Impact of a functionally graded configuration on the thermal residual stresses in dental restorations

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Abstract
The aim of this work was to employ the FE method on the study of the thermally induced stresses in metal-ceramic dental restorations with different interface configurations: conventional sharp transition, 50%M composite interlayer and a compositionally graded transition (FGM interlayer). The FE analysis was performed based on experimental data obtained from Dynamic Mechanical Analysis (DMA) and Dilatometric (DIL) studies of the monolithic materials and metal/ceramic composites. Results have shown significant stress reduction promoted by the 50M interlayer and FGM interlayer when compared to those observed for the conventional sharp transition configuration. Maximum stresses were reduced by 50% and FGM provided smoother stress profiles. The reduction in stress magnitude and smoothness of the stress distribution profile due to the FGM architectures has been suggested to account for improvements of metal-ceramic systems in regard to their clinical performance. The findings of this study are in good agreement with the experimental data obtained for metal-ceramic restorative systems and reported in literature.

Keywords: thermal residual stresses, dental restorations, functionally graded materials, metal, ceramic.