

**THERMO-MECHANICAL INVESTIGATION OF THE SHORT GLASS FIBRE  
REINFORCED EPOXY USED AS THE CORTICAL BONE ANALOGUE IN  
SAWBONES FEMURS**

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Presented at the 11<sup>th</sup> Annual Scientific Meeting of the Australian and New Zealand  
Orthopaedic Research Society

Perth, Australia 6 – 8 October 2005

Tensile and four point bending tests were used to assess the material properties of the short glass fibre reinforced (SGFR) epoxy resin that are used as the cortical analogue in third generation *Sawbones*, at both room (22°C) and body temperatures (37°C). Standardised specimens were machined from the shaft of *Sawbones* femurs obtaining sections from the anterior, posterior, lateral and medial quadrants in the long axis of the femur. The flexural properties of the specimens were determined using ASTM D6272-02 and the tensile properties were obtained using ASTM D638-02. The mean (SD) values of the modulus of elasticity in four point bending for room and body temperature specimens were 10.74(0.88)GPa and 3.98(0.9)GPa respectively ( $P < 0.001$ ). The mean (SD) values of the modulus of elasticity in tension for the room and body temperature specimens were 9.4(0.8)GPa and 5.4(1.3)GPa respectively ( $P = 0.02$ ).

This research demonstrates that the modulus of elasticity of SGFR epoxy used in third generation *Sawbones* is highly temperature dependent. A reduction in modulus of elasticity of up to 63 percent was observed when increasing the temperature of the specimens from room to body temperature. When performing in vitro total hip modelling ideally the specimens should be at 37°C due to the properties of PMMA cement, however SGFR epoxy *Sawbones* do not accurately represent bone at this temperature. Hence, this material is not an appropriate model for testing the mechanics of implants that use bone cement.