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• 中文關鍵字	牙本質黏著系統；複合材料；鍵結解離；雷射；聲射；有限元素分析		
• 英文關鍵字	Dentin bonding system；Composite material；Debonding；Laser；Acoustic emission；Finite element analysis		
• 中文摘要	有限元素分析法(Finite element method,FEM)近年來已廣泛應用於生物力學的領域,以探討生醫材料與組織間以及材料內部的界面問題。本實驗即以 FEM 來探討牙科常用的樹脂複合材內基質與填料間,在給予適當熱源時熱應力的行爲表現,期能深入瞭解複合材料系統內部的顯微鍵結解離或斷裂機轉,以便與先前雷射熱解音洩實驗(Laser Thermoacoustic Technique)結果相互對照印證。以填料(8.mu.m 鋇玻璃---矽化及非矽化)0%,25%,50%,75%重量比加入 Bis-GMA 基質後製成模型複合材。在電子顯微鏡下實測填料與基質距離,作爲建立電腦模型的參考。同時參考雷射熱解音洩實驗及相關文獻之實驗數據,以 FEM (ANSYS 5.3 版)併用 Transient 及 Steady-state thermal analysis 來求得有時間累積性的熱應力變化。電腦模擬所得之應力線、應力值、能量值,對照實驗資料可獲得下述結論:(1)以靜態及動態分析兩者綜合觀察結果發現,高振幅的訊號來源應來自基質與填料界面之解璃(不論矽化與否或填料重量百分比),此時材料應從界面破壞。(2)應變能與界面的抗剪應力是衡量材料破壞的指標,且兩者呈現相反關係,而比較結果確立了有限元模型的正確性,因此能據以作更深入的界面分析探討。有限元電腦模擬實驗所得與雷射熱解音洩結果確能相互印證,兩者似乎爲分析界面接合性質的有效輔助工具。		
• 英文摘要	Finite element analysis (FEM) has been widely used in biomechanics for evaluating the interfacial relationship inside biomaterials or between implant and natural tissues. The study was designed to evaluate the thermal stress behavior of filler-matrix interface in dental composites under laser heating using FEM to further understand the microscopic debonding or fracture mechanism and to compare with our previous experimental results obtained by a laser thermoacoustic technique (LAETT). The same model systems (75/25 Bis-GMA/TEGDMA resin reinforced with 0, 25, 50, and 75wt% 8.mu.m silanized/unsilanized BaSiO/sub 6/) as in the former experiment were used. Their finite element models were created using a		

commercial computer software (ANSYS 5.3) according to the LAETT experiments, SEM findings, and referred papers. The properties of silane coupling agent such as elastic modulus and thermal expansion coefficient used in the silanized model were assumed to have the best conductivity of thermal stress. A third material was proposed to block the thermal stress between filler and matrix in the unsilanated model. Temperatures of 25 to 50.degree.C obtained from laser heating through thermal gauge were used. The thermal load solution is based on steady state and transient analysis. The results showed that 1) The sources of acoustic signal with high amplitudes are mainly derived from the debonding of filler-matrix interface whether silanization or different filler weight fractions in finite element models. 2) The strain energy and interfacial shearing stress calculated from FEM can further support the materials' properties shown by LAETT. Finite element method appears to be a valuable adjunct to thermoacoustic testing.