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Research paper

Shear bond strength of a hot pressed Au–Pd–Pt alloy–porcelain dental composite

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ABSTRACT

Objectives: The purpose of this study was to evaluate the effect of hot pressing on the shear bond strength of a Au–Pt–Pd alloy–porcelain composite.

Methods: Several metal–porcelain composites specimens were produced by two different routes: conventional porcelain fused to metal (PFM) and hot pressing. In the latter case, porcelain was hot pressed onto a polished surface (PPPS) as well as a roughened one (PPRS). Bond strength of all metal–porcelain composites were assessed by the means of a shear test performed in a universal test machine (crosshead speed: 0.5 mm/min) until fracture. Interfaces of fractured specimens as well as undestroyed interface specimens were examined with optical microscope, stereomicroscope, Scanning Electron Microscope (SEM) and Energy Dispersive X-Ray Spectroscopy (EDS). The data were analyzed using one-way ANOVA followed by Tuckey's test ($p < 0.05$).

Results: Shear bond strength of conventional PFM specimens were in line with the upper range of literature data (83 ± 14 MPa). Hot pressing proved to significantly increase bond strength between metal and porcelain ($p < 0.05$). For both polished and roughened surface the shear bond strength values for hot pressed specimens were 120 ± 16 MPa and 129 ± 5 MPa, respectively, which represents an improvement of more than 50% relatively to a conventional PFM. Roughened surface did not have a significant effect on bond strength of hot pressed specimens ($p > 0.05$).

Significance: This study shows that it is possible to significantly improve metal–porcelain bond strength by applying an overpressure during porcelain firing.

1. Introduction

Metal–ceramic restorations are still the most reliable method in dental prosthetics, especially when a good adhesion of the ceramic to the metal substrate is achieved (Anusavice, 2006). The rising use of all ceramic restorations is not accompanied of the desired life span and premature clinical failure is often reported (Kelly, 1997; Donovan and Swift, 2009). Within the materials for all-ceramic restorations, zirconia is one of the most promising restorative materials because of its favorable mechanical and aesthetic properties. Several studies confirmed its suitability in particular for single crowns and short-span partial dentures (premolars and anterior teeth), being registered higher failure rates on molars. The major problem associated with zirconia-cored restorations is the high incidence of ceramic veneer chipping from zirconia

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