

Structure and Physico-Chemical Properties of Paravertebral Tendons

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Tendon tissue is actively used as a raw material in the production of collagen gels. This does not always take into account the structure and physico-chemical properties of the intracapsular bundles and sheaths (peritenones) of the tendons. In order to refine this information, scanning electron microscopy, X-ray phase and thermal analysis, and IR spectroscopy were used to study the intracapsular bundles and peritenons of the paravertebral tendons of Wistar rats. It has been established that intracapsular tendon collagen fibers are assembled into cylindrical bundles sutured with fibrillar knots. The priority locations of fibrillar knots are crimps in the boundary layers of intracapsular bundles and peritenons, endotenons and remodeling zones of collagen fibrils. Peritenones have a framework structure that forms solid blocks of collagen arrays in the outer and inner layers. Tissue-specific structures of peritenons are sesamoid islets and globules, needle-like and lamellar growths, osteon-like lamellae involved in the strengthening and ossification of tendons by the mechanisms of heterogeneous and homogeneous nucleation of calcium phosphates. The main components of the mineral phase are pyrophosphates of the $\text{Ca}_2\text{P}_2\text{O}_7 \cdot n\text{H}_2\text{O}$ family and hydroxyapatites. In the tendon bundles, pyrophosphates are decondensed, which prevents the formation of hydroxyapatite. In peritenones, pyrophosphates are condensed into monoclinic phenotypes that induce the synthesis of hydroxyapatite. There are also differences in the state of hydroxyapatite: in bundles it is crystalline, in peritenones it is amorphous. According to thermal analysis and IR spectroscopy, the extracellular matrix of intracapsular tendon bundles is more mobile, fibrillar collagen is partially coagulated and hydrophobic, resistant to maceration. In peritenons, the extracellular matrix is viscous, the collagen fibers are hydrophilic and sensitive to maceration. The data obtained are important in predicting the specialized properties of collagen-containing materials, taking into account the structural and metabolic features of the anatomical components of the tendons.

Keywords: tendons, peritenons, collagen fibrils, sesamoid tissue, heterogeneous and homogeneous nucleation of calcium phosphates, pyrophosphates, hydroxyapatite