Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr Index Copernicus value = 85.10

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Research

Shear bond strength between ceramic layered over titanium and ceramic layered over cobalt-chromium alloy

[1]Dr. Sakshi Jha, [2]Dr. Shubham Gupta

[1]BDS, Private Practitioner, Faridabad, Haryana, India;
[2]Final year, Faculty of Dentistry, Jamia Millia Islamia New Delhi, India

ABSTRACT:
Background: There is a current trend for replacing the Ni-Cr alloys, commonly used with dental ceramic, with Co-Cr alloys, which seem to be more biocompatible. The present study was conducted to compare the shear bond strength between ceramic layered over titanium and ceramic layered over cobalt-chromium alloy. **Materials & Methods:** 25 samples of titanium were in group I and 25 samples of cobalt- chromium were in group II. For all the samples bonding agent was applied on to the sand blasted surface and firing was done at a temperature of 980° C. Shear bond strength was measured using a Universal Testing Machine. **Results:** The mean shear bond strength was 29.8 and ingroup II was 23.8. The difference was significant (P< 0.05). **Conclusion:** Shear bond strength of titanium was higher as compared to cobalt-chromium.
Key words: Cobalt- chromium, titanium, Shear bond

Received: 05 August, 2021 Accepted: 16 September, 2021

Corresponding author: Dr. Sakshi Jha, BDS, Private Practitioner, Faridabad, Haryana, India

This article may be cited as: Jha S, Gupta S, Shear bond strength between ceramic layered over titanium and ceramic layered over cobalt-chromium alloy. J Adv Med Dent Scie Res 2021;9(10):104-106.

INTRODUCTION

The use of metal ceramic restorations began in late 1950s allowing the development of prosthetic rehabilitation with better cosmetic results. However, the actual mechanism of adhesion of ceramic to metal is complex and is not fully understood mostly due to differences in thermal expansion and formation of oxide layer on surface of dental metal alloys.[1] Several metal alloys have been introduced to the fabrication of implant superstructures covered with ceramic. Two among them are titanium and cobalt-chromium (Co-Cr).[2] Metal ceramic restorations have been widely used in dental practice, although many studies have focused on the development and improvement of metal-free restorations.[3] There is a current trend for replacing the Ni-Cr alloys, commonly used with dental ceramic, with Co-Cr alloys, which seem to be more biocompatible.[4] Ni-Cr-Mo alloys submitted to a corrosive test presented corrosion losses between 0.54 and 3261 µg/ cm2, enough to induce an allergic reaction after a single exposure (0.6 to 2.5 mg). Additionally, base metal alloys as well as the noble palladium alloys are economical alternatives to the expensive gold alloys.[5]

Titanium due to its good biocompatibility, excellent biological, and mechanical properties is an ideal material for use in the human body and is being used in many fields of dentistry as well.[6]Co-Cr alloy is also in use for fabrication of implant-supported prosthesis. It is a material of choice due to its biocompatibility and low cost features.[7] The present study was conducted to compare the shear bond strength between ceramic layered over titanium and ceramic layered over cobalt-chromium alloy.

MATERIALS & METHODS

The present invitro study comprised of 50 samples in which 25 samples of titanium were in group I and 25 samples of cobalt- chromium were in group II.

For all the samples bonding agent was applied on to the sand blasted surface and firing was done at a temperature of 980° C. A layer of opaque was applied using a brush and placed back in the furnace at a temperature of 910° C. Then ceramic was layered on

to the surface with putty index as guide and firing was done in the ceramic furnace up to a temperature of 880° C followed by glazing. Shear bond strength was measured using a Universal Testing Machine. Results of the study was assessed using Mann Whitney test. P value less than 0.05 was considered significant.

Results

Table II Distribution of samples

Total- 50		
Groups	**Group I**	**Group II**
Materials	titanium	cobalt- chromium
Number	25	25

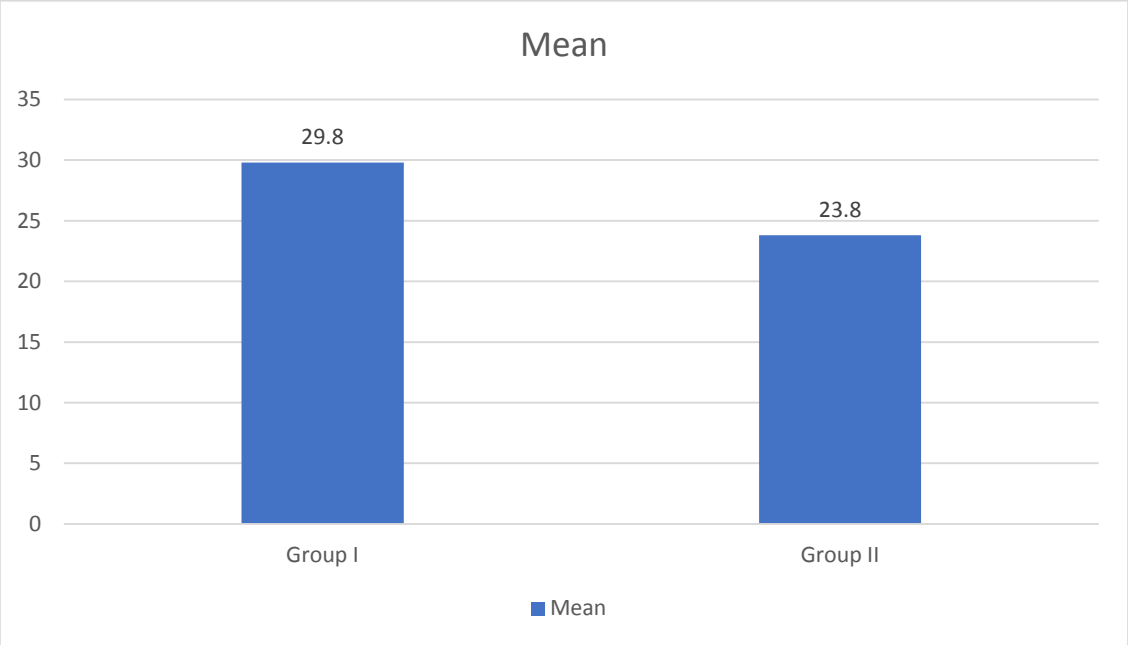
Table I shows distribution of samples in group I and II.

Table II Comparison of shear bond strength

Groups	Mean	P value
Group I	29.8	0.01
Group II	23.8	

Table II, graph I shows that mean shear bond strength was 29.8 and ingroup II was 23.8. The difference was significant (P< 0.05).

Graph IComparison of shear bond strength



DISCUSSION

Base metal alloys allow the fabrication of thinner infrastructures because they have greater rigidity, which is related to the modulus of elasticity.[8] Nevertheless, the success of metal ceramic restorations depends primarily on an optimal bond strength of ceramic to metal. Some studies have reported that the bond strength of ceramic to Co-Cr and Ni-Cr alloys ranges from 35 MPa to 95 MPa.[9] Others have attempted to explain the mechanism of adhesion between ceramic and metal. There should be chemical and thermal compatibility between the metal and ceramic to allow adhesion of the interface during ceramic sintering and also when the restoration is in service.[10]The present study was conducted to compare the shear bond strength between ceramic layered over titanium and ceramic layered over cobalt-chromium alloy. In present study, mean shear bond strength was 29.8 and ingroup II was 23.8.Vaska et al[11]evaluated and compared the shear bond strength between ceramic layered over titanium and ceramic layered over cobalt-chromium alloy, which are used in the fabrication of screwretained implant prosthesis. The mean bond strength of titanium- ceramic samples was more than those of cobalt-chromium-ceramic samples. Inferential statistics used in the study were one sample t-test for intra-group comparison and paired sample t-test for inter group comparison which showed no statistically significant difference between the two metal types (P value = 0.163). Olivieri et al[12] performed a study to evaluate SBS of gold and titanium and also analyze bonding interface using SEM. Twelve specimens each of gold and titanium were prepared. All the samples were layered with ceramic and subjected to shear bond test. They concluded that titanium has better bond strength

compared to gold.Joias et al[13]evaluated the shear bond strength of a dental ceramic to 5 commercially available Co-Cr alloys. Five Co-Cr alloys were tested and compared to a control group of an Au-Pd alloy (Olympia). Specimen disks, 5 mm high and 4 mm in diameter, were fabricated with the lost-wax technique. Sixty specimens were prepared using opaque and dentin ceramics (VITA Omega 900), veneered, 4 mm high and 4 mm in diameter, over the metal specimens (n=10). The shear bond strength test was performed in a universal testing machine with a crosshead speed of 0.5 mm/min. After shear bond testing, fracture surfaces were evaluated in a stereomicroscope under x25 magnification. The mean (SD) bond strengths (MPa) were: 61.4 (7.8) for Olympia; 94.0 (18.9) for IPS 20; 96.8 (10.2) for IPS 30; 75.1 (12.4) for Remanium; 71.2 (14.3) for Heranium P; and 63.2 (10.9) for Wirobond C. Mean bond strengths for IPS 20 and IPS 30 were not significantly different, but were significantly. Akova et al[14] conducted a study to compare SBS of laser sintered Co-Cr alloy and cast base metal dental alloys: Ni-Cr and Co-Cr. Ten specimens were prepared for each group, layered with dental porcelain, and subjected to shear bond test in universal testing machine. It was concluded that SBS was highest for Co-Cr specimens fabricated by casting method.

CONCLUSION

Authors found that shear bond strength of titanium was higher as compared to cobalt- chromium.

REFERENCES

1. Azer SS, Ayash GM, Johnston WM, Khalil MF, Rosenstiel SF. Effect of esthetic core shades on the final color of IPS Empress all-ceramic crowns. J Prosthet Dent 2006;96:397-401.
2. Pisani-Proenca J, Erhardt MC, Valandro LF, Gutierrez-Aceves G, Bolanos-Carmona MV, Del Castillo-Salmeron R, Bottino MA. Influence of ceramic surface conditioning and resin cements on microtensile bond strength to a glass ceramic. J Prosthet Dent 2006;96:412-7.
3. Bezzon OL, de Mattos Mda G, Ribeiro RF, Rollo JM. Effect of beryllium on the castability and resistance of ceramometal bonds in nickel-chromium alloys. J Prosthet Dent 1998;80:570-4.
4. Geis-Gerstorfer J, Sauer KH, Passler K. Ion release from Ni-Cr-Mo and Co-Cr-Mo casting alloys. Int J Prosthodont 1991;4:152-8.
5. Kaaber K, Veien NK, Tjell JC. Low nickel diet in the treatment of patientes with chronic nickel dermatitis. Br J Dermatol 1978;98:197-201.
6. Anusavice KJ, Shen C, Hashinger D, Twiggs SW. Interactive effect of stress and temperature on creep of PFM alloys. J Dent Res 1985;64:1094-9.
7. Geis-Gerstorfer J, Weber H, Sauer KH. In vitro substance loss due to galvanic corrosion in Ti implant/Ni-Cr supra construction systems. Int J Oral Maxillofac Implants 1989;4:119-23.
8. Eliopoulos D, Zinelis S, Papadopoulos T. Porosity of cpTi casting with four different casting machines. J Prosthet Dent 2004;92:377-81.
9. Serra-Prat J, Cano-Batalla J, Cabratosa-Termes J, Figueras-Àlvarez O. Adhesion of dental porcelain to cast, milled, and laser-sintered cobalt-chromium alloys: Shear bond strength and sensitivity to thermocycling. J Prosthet Dent 2014;112:600-5.
10. Bhola R, Bhola MS, Mishra B, Olson LD. Corrosion of titanium dental implants and prosthesis – A review. Trends BiomaterArtif Organs 2011;25:34-46.
11. Vaska KR, Nakka C, Reddy KM, Chintalapudi SK. Comparative evaluation of shear bond strength between titanium-ceramic and cobalt-chromium-ceramic: An in vitro study. J Indian Prosthodont Soc 2021;21:276-80.
12. Olivieri K, Neisser M, Bottino M, Miranda M. Bond characteristics of porcelian fused to cast and milled titanium. Braz J Oral Sci 2005;4:923-8.
13. Joias RM, Tango RN, Junho de Araujo JE, Junho de Araujo MA, Ferreira Anzaloni Saavedra Gde S, Paes-Junior TJ, et al. Shear bond strength of a ceramic to Co-Cr alloys. J Prosthet Dent 2008;99:54-9.
14. Akova T, Ucar Y, Tukay A, Balkaya MC, Brantley WA. Comparison of the bond strength of laser-sintered and cast base metal dental alloys to porcelain. Dent Mater 2008;24:1400-4.