CHARACTERIZATION OF TIME-DEPENDENT MECHANICAL RESPONSE OF LIVER TISSUE

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ABSTRACT

Developing improved models of the mechanical response of abdominal organs in crash test simulations is important for understanding and preventing crash related injuries to children and adults. Studies have reported that suboptimal restraint use by children leads to an increased risk of injuries associated with "seat belt syndrome", which involves hip and abdominal contusions, pelvic fractures, and intra-abdominal injuries to both solid and hollow organs.[1] In addition, reports show that in adult crash victims injuries to the abdominal organs, especially the solid organs such as the liver, constitute a critical portion of all injuries.[2] The knowledge of the material properties of soft biological tissues is imperative in the field of automotive safety research and plays an important role in developing finite element models of the human body's response to severe loading conditions such as those present in motor vehicle crashes. The aim of the present study is to characterize the time-dependent response of excised porcine liver tissue. Indentation tests were performed on the porcine liver tissue using an Instron machine with a custom spherical indenter attachment. An ex vivo liver perfusion and hydration system that mimics physiological conditions was utilized during testing. A loading scheme was also designed to investigate the appropriate preconditioning regime and collect force-displacement data. With the data collected, preliminary shear moduli of the liver were calculated that were consistent with those of other soft biological tissues.[3] With the knowledge of the material properties of the liver, such as the shear modulus, the development of a finite element model will be possible. The development of a finite element model of the liver will allow the use of computer-aided simulations in which various conditions can be designed, controlled, and predicted that may otherwise be impossible in a laboratory setting.

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