Bond Strength of Poly (methyl methacrylate) Denture Base to cast Titanium and cobalt-chromium Frameworks of Different Designs

Fahad A. Al-Harbi and Mohamed Saber A

Department of Substitutive Dental Sciences, College of Dentistry, University of Dammam, Dammam, Saudi Arabia
falharbi@ud.edu.sa

Abstract: The lack of a chemical bond between conventional denture base materials and framework elements represents a significant problem in removable prosthodontics. Poor chemical bonding of a denture base resin to cast metal frameworks often introduces adhesive failure and increases microleakage. **Purpose.** The purpose of this study was to examine the shear bond strength of a denture base acrylic resin to commercially pure titanium alloy (CP Ti) and a cobalt-chromium alloy (Co-Cr) using a hybrid bonding system. **Material And Methods.** Square plates (of different designs) were cast from the 2 alloys. The plates were grit-blasted with 50 µm of alumina and treated with the Rocatec™ bonding system. A denture base heat-cured acrylic resin was then applied to the plates. Specimens without bonding were also prepared as controls. Both alloys were configured as frameworks with different retentive designs: flat plate, lattice retention, mesh retention and bead retention. Shear bond strength values were determined at a crosshead speed of 0.5 mm/min. **Results.** For CP Ti plates, shear bond strength was the highest for acrylic resin adhered with Rocatec™ to flat plates, followed by the bead, lattice and mesh designs. The shear bond strength for different retentive Co-Cr frameworks, with or without Rocatec™, was the highest for bead retention, followed by mesh, flat plate and lattice. There was a statistically significant difference (*P*<.05) in bond strength between the 2 alloys for both flat plate and lattice retentive frameworks bonded with Rocatec™ to acrylic resin. **Conclusion.** The application of the Rocatec™ bonding system significantly improved the shear bond strength of denture base resin using both cast (CP Ti) and Co-Cr alloys.

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1. Introduction:

In 2011, **Carr and Brown** described removable partial dentures (RPDs) as combinations of cast metal and acrylic denture bases consisting of cast metal bases that were fitted over residual ridges, and acrylic resin that is processed to the metal to enhance esthetics, restore lost tissue contours, and retain artificial teeth[1]. Cobalt-chromium (Co-Cr) alloys are frequently used to fabricate denture frameworks due to their favorable mechanical properties, whereas commercially pure titanium (CP Ti) and titanium alloys are preferred for their biocompatibility as well as desirable mechanical properties. The denture framework surface to be bonded with the denture base material should be effectively conditioned as a reliable bond between the denture base material and metal framework is required for the denture to function properly.[2]Co-Cr alloys may contain elements (Co and or Cr) causing sensitivity or allergic reactions in some patients. Due to the potential of titanium to eliminate some of these problems associated with Co-Cr alloys, titanium has been increasingly used in clinical practice for the fabrication of removable prostheses[3].

Allergic reactions, sometimes encountered in treatment with RPDs, may be a problem due to the presence of nickel in base metals. In a study comparing conventional base metal alloy and Ti in terms of biocompatibility, sensitivity or allergic reactions were found to decrease with the use of Ti.Base metal alloys show high shear bond strength values, which might be due to the thickness of the oxide layer and the surface roughness of the alloy surface[4].

The use of titanium for the production of cast RPD frameworks has gradually increased. There are no reports about metallic allergy apparently caused by (CP Ti) dentures. There are still some laboratory-related drawbacks associated with the use of Ti alloy, such as the lengthy burn-out, inferior castability and machinability, reaction layer formed on the cast surface, difficulty of polishing, and high initial costs. However, clinical problems, such as the discoloration of titanium surfaces, unpleasant metal taste, decrease of clasp retention, tendency for plaque to adhere to the surface, detachment of the denture base resin, and severe wear of titanium teeth, have gradually been resolved with the use of Ti alloys[5].

The mechanical retention for a denture resin (poly(methyl methacrylate), PMMA) in removable prostheses is usually provided by the framework design in the denture base, such as through the use of beads, posts, an open lattice, a mesh, or some other macroscopic retentive design[6].The 3 most commonly used acrylic retentive designs are open lattice, preformed mesh, and a metal base with bead retention. The lattice design has a high susceptibility to permanent deformation,[7]and the open lattice design produces the greatest amount of retention for acrylic resin. Mesh can be used interchangeably with lattice in any given clinical situation. Beads or nail beads are used with metal base alloys that are cast to fit against edentulous ridges. This attachment is the weakest of the three types of acrylic retentive designs[8].

External and internal finishing lines should be placed on the cast metal framework of all three types of acrylic retentive designs, wherever the acrylic resin joins the cast framework[9]. If there is a separation between the acrylic resin and the cast metal, especially at the finishing line, cracks or crazing may occur in the acrylic resin, leading to microleakage that is accompanied by staining[10-12].Microleakage from the metal-PMMA interface can lead to discoloration, deterioration of the resin, and the creation of a reservoir for oral debris and microorganisms. Incomplete fracture or total separation of the resin can also occur. The lack of a chemical bond can directly affect the metal-resin interface. The difference in the coefficients of thermal expansion between the metal and the resin might create a gap at the interface, leading to microleakage. Therefore, conventional adaptation between the acrylic resin denture base and the metal framework may not be sufficient to prevent microleakage (Kim *et al.*) [3].

Significant research has focused on improving the chemical bond strength between the acrylic resin and the metal to withstand intermittent occlusal forces and endure the constant moisture from saliva and temperature variations in the oral environment[13,14].

Metal-resin bonding systems are classified into 2 categories: surface modification to create a thin layer of metal on the substrate metal alloys and direct application of a functional monomer to create a chemical bond[15, 16].Silica-coating and tribochemical coating systems are considered surface modification methods[16].Tribochemistry involves the creationof chemical bonds by the applicationof mechanical energy that may take the form of rubbing, grinding or sandblasting. There is no heat or light application, which is normally used with chemical reactions[17]. In the silicoating system, a silica layer is pyrolytically applied to the surface over which a silane coupling agent is applied[15].

The purpose of this study was to evaluate the bond strength of heat-cured PMMA to CP Ti and Co-Cr alloys, when pretreated with or without the Rocatec™ bonding agent, in a laboratory model system.

2. Material and Methods

Two groups, each consisting of 48 frameworks made of commercially pure titanium alloy (CP Ti) or cobalt-chromium alloy (Co-Cr), were prepared. Frameworks in each group were further subdivided into 4 subgroups (n=12). The framework in each subgroup was designed as a flat plate, lattice retention; mesh retention or a flat plate with beads retention.

For each alloy, forty-eight square wax patterns (20 x 20 x 2mm) were prepared. Wax patterns of group-I were kept flat. The remaining patterns in groups II,III and IV incorporated a different central area (10 x 10mm) according to the other three framework designs (lattice, mesh and beads) using traditional wax specimens.

For Ti alloy specimens, 48 wax patterns were invested in casting rings (six in each ring) using Rematitan® Plus (Dentaurum J. P. Winkelstroeter KG, Pforzheim, Germany) as the investment material. The ring was then burned out by following the manufacturer's recommendations and then cast with CP Ti (grade II, ASTM-Rematitan®-Dentaurum) ingots using a vacuum-pressure machine (Rematitan System, Dentaurum J. P. Winkelstroeter KG, Pforzheim, Germany).

The casting machine automatically evacuated the chamber, which was filled by argon gas in 70 s. The argon supply continued for approximately 120 s after the molten metal had dropped into the mould. The machine then stopped automatically to allow air to enter the chamber. Castings were carefully removed from the mould, scrubbed under running water and then cleaned in an ultrasonic cleaner. The surface was ground and polished with sandpaper and alumina using rotary equipment (Metaserv 2000, Buehler UK Ltd., Coventry, England). Radiographic screening of the castings for internal defects excluded specimens showing porosities.

For comparison, 48 wax patterns (of the same size as those made of CP Ti alloy) of the Co-Cr alloy (Biosil F, DeguDent, York, PA, US) were conventionally cast using a silica-based investment (Univest Silky, Shofu Dental Corp., San Marcus, CA, US) in a centrifugal induction melting machine (Neutrodyn-EasytiManfredi, Italy). The 48 cast Co-Cr plates were also made with the same configurations representing the 4 framework designs. After bench cooling, castings were retrieved from the casting rings, and then cleaned with distilled water in an ultrasonic bath for 30 min to remove most of the adhering investment.

Metal plates (CP Ti and Co-Cr) were separated from the sprue using a diagonal cutter nipper while avoiding contact with the test central areas. Metal plates were then sandblasted with 110 µm of alumina delivered by air pressure applied for one minute.

In the central area of each metal specimen where the retentive framework designs were effected, rectangularwax blocks of 25mm height and 10mm X 10mm area were built to ensure that the acrylic resin portions of all test frameworks were of the same size and contour. These wax blocks were covered with high viscosity polyvinylsiloxane (Silagum Putty®, DMG, Hamburg, Germany) then invested in conventional flasks with Type 3 dental stone (Moldano; HeraeusKulzer, Hanau, Germany).

The 96 metal specimens with the wax blocks were invested in 16 denture flasks (six specimens per flask), and then placed in boiling water. The wax was boiled out and the flasks were allowed to cool.This procedure provided molds for processing heat-cured acrylic resin to all the test metal plates. In each group, metal plates were removed from the flask and sandblasted again with 50 µm alumina for 60 s before acrylic resin packing.

Acrylic resin (Lucitone L.D. Caulk Co., Milford, DE, USA)was polymerized on the sandblasted metal plates, with or without Rocatec™ bonding agent (Rocatec, ESPE GmbH, Seefeld/ Oberbay, Germany),according to the manufacturers' recommendations. Sandblasted metal plates in each group were subdivided into two subgroups according to this surface treatment with Rocatec™ (6 plates in each flask): sandblasted metal plates without Rocatec™ (subgroup A) and sandblasted metal plates with Rocatec™ (subgroup B).Rocatec™ bonding agent was applied to the central area of the sandblasted metal plates (subgroup B) in three steps[17]:

1- Preabrasive cleaner was used to create a matte finish on the metal plates.
2-An adhesive (Rocatec Plus) was then applied as a thin coating to provide a chemically reactive surface.
3- Finally, a silane coupling agent (Rocatec-Sil) was applied to provide the bond with the acrylic resin block.

Specimens were deflasked and cleaned, the acrylic blocks were smoothed with burs, and all the samples were stored in distilled water at 20 °C for 7 days prior to bond testing.

The bond strength of the acrylic resin blocks that had adhered to the metalplates was determined by loading the bonded specimens to failure on an Instron Universal Testing Machine (Instron Corp. Canton, MA, USA). Specimens were held in a metal fixture (grasping unit). The test holder was oriented such that the shear force could be applied to the resin-metal interface with a knife-edged rod. Bond strength was calculated by dividing the load at fracture by the surface area[18]. Specimens were loaded at a cross head speed of 5 mm/minute. The bond strength was calculated in kg/cm^2 for each specimen. The means and standard deviations were calculated for each test group. The data were analyzed using 3-way ANOVA, followed by Scheffé's multiple range test at a significance level of 0.05.

3. Results

Table (1) shows the tensile bond strength (kg/cm^2) of acrylic resin bocks adhered to CP Ti plates at the time of failure for each of the tested specimens. There was a statistically significant difference between the treated versus non-treated groups ($P<.05$).For CPTi plates that were not treated with Rocatec™ in subgroup (A), the highest bond strength was observed for the lattice design (77.35 ± 13.20 kg/cm^2). The mesh and beads retention areas incorporated in the CP Ti plates without treatment showed comparable bond strength, 75.42±6.83 kg/cm^2 and 72.37±10.43 kg/cm^2, respectively. The lowest tensile bond strength was noted for the plain-flat CP Ti plate, 40.48±7.64 kg/cm^2, which was statistically significant when compared with all types of retentive framework designs (t=11.667).

Table 1: Bond strength (kg/cm^2) of acrylic resin to different designs of Ti frameworks

Group	Group I Acrylic resin bonded with Ti-flat plate design		Group II Acrylic resin bonded with Ti-lattice design		Group III Acrylic resin bonded with Ti- mesh design		Group IV Acrylic resin bonded with Ti- beads design	
Sample No.	Subgroup		Subgroup		Subgroup		Subgroup	
	A	B	A	B	A	B	A	B
Mean	40.48	136.39	77.35	105.53	75.42	98.54	72.37	123.48
SD	7.64	18.63	13.20	14.70	6.83	9.30	10.43	14.63
t-value	11.667		3.494		4.907		6.958	
p-value	<0.001		0.005		0.001		<0.001	

Subgroup (A): Sandblasted CP Ti design without treatment
Subgroup (B): Sandblasted CP Ti design treatment with Rocatec™ bonding agent

Table 2: Comparison of bond strength (kg/cm^2) of acrylic resin to different designs of Ti frameworks with and without Rocatec™ bonding agent

Group	Group I	Group II	Group III	Group IV	F
Without treatment (A)	40.48 ± 7.64	77.35 ± 13.20	75.42 ± 6.83	72.37 ± 10.43	18.736 $P<0.001$
Treatment with Rocatec™ (B)	136.39 ± 18.63	105.53 ± 14.70	98.54 ± 9.30	123.48 ± 14.63	8.209 $P=0.001$

In contrast, CPTi plates pretreated with Rocatec™ bonding agent in subgroup (B) demonstrated improved adhesion to the acrylic resin blocks. The highest bond strength was noted when using plain flat CPTi plates in group I, 136.39±18.63 kg/cm^2, followed by the beads design (group IV, 123.48±14.63 kg/cm^2). The lowest bond strength was observed between acrylic resin and the CPTi plates of the lattice and mesh retentive frameworkdesigns, 105.53±14.70 kg/cm^2 and 98.54 ±9.30 kg/cm^2, respectively.Tensile bond strength comparison between the test specimens (Table 1) also showed that the tensile bond strength of acrylic resin blocks adhered to different Ti designs wassignificantly improved after using the Rocatec™ bonding agent (t=11.667, 3.494, 4.907and 6.958, respectively;$P<0.5$). Table 2 shows the bond strength of the titanium frameworksto be significantly different, either with or without treatment using theRocatec™ bonding agent(t=18.736 and 8.209, respectively;$P<0.5$).

Table 3: Bond strength (kg/cm^2) of acrylic resin to different designs of Co-Cr frameworks

Group	Group I Acrylic resin bonded with Co-Cr flat plate design		Group II Acrylic resin bonded with Co-Cr lattice design		Group III Acrylic resin bondedwith Co-Cr mesh design		Group IV Acrylic resin bondedwith Co-Cr beads design	
Sample No.	Subgroup		Subgroup		Subgroup		Subgroup	
	A	B	A	B	A	B	A	B
Mean	65.59	107.28	63.39	94.18	78.76	135.33	91.72	147.01
SD	16.11	15.12	17.60	11.41	13.15	24.14	17.33	20.65
t-value	4.621		3.596		5.042		5.024	
p-value	0.001		0.005		0.001		0.001	

Subgroup (A): Sandblasted **Co-Cr** design without treatment
Subgroup (B): Sandblasted **Co-Cr** design treatment with Rocatec™ bonding agent

Table 4: Comparison of bond strength (kg/cm^2) of acrylic resin to different designs of Co-Cr frameworks with and without Rocatec™ bonding agent

Group	Group I	Group II	Group III	Group IV	F
Without treatment (A)	65.59± 16.11	63.39± 17.60	78.76± 13.15	91.72± 17.33	3.966 $P=0.023$
Treatment with Rocatec™ (B)	107.28± 15.12	94.18± 11.41	135.33± 24.14	147.01± 20.65	10.466 $P<0.001$

Tables 3 and 4 show that the shear bond strength for different retentive frameworks without treatment (subgroup A) was highest for Co-Cr plates with bead retention (91.72±17.33 kg/cm^2), followed by mesh retention (78.76±13.15 kg/cm^2) and the flat plate (65.59±16.11 kg/cm^2)designs.The lattice retentive framework yielded the lowest shear bond strength (63.39±17.60 kg/cm^2).Greater bond strength was observed when Co-Cr frameworks were bonded with Rocatec™ to the acrylic resin (subgroup B). The bond strength for Rocatec™-treated frameworks was highest for Co-Cr plates with the bead retentive design (147.01±20.65 kg/cm^2), followed by the mesh retention (135.33±24.14 kg/cm^2) and flat plate (107.28±15.12 kg/cm^2) designs. Lattice retention showed the lowest bond strength (94.18±11.41 kg/cm^2).

Table 5: Comparison of bond strength (kg/cm^2) of acrylic resin to different designs of Ti and Co-Cr frameworks with Rocatec™ bonding agent

Retentive Framework Designs	**Group I**	**Group II**	**Group III**	**Group IV**
Ti	40.48 ± 7.64	77.35 ± 13.20	75.42 ± 6.83	72.37 ± 10.43
Co-Cr	65.59 ± 16.11	63.39 ± 17.60	78.76 ± 13.15	91.72 ± 17.33
t-value	3.449	2.972	1.555	1.494
p-value	0.006	0.014	0.151 NS	0.166 NS

NS= not significant at the 5% level

Table 6: Comparison of bond strength (kg/cm^2) of acrylic resin to different designs of Ti and Co-Cr frameworks without Rocatec™ bonding agent

Retentive Framework Designs	Group I	Group II	Group III	Group IV
Ti	136.39± 18.63	105.53± 14.70	98.54± 9.30	123.48± 14.63
Co-Cr	107.28± 15.12	94.18± 11.41	135.33± 24.14	147.01± 20.65
t-value	0.551	3.484	2.343	2.277
p-value	0.494 NS	0.006	0.041	0.046

NS= not significant at the 5% level

Table 5 showed a statistically significant ($P<0.05$) difference in bond strength between the 2 alloys for both flat plate and lattice retentive frameworks bonded with Rocatec™ to the acrylic resin.No significant ($P>0.05$) differences in bond strength were found between the 2 alloys for the mesh or bead retentive frameworks, as they both adhered to the acrylic resin with Rocatec™.

There was a statistically significant ($P<0.05$) difference in bond strength between the 2 alloys for all retentive frameworks bonded without Rocatec™ to acrylic resin, except for the flat plate retentive frameworks, whichwas not significant ($P>0.05$) (Table 6).

4. Discussion

Recent developments in resin bonding have provided the means for direct chemical bonding of acrylic resin to a metal framework. The investing alveolar and gingival tissue replacement components can be attached without the use of loops, mesh or surface mechanical locks[1]. Many studies have been conducted to determine the retentive design that can establish better bonding[14]. Chemical bonding between the metal framework and the denture base resin is also important. Poor chemical bonding in that area is a significant clinical problem, often introducing an adhesive failure and increasing microleakage of oral fluids into the finish lines, which causes an accumulation of oral debris, microorganisms and stains. As a result, the propagation of microorganisms contributes to an unfavorable soft tissue response[19]. In the present study, the Rocatec™ had a significantly positive effect on the bond between the heat-cured denture base resin and both CP Ti and Co-Cr alloys. May *et al.,* found that airborne particle abrasion of grade IICP Ti frame works did not improve the bond strength to PMMA when compared with those without any treatment[9, 10].They also found that surface pre-treatment of grade II titanium with 110µm of alumina airborne particle abrasion and silica coating significantly enhanced the shear bond strength to PMMA. The bonding method applied here required mechanical cleaning by air abrasion with alumina prior to the bonding procedure, which also increased the bonding area. Air abrasion can create suitable surface conditions of roughness and increase the wettability of the metal surface. Thus, air abrasion with alumina should be performed prior to chemical modification[16].

Airborne particle abrasion creates surface roughness by cleaning the surface of metal oxides and other substances and increases the chemo-mechanical bond strength between the metal and the acrylic resin. Specifically, the bonding generated by alumina air abrasion is mechanical, whereas the bonding generated by the Rocatec system is chemical-mechanical[2]. In 2010, Bulbul and Kesim reported that the shear bond strength of base metal, titanium, and noble alloy to acrylic resins was improved by primer application[20].

The current study determined that surface pretreatment of CP-Tiand Co-Cr alloys improved bonding adhesion of the denture base to acrylic resin. The bond strength of heat-cured PMMA retained on both alloys pre-treated with Rocatec™ was evaluated. This agent is considered to be a hybrid bonding system that uses mechanical (embedded silane) and chemical retentive mechanisms that function together to enhance retention of acrylic resin. BothCP-Ti and Co-Cr alloys were configured as frameworks with four acrylic retentive designs: flat plate, lattice retention, mesh retention and bead retention.The dimensions of the retentive frameworks were selected to represent a clinical situation. CP-Ti and Co-Cr plates were either pretreated or not pretreated with Rocatec™ bonding agent. PMMA showed the highest bond strength to both flat plates and beads of pretreated titanium plates. The results of this study were not in agreement with those reported by Lee *et al.,* who demonstratedthat the metal plate with bead retention showed significantly higher mean separation forces compared with smooth metal plate and lattice retention. The metal plate with bead retention proved to be effective in mechanically bonding acrylic resin to cast metal frameworks[13].

The lowest bond strengths were observed with both lattice and mesh types. Bond strength of acrylic resin to titanium not pretreated with the bonding agent gradually decreased in the following order: flat surface, lattice, mesh, and bead retentive designs. Denture base resins and metal frameworks are substantially joined by mechanical retentive devices. An adhesive bonding agent may be useful to prevent marginal leakage as well as fracture of the resin material at the border of the resin-to-metal joint[2]. Denture deflection during mastication can result in debonding between the denture base resin and the framework, eventually leading to resin fracture. Thus, titanium frameworks should be designed to be stiff enough to keep deflection to a minimum[24].

In contrast, bond strength of acrylic resin to Co-Cr plates, whether pretreated with Rocatec™ or not, gradually decreased in the reverse order as that observed with titanium not pretreated with bonding agent: beads, mesh, flat surface, and lattice retentive designs. Any difference between bond strength values reported in the literature and in the present report may be due to the difference in chromium content of the tested alloys[21].The Co-Cr plates with bead retentive design showed significantly higher bond strength thanthe mesh, flat plate and lattice retentive designs. This finding was inconsistent with a previous study that showedthat bead retention did not offer strong retention for acrylic resin, whereasthe open lattice design provided the strongest retention due to the bulk of the acrylic resin[22]. Mesh retention showed significantly higher bond strength than the lattice and flat plate designs. This was consistent with findings reported by Brown *et al.,* and Canay *et al.,* who demonstratedthat retentive mesh was more effective in retaining acrylic resin than the lattice design[6,23]. Additionally, flat Co-Cr plate designs showed significantly higher bond strength than lattice retentive designs, which supported the results obtained by Lee et al., as smooth primed metal plates displayed significantly higher mean separation forces than those of primed lattice retention[13].

Microleakage at the junction between the metal alloy and the acrylic resin in RPDs may result in discoloration, fluid percolation, and acrylic resin deterioration. Enhancing resistance to microleakage at this interface may improve the long-term union between the 2 materials[25]. The application of an adhesive bonding agent may prevent marginal leakage as well as fracture of the resin material at the border of the resin-to-metal joint[2].May *et al.,* evaluated bond strength using air-abrasive, pretreated titanium adhered to PMMA but found no significant differences between the bond strength for Ti and PMMA when treated (or not treated) with an air abrasive. The tensile bond strength test allowed initial bond failure at the metal-PMMA interface to be quantified. The results of this study estimated that the highest bond strength was observed between acrylic resin and both plain-flat and beaded titanium plates when pretreated with Rocatec™ bonding agent. This finding may be explained by the bond strength being proportional to the surface area of titanium-PMMA interface[14]. May *et al.,* suggested that shear bond strength of heat-processed PMMA bonded to the machined surface of wrought CP titanium with 110 µm of alumina air abrasion and silane coating was 63% greater when compared with specimens with no pretreatment. Canay *et al.,* studied 3 different retentive designs (mesh, ring-shaped, flat plate) that were subjected to a shear test and observed that the bond strength was highest between the 4-META adhesive acrylic resin and the flat plate design.4-META is a recently developed, metal-bonding denture base material that is reported to possess excellent bond strength to metal[9,12]. The metal plate with bead retention proved to be effective in mechanically bonding acrylic resin to cast metal frameworks. The size and number of beads were important, as the acrylic needed to flow evenly around the bead undercuts[13].

In this study, a decrease in bond strength was observed when either lattice or mesh was incorporated in the center of pre-treated Ti plates. This may be due to the open spaces that reduced the surface area of the bond, resulting in lower strength. May et al. showed that the treatment of Ti with 4-META leads to a bond strength to acrylic resin denture base as consistent as when Ti was treated with the Rocatec™ bonding material[9].

In this study, the bond strength between the acrylic resin and Ti plates not pre-treated with Rocatec™ bonding agent were highest with the lattice design followed by mesh then the beads. However, the difference among these designs was not statistically significant. This sequence supported the design considerations for minor connectors in which more open areas contained within the retentive minor connectors permit increased bulk of resin and, thereby, increase strength[7,8]. In contrast, the weakest bond was noted when using flat Ti plates as the initial sandblasting may achieve micro-retentive topography and increase the surface area[26]. The need of mechanical retentive elements such as lattice, mesh, loops, beads or posts, is essential for retaining denture base acrylic resin to minor connectors. These retentive elements may weaken the acrylic resin base by creating stress and by reducing the bulk on which the resin depends for strength. Failure of acrylic resin at the interface is a common problem when forces exceed the capacity of the retentive mechanisms.[6]To minimize or eliminate these mechanical retentive elements that weaken the acrylic resin base, the strength of the bonding of the acrylic resin to the metal framework is an important aspect of prosthodontic research when compared with the emerging trends for fabricating implant-supported fixed or removal prostheses using Co-Cr or Ti metal frameworks.

Conclusion:

Within the limitations of this study, the shear bond strength of PMMA denture base material to cast titanium or cobalt-chromium alloy can be improved significantly by the application of the Rocatec™ bonding system.

Corresponding author
Fahad A. Al-Harbi
Department of Substitutive Dental Sciences, College of Dentistry, University of Dammam, Dammam, Saudi Arabia
e.mail: falharbi@ud.edu.sa

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