Statistical Factorial Analysis on the Material Property Sensitivity of the Mechanical Responses of the C4-C6 under Compression, Anterior and Posterior Shear

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Abstract
A systematic approach using factorial analysis was conducted on the C4-C6 finite element model to analyse the influence of six spinal components (cortical shell, vertebral body, posterior elements, endplate, disc annulus and disc nucleus) on the internal stresses and external biomechanical responses under compression, anterior and posterior shear.

Results indicated that the material properties variation of the disc annulus has a significant influence on both the external biomechanical responses and internal stress of the disc annulus and its neighboring hard bones. The study reveals for the first time, the significant influence of the cancellous bone under compression, while variation in the cortical shell modulus has a high influence under anterior and posterior shear. The study also reveals that the effects of interaction between two main components are insignificant.

Keywords: Stress Analysis, Biomechanics, Material, Finite Element Method, Statistic, Cervical Spine