Finite Element-Based Mechanical Evaluation of Bone Graft Substitutes

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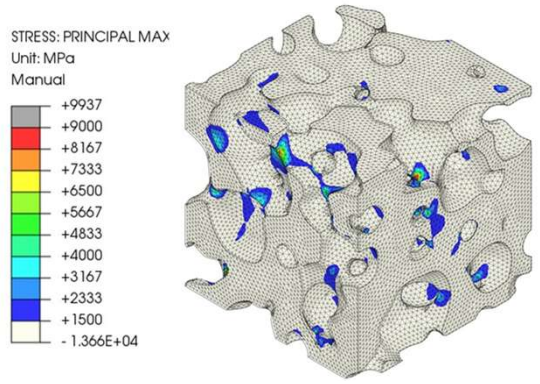
Purpose: This study employed finite element analysis (FEA) to develop evaluation methods for the mechanical properties of porous artificial bone under physiological loading conditions. In particular, a fracture strength evaluation approach was developed for next-generation bone graft substitutes based on ceramic composites fabricated using additive manufacturing technologies.

Methods: A porous ceramic composite reconstructed from micro-CT data was analyzed by finite element analysis (FEA) to predict strength up to fracture. Owing to the large model size required for porous bone graft substitutes, computations were performed using OCTOPUS.

Results: The results show that the apparent elastic modulus is independent of model size but increases with element size, indicating that it can be efficiently estimated by simulation despite difficulties in experimental measurement.



Fracture of bone graft

System Environments: OCTOPUS (CalculiX, Elmer and Paraview)