# Structure-function relationships of human meniscus

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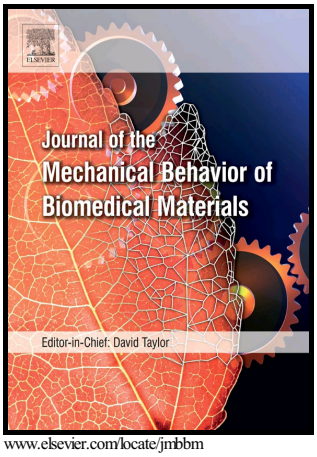


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**ABSTRACT**

Biomechanical properties of human meniscus have been shown to be site-specific. However, it is not known which meniscus constituents at different depths and locations contribute to biomechanical properties obtained from indentation testing. Therefore, we investigated the composition and structure of human meniscus in a site- and depth-dependent manner and their relationships with tissue site-specific biomechanical properties. Elastic and poroelastic properties were analyzed from experimental stress-relaxation and sinusoidal indentation measurements with fibril reinforced poroelastic finite element modeling. Proteoglycan (PG) and collagen contents, as well as the collagen orientation angle, were determined as a function of tissue depth using microscopic and spectroscopic methods, and they were compared with biomechanical properties. For all the measurement sites (anterior, middle and posterior) of lateral and medial menisci ($n$=26), PG content and collagen orientation angle increased as a function of tissue depth while the collagen content had an initial sharp increase followed by a decrease across tissue depth. The highest values ($p$<0.05) of elastic parameters (equilibrium and instantaneous moduli) and strain-dependent biomechanical parameters