Modeling of Uncertain Distribution of Porous Foam of Original Bone Model for Orthopaedic Simulator to Predict its Mechanical Properties

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The mechanical behavior of our new artificial bone model, which is mainly made of polyurethane, for orthopaedic simulation of the cutting and drilling procedure can be changed depending on the distribution of inner porous foam in micro-scale. In the present study, to predict the relationship between the uncertain pore distribution derived from its size and ratio and the mechanical properties of the model, first, we observed the range of pore size in the model using SEM and μCT. Second, we evaluated the mechanical properties by using FEM and homogenization technique. We found that the pore size/ratio and apparent stiffness of the model have an exponential relationship and the sensitivity of the stiffness to pore ratio is greater, suggesting that the mechanical behaviors of the model can be controlled dominantly by the pore ratio. Availability of the modeling for the bone model with uncertain pore distribution is discussed.