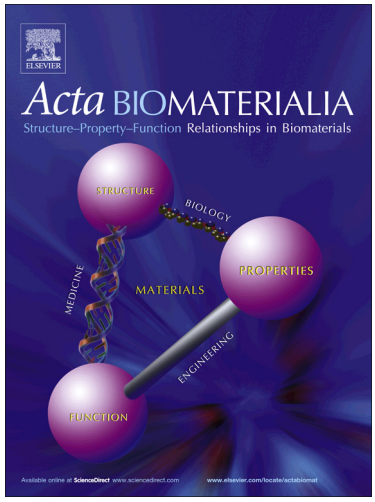

Full length article

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Influence of Ageing on Glass and Resin Bonding of Dental Glass-Ceramic Veneer Adhesion to Zirconia: A Fracture Mechanics Analysis and Interpretation

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Abstract: Adhesion plays a major role in the bonding of dental materials. In this study the adhesion of two glass-ceramic systems (IPS e.max and VITABLOCS) to a zirconia sintered substrate using a glass (for IPS e.max) and resin (VITABLOCS) before and after exposure to ageing for 14 days in distilled water at 37°C are compared using two interfacial fracture mechanics tests, the 3 point bend Schwickerath (1,2) and 4 point bend (3) approaches. Both tests result in stable crack extension from which the strain energy release rate (G, N/m or J/m^2) can be determined. In the case of the 3PB test the Work of Fracture was also determined. In addition, the Schwickerath test enables determination of the critical stress for the onset of cracking to occur, which forms the basis of the ISO (ISO9693-2:2016) (4) adhesion test for porcelain ceramic adhesion to zirconia. For the aged samples there was a significant reduction in the resin-bonded strengths (Schwickerath) and strain energy release rate (both 3 and 4 PB tests), which was not evident for the glass bonded specimens. Critical examination of the force-displacement curves showed that ageing of the resin resulted in a major change in the form of the curves, which may be interpreted in terms of a reduction in the critical stress to initiate cracking and also in the development of an R-curve. The extent of the reduction in strain energy release rate following ageing was greater for the Schwickerath test than the Charalambides test. The results are discussed in terms of; the basic mechanics of these two tests, the deterioration of the resin bonding following moisture exposure and the different dimensions of the specimens. These in-vitro results raise concerns regarding resin bonding to zirconia.

Key words: Zirconia bonding; Glass-ceramic bonding; Resin bonding; Glass bonding; Dental ceramics; Fracture Mechanics; Ageing; Schwickerath test; strain energy release rate.

Introduction.