Faculty of Dentistry

Department: Restorative Dentistry and Prosthodontics

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Title: Corrosion behavior of as-received and previously cast high noble alloy

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Abstract:

The rationale for using high noble alloys is based largely upon their alleged ability to resist corrosion. However, combining previously cast metal with new alloy might have a detrimental effect on the corrosion behavior of a high noble alloy.

The purpose of this study was to characterize the elemental composition of an as-received and recast high noble alloy and to examine the in vitro corrosion behavior in 2 media, using a potentiodynamic polarization technique.

Dis shaped specimens, 6 mm in diameter and 3 mm thick, were prepared from a high noble alloy (Ney-Oro-B2) under 3 casting protocols, according to the proportion of as-received and recast gold alloy (n=26); the groups included an as-received (100% as-received metal) group, 50% to 50% group (50 wt% new metal, 50 wt% once-recast metal), and recast group (100 % once-recast metal). The surface structures of 20 specimens from each group were examined under scanning electron microscopy (SEM) , the elemental compositions were determined using x-ray energy-dispersive spectroscopy t 3 sites on the specimen, and the data were averaged. Further, the potentiodynamic cyclic polarization between -1000 and +1000 mV (SCE , or saturated calomel electrode) was performed for 6 specimens from each casting protocol in 0.09% NaCl solution (n=3) and Fusayama artificial saliva (n=3) at 30 C . Zero-current potential and corrosion current density were determined. The data were analyzed with 1-way and 2-way analysis of variance and the Ryan-Einot-Gabriel-Welsch multiple-range t test ($\acute{\alpha} = 0.05$).

Elemental composition was significantly different among the casting groups ($P<0.001$). The mean weight percentage values were 72.7% to 75.7% Au, 4.5 to 7.0 Pd; 10.7% to 11.1 % Ag; 7.8% to 8.4% Cu and 1.0% to 1.4% Zn. The mean values for zero-current potential (ZCP) and corrosion current density (1 CORR) for all the casting protocols were not significant (P= .67 and P= .51, respectively). Moreover, the mean values were not significant for corrosion current density with the electrolyte effect (P= .45). Only zero-current potential had a significant electrolyte effect (P<.001) . Furthermore, the interaction between casting protocols and electrolyte were not significant among all corrosion parameters.

High noble alloy in all casting protocols evaluated retained passivity under electrochemical conditions similar to the oral environment.

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Title: Effect of surface treatment on roughness and bong strength of a heat-pressed ceramic

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Abstract:

Bonding ceramic restorations to tooth structure relies on treatment of the ceramic intaglio surface, selection of a suitable resin luting agent, and appropriate treatment of prepared tooth structure. Various information is available to identify the interaction between the resulting surface topography and bond strength.

The purpose of this in vitro study was to evaluate the effect of surface treatments on surface roughness and bond strength to dentin and enamel of a commercially available heat-pressed dental ceramic (IPS Empress).

One hundred heat-pressed ceramic disks were fabricated according to the manufacturer's recommendations. Specimens were divided into 5 groups (n=20) and treated with 1 of the following: (1) etching with 9.5% hydrofluoric acid, (2) 50% or (3) 60% orthophosphoric acid and airborne-particle abrasion with (4) 50 um, or (5) 250 um alumina for 10 seconds. Morphological changes obtained with the surface treatments were investigated with a surface texture analyzer on half of the treated specimens. Two additional specimens from each group were treated and prepared for scanning electron microscopy. The specimens were then used for a bond strength test. The treated specimens were silanated and luted with a composite resin luting agent (Nexus 2) to enamel (n=50) and dentin (n=50) surfaces with 10 specimens for each treatment group. The luted specimens were loaded to failure in a universal testing machine in the shear mode with a crosshead speed of 0.05 mm/min. The data were analyzed with 1-way ANOVA followed by the Ryan-Einot-Gabriel-Welsch Multipel Range Test (ά = .05).

Surface treatments resulted in significant differences for surface topography and shear bond strength (P<.001). Mean surface roughness (RA) (SD) was (2.54 (0.21) um) for ceramic surfaces treated with 50 um aluminum powder. Treatment of ceramic specimens with 50% orthophosphoric acid appeared to result in a smoother surface (1.02 (0.38) um). The highest mean bond strength (SD) to enamel (14.7 (0.6) MPa) and dentin (8.2 (1.5)MPa) was associated with hydrofluoric acid etching. The lowest mean bond strength (SD) to enamel (2.7 (0.8) MPa) and dentin (1.5 (0.1) MPa) was recorded for 50% phosphoric acid.

Hydrofluoric acid treatment resulted in the generation of pores and grooves that product the greatest bond strength between the ceramic and tooth dentin and enamel. Orthophosphoric acid treatment was the least effective surface treatment method evaluated. The results are applicable to only the all-ceramic/luting system evaluated.