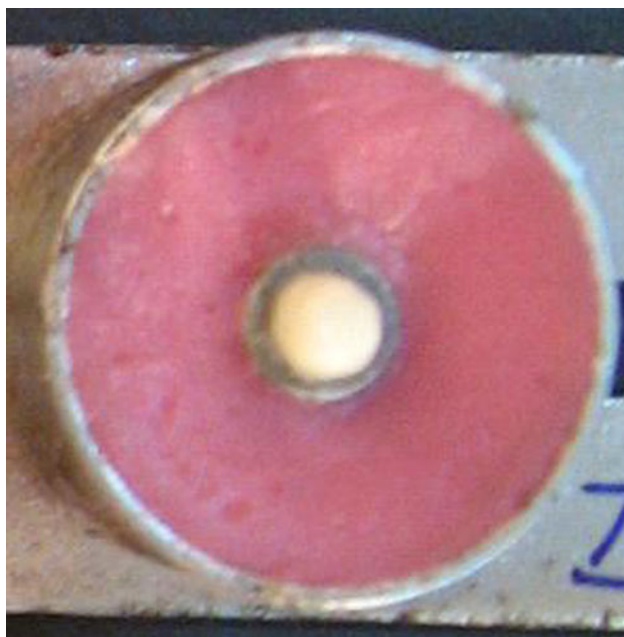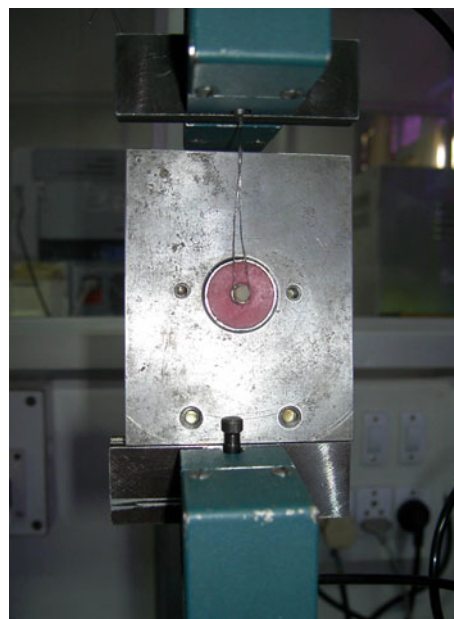

Fig. 3 Acrylic resin mold

Fig. 4 Mounted sample

Calculation of Shear Bond Strength

Shear bond strength, F/A (force per unit area), was calculated from the recorded failure loads. The force output from the machine was divided by the bonding surface area/adherence area and the results recorded in Megapascals (Mpa = MN/m^2).

Adherence area was calculated for all specimens:

$$Area\ (A) = \pi \times r^2$$

where $\pi = 3.14$ and $r = 2$ mm.

Evaluation of Bond Failure

Debonded surfaces of all specimens were observed under an optical microscope to assess the mode of bond failure. The fracture mode was classified (Table 1) based upon the percentage of remaining resin on the bonding surface of specimen (Fig. 5).

Method of Statistical Analysis

The following methods of statistical analysis were used in this study:

1. One-way analysis of variance
2. Post hoc test using Bonferroni method
3. Chi-square test

The results were averaged (mean + standard deviation) for each test group.

Table 1 Mode of failure and percentage of remaining resin

Mode of failure	Percentage of remaining resin (%)
Adhesive	<25
Cohesive	>75
Combination (predominantly cohesive)	50–75
Combination (predominantly adhesive)	25–50

Results

Table 2 depicts the mean shear bond strength for the four different groups

Group 1: mean shear bond strength was 4.24 ± 0.40
Group 2: mean shear bond strength was 10.51 ± 0.62
Group 3: mean shear bond strength was 8.92 ± 0.56
Group 4: mean shear bond strength was 5.03 ± 0.37

Further analysis revealed that there was statistically significant difference in the mean shear bond strength of the 4 groups ($p < 0.001$). Among the four groups, group 2 had the highest shear bond strength followed by group 3, group 4 and group 1 respectively.

Table 3 depicts the multiple comparisons of the mean shear bond strength values for the four different test groups. It was concluded that there was a statistically significant difference in the mean shear bond strength values between all the four groups ($p < 0.05$).

Table 4 gives the different types of failures in all the four groups. Adhesive failure was predominant in group 1 and group 4, cohesive failure was predominant in group 2 and group 3. Predominantly cohesive failure was very low when compared to the other types of failure and was found in group 2 and group 3. A statistically significant association between the test groups and the type of failure was observed (p value < 0.001).

Discussion

The metal-ceramic crown application has been a successful dental restoration for more than 30 years and the most popular indirect restoration; however, questions remain about the optimal condition of the alloy during application of opaque porcelain and firing procedures [8]. In recent years highly filled resins have become alternatives to porcelain as veneering material for crowns and fixed partial dentures. The advantages of light-cured veneering materials include favorable esthetics, abrasion characteristics similar to that of natural tooth substance, repairability, and fast, simple laboratory procedures.

This study compared the shear bond strength of different methacrylate and composite veneering materials to a Ni–Cr alloy. Bond strength refers to the force required to separate two parts, and it consists of two factors: chemical bonding and mechanical bonding [9].

Mechanical bonding is an anchoring effect related to surface roughness and preparations applied onto the metal surface that may produce high bond strength. However, this process results in a bulkier framework that is difficult to opaque because of the pooling around the beads, with a decrease in retention. Because of insufficient chemical bonding between the metal framework and the veneering material, a gap of as much as 20 μm between the metal and

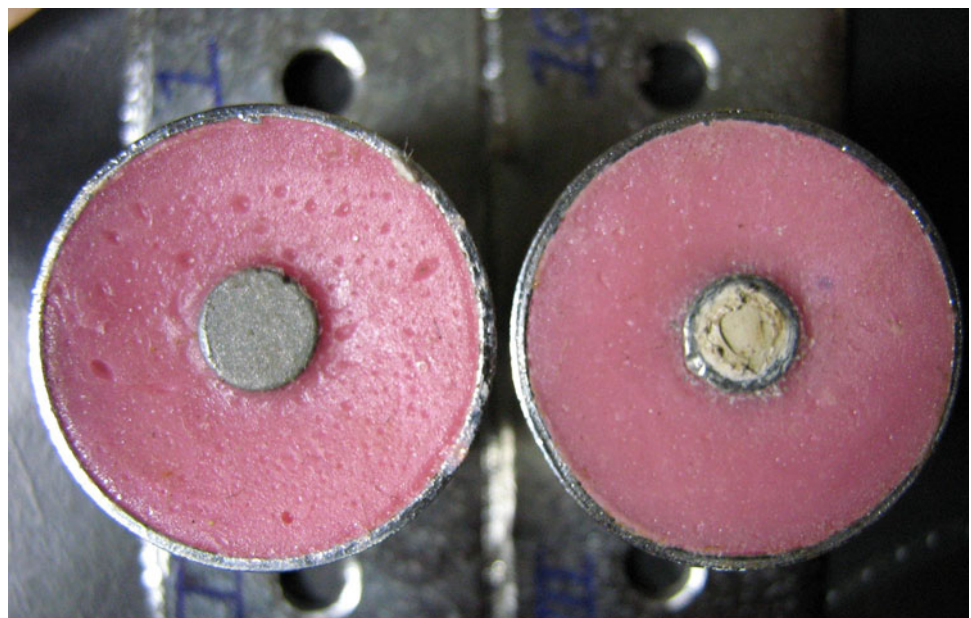**Fig. 5** Adhesive and cohesive failures

Table 2 Mean values and standard deviations—shear bond strength

SBS (MPa)	Descriptives					
	N	Mean	Std. deviation	Std. error	95% Confidence interval for mean	
					Lower bound	Upper bound
Group 1	10	4.23906	0.40349	0.12759	3.95042	4.52770
Group 2	10	10.51250	0.62345	0.19715	10.06651	10.95849
Group 3	10	8.92422	0.56468	0.17857	8.52027	9.32817
Group 4	10	5.03672	0.37572	0.11881	4.76794	5.30550
Total	40	7.17813	2.69382	0.42593	6.31660	8.03965

Table 3 Multiple comparisons of shear bond strength values of various groups

Dependent variable: SBS (MPa) Bonferroni		Multiple comparisons				
(I) Group	(J) Group	Mean difference (I − J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Group 1	Group 2	−6.27344*	0.22489	0.000	−6.90133	−5.64555
	Group 3	−4.68516*	0.22489	0.000	−5.31305	−4.05727
	Group 4	−0.79766*	0.22489	0.007	−1.42555	−0.16977
Group 2	Group 1	6.27344*	0.22489	0.000	5.64555	6.90133
	Group 3	1.58828*	0.22489	0.000	0.96039	2.21617
	Group 4	5.47578*	0.22489	0.000	4.84789	6.10367
Group 3	Group 1	4.68516*	0.22489	0.000	4.05727	5.31305
	Group 2	−1.58828*	0.22489	0.000	−2.21617	−0.96039
	Group 4	3.88750*	0.22489	0.000	3.25961	4.51539
Group 4	Group 1	0.79766*	0.22489	0.007	0.16977	1.42555
	Group 2	−5.47578*	0.22489	0.000	−6.10367	−4.84789
	Group 3	−3.88750*	0.22489	0.000	−4.51539	−3.25961

* The mean difference is significant at the 0.05 level

Table 4 Types of failures observed among various test groups

Count	Group * Failure crosstabulation			Total
	Failure			
	Adhesive failure	Cohesive failure	Combination (pre-dominantly cohesive)	
Group				
Group 1	10			10
Group 2		8	2	10
Group 3		7	3	10
Group 4	10			10
Total	20	15	5	40

the veneer is developed. Oral fluids fill the gap allowing discoloration and odors to develop, destroying the esthetics of the veneer [6].

Chemical bonding involves modification of the alloy surface either with the creation of interfacial layers or with the use of adhesive monomers. The chemical bonding between the veneering agent and metal substructure can be improved with coating and primer systems. The chemical attachment of an opaque layer to the metal surface limited microleakage at the resin–metal interface that occurred because of polymerization shrinkage and mismatch of the coefficient of thermal expansion between the composite
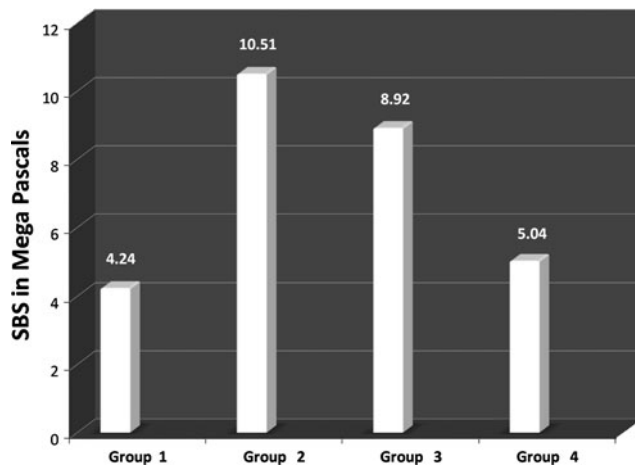
Fig. 6 Mean SBS of 4 groups

and the metal. However, chemical bonding is technique sensitive and a possible contamination of the interfacial adhesive layer may substantially decrease the metal-composite bond strength [6].

The results of the current study have shown that the greatest mean shear bond strength was between the metal and the UDMA composite material when thermal conducting paste was used during the curing of veneering material (10.51 MPa) (Fig. 6). The mean bonding strength values of Adoro without thermal conducting paste (8.92 MPa), heat cured acrylic veneering material (4.24 MPa) and restorative composite material (5.03 MPa) were significantly different from each other ($p > 0.05$).

Concerning the clinical performance of these systems, Matsumura et al. [11] reported that on the basis of their judgment from experience, the application of chemical bonding systems necessitates shear bond strength >10 MPa for the achievement of clinically satisfactory results. According to the requirements of the revised ISO 10477 the minimum acceptable bond strength value is 5 MPa [6].

The bond strength values recorded in the present study for all materials except the heat cure acrylic exceed the requirements of ISO whereas only the Adoro veneering material when used with heat protection paste has recorded a value >10 MPa as per the requirement suggested by Matsumura et al. [11].

As per the expectations, Adoro veneering composite when used with the thermal conducting paste showed increased shear bond strength, which may be a result of more regular temperature distribution during polymerization. It has been suggested that the diethylene/water paste decelerates warm-up and cooling during polymerization and therefore should guarantee a more equal temperature distribution. The wide range of debonding force distribution for the Adoro samples, especially with Thermo Guard,

may indicate some sensitivity to the fabrication process [10].

Mechanical retention, in the form of small beads, in combination with chemical bonding has been shown to increase bond strength [6]. Thus it can be suggested that a combination of mechanical and chemical retention should be provided for heat cure acrylic veneering material, Adoro without thermal conducting paste and restorative composite for successful clinical outcome.

In the present study samples veneered with heat cure acrylic veneering material and restorative composite material showed adhesive failure. This could be explained by insufficient strength of mechanical bonding to the metal surface. Samples prepared with Adoro veneering composite in the current study showed cohesive or predominantly cohesive failure irrespective of the thermal conducting paste. This suggests that the limiting factor in improving the adhesion between metal and Adoro veneering composite could be the cohesive strength of the opaque [10].

An important aspect to be investigated relates to the thickness of the opaque layer. The application of the opaque layer to the conditioned metal surface was made by hand and special care was taken to ensure equal thickness of the layer in all the samples. However, because the failure type seemed to be cohesional, it could be assumed that thinner opaque layers can result in higher bond strengths. This, however, requires further investigation [10].

It has been reported that surface treatment of the metal by sandblasting with Al_2O_3 particles (50 μm) increases the surface area of the metal as well as the composite resin–metal bond strengths. Metal sandblasting with Al_2O_3 particles can form a passive film made of Ni, Cr, and Co oxides. Metal primers have an affinity for this layer of oxides. These reactive groups contain polar terminations which will bond to the oxide layer formed on the metal surface [11].

In the present study the abrasion of alumina was performed to mechanically clean the surface and to increase the surface bonding area, increasing surface energy and activity of the surfaces. Indeed, the adhesive strength of composite resins with alloys significantly improves by sandblasting; however, sandblasting restorations, especially with 250 μm alumina (Al_2O_3), has the potential to remove significant amounts of substances and could affect the clinical adaptation of the prostheses. Unnecessary sandblasting should be avoided because it is likely to damage the margins of the restorations [11].

One of the problems associated with the photoactivation system is lack of uniformity in the resin matrix conversion. Inadequate polymerization adversely affects the post curing properties of composite materials. These include strength, stiffness, colour stability, hardness and wear resistance. Radiation in the proper wavelength range and of

sufficient intensity is essential for adequate polymerization of light activated composite materials. In addition, the material-light source combination is also an important factor influencing the properties of composite veneering materials [11].

A number of additional curing procedures have been proposed for overcoming insufficient material monomer conversion. Longer exposure is one of the simplest techniques for improving material properties, although the efficacy is influenced by the type of light source [12].

Post-radiation, which represents at least twice the exposure with a relatively long intervening period, is also a widely accepted technique. Secondary heat treatment is an alternative approach for reducing unreacted monomers. Application of secondary heating has been reported for prosthetic composite veneering materials as well as indirect inlay and onlay composites [12]. The use of a combination of composite material and photo-curing unit that generates better property testing results is generally recommended [11].

Biocompatibility of dental materials is of major importance not only to dental practitioners, but also to patients, who have shown growing interest in the materials being used in their mouths [13]. The veneer composites e.g. Adoro SR have shown lower average toxicity results in fresh conditions. These superior results may be explained by the optimal hardening in the photocuring unit, which allows for optimized luminescence from all directions, in contrast to the lamps for direct composites [14].

Restorations in the oral environment are continuously subjected to temperature changes. Thermocycling is a common laboratory technique to simulate aging of materials in the oral environment. It was observed in a few studies that thermocycling did not significantly affect the bond strength of any of the various veneering resin/surface treatment combinations used. It has been found that thermocycling for a restricted number of thermal cycles has limited effect and in some cases may even cause a slight increase of the bond strength, which may be attributed to relaxation of polymerization stresses of the composite material. It has been also reported that any increase of the metal–resin bond strength after thermocycling, may be related to the improvement of the degree of conversion of the polymer materials, because of the elevated temperatures during this procedure [6].

It has been reported that the mean shear bond strength of porcelain fused-to-metal varies from 31.83 to 46.6 MPa. Although we do not know the minimum bonding force value that the resin–metal interface has to withstand in order to have a good clinical performance, it is evident that it must approach the values of the porcelain bond strength [8, 9]. The bond strength of porcelain to metal substrate can be considered the standard against which the alternative

veneering materials can be tested. It is conceivable that in an actual clinical situation the difference between metal resin and metal ceramic bond might be greater. Further research and development should be performed to improve the consistency and reliability of resin–metal bonding systems [1].

The results indicate that for extending the service period of resin composite the development of a chemical resin-to-metal bonding should be considered, which will also reduce the need for mechanical retention on metal frameworks.

In vitro evaluation is the first step of testing any technique or material to examine the properties and potential it possesses. It is the prospective randomized controlled trials that present the ultimate test [1]. Because this study tested only two aspects (shear bond and type of failure) of the resin–metal bond, it is suggested that the other aspects of the bond (effect of different mechanical test designs, microleakage, thermocycling) be studied for a more comprehensive evaluation of the potential of these systems.

Conclusion

Within the limitations of this in vitro study, the following conclusions were drawn:

1. The greatest mean shear bond strength was between the metal and the UDMA composite material when thermal conducting paste was used during the curing of veneering material (10.51 MPa).
2. The mean bonding strength values of Adoro without thermal conducting paste (8.92 MPa), heat cured acrylic veneering material (4.24 MPa) and restorative composite material (5.03 MPa) were significantly different from each other ($p > 0.05$).
3. Samples veneered with heat cure acrylic veneering material and restorative composite material showed adhesive failure.
4. Samples prepared with Adoro veneering composite showed cohesive or predominantly cohesive failure irrespective of the thermal conducting paste.
5. A combination of mechanical and chemical retention should be provided for heat cure acrylic veneering material, Adoro without thermal conducting paste and restorative composite for successful clinical outcome.
6. For extending the service period of resin composite the development of a chemical resin-to-metal bonding should be considered, which will also reduce the need for mechanical retention.

Summary

This study compared the shear bond strength of UDMA based composite, restorative composite, and heat cure

acrylic when veneered to nickel chromium alloy and evaluated the type of bond failure which can occur with each of the above combinations. Samples were fabricated with heat cure acrylic, restorative composite and UDMA based composite using heat protection paste or without heat protection paste. Samples were subject to shear bond stress fracture tests and observed for the type of bond failure. The greatest mean shear bond strength was recorded in relation to the UDMA based composite material when thermal conducting paste was used during the curing of veneering material followed by UDMA based composite without thermal conducting paste, heat cured acrylic veneering material and restorative composite material. Samples veneered with heat cure acrylic veneering material and restorative composite material showed adhesive failure. Samples prepared with UDMA based composite veneering composite showed cohesive or predominantly cohesive failure irrespective of the thermal conducting paste. So clinically acceptable veneers can be fabricated with UDMA based composite veneering material when used with heat protection paste. A combination of mechanical and chemical retention should be provided for heat cure acrylic veneering material, UDMA based composite without thermal conducting paste and restorative composite for successful clinical outcome.

Conflict of interest   None.

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