Modification of the Strength and Structure of Collagen Biomaterials

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Collagen based biomaterials derived from natural tissues are remarkably strong and tear resistant due to a complex nanostructure. These materials find a wide variety of uses in surgical and consumer applications. These applications often have strength requirements but also the need for flexibility of suppleness. Mechanical measurements (tear and tensile strength, bend force) combined with synchrotron based small angle X-ray scattering are used to investigate the strength-flexibility-structure relationships in manufactured collagen materials. The fibril orientation in-plane is a key determinant of tear strength and the nature of the fibril orientation affects the directional mechanical properties. These can be influenced by source material selection and by processing conditions. Intermolecular packing is the critical property for suppleness and may be influenced by water-controlling chemical treatments. This knowledge enables the development of nanostructured materials with tailored physical properties for a variety of applications.