ONLINE ISSN : 1881-1361
PRINT ISSN : 0287-4547

Dental Materials Journal
Vol. 27 (2008) , No. 1 p.7-15

Mechanical and Thermal Cycling Effects on the Flexural Strength of Glass Ceramics Fused to Titanium

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(Received April 4, 2007)
(Accepted July 20, 2007)

Abstract:
This study evaluated the effects of mechanical and thermal cycling on the flexural strength (ISO 9693) of three brands of ceramics fused to commercially pure titanium (cpTi). Metallic frameworks of 25×3×0.5 mm dimensions (N=84) were cast in cpTi, followed by 150-µm aluminum oxide airborne particle abrasion at a designated area of the frameworks (8×3 mm). Bonder and opaque ceramic were applied on the frameworks, and then the corresponding ceramic (Triceram, Super Porcelain Ti-22, Vita Titankeramik) was fired onto them (thickness: 1 mm). Half of the specimens from each ceramic-metal combination were randomly tested without aging (only water storage at 37°C for 24 hours), while the other half were mechanically loaded (20,000 cycles under 10 N load, immersion in distilled water at 37°C) and thermocycled (3,000 cycles, between 5—55°C, dwell time of 13 seconds). After the flexural strength test, failure types were noted. Mechanical and thermal cycling decreased the mean flexural strength values significantly ($p<0.05$) for all the three ceramic-cpTi combinations tested when compared to the control group. In all the three groups, failure type was exclusively adhesive at the opaque ceramic-cpTi interfacial zone with no presence of ceramic on the substrate surface except for a visible oxide layer.

Key words:
Flexural strength, Aging, Titanium

To cite this article:
Vanessa VÁSQUEZ, Mutlu ÖZCAN, Renato NISHIOKA, Rodrigo SOUZA, Alfredo MESQUITA and Carlos PAVANELLI. Mechanical and Thermal Cycling Effects on the Flexural Strength of Glass Ceramics Fused to Titanium . Dent. Mater. J. 2008; 27: 7-15 .

doi:10.4012/dmj.27.7
JOI JST.JSTAGE/dmj/27.7