World Academy of Science, Engineering and Technology
International Journal of Bioengineering and Life Sciences
Vol:9, No:04, 2015

Mechanical Characterization of Brain Tissue in Compression

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Abstract : The biomechanical behavior of brain tissue is needed for predicting the traumatic brain injury (TBI). Each year over 1.5 million people sustain a TBI in the USA. The appropriate coefficients for injury prediction can be evaluated using experimental data. In this study, an experimental setup on brain soft tissue was developed to perform unconfined compression tests at quasistatic strain rates ∈0.0004 s-1 and 0.008 s-1 and 0.4 stress relaxation test under unconfined uniaxial compression with ∈ 0.67 s-1 ramp rate. The fitted visco-hyperelastic parameters were utilized by using obtained stress-strain curves. The experimental data was validated using finite element analysis (FEA) and previous findings. Also, influence of friction coefficient on unconfined compression and relaxation test and effect of ramp rate in relaxation test is investigated. Results of the findings are implemented on the analysis of a human brain under high acceleration due to impact.

Keywords : brain soft tissue, visco-hyperelastic, finite element analysis (FEA), friction, quasistatic strain rate
Conference Title : ICBSET 2015 : International Conference on Biological Science, Engineering and Technology
Conference Location : Istanbul, Türkiye
Conference Dates : April 21-22, 2015