X-ray diffraction reveals structural aspects of protein assemblies in connective tissues.

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X-ray diffraction is a powerful tool for analysis of partially-ordered and disordered biological materials, such as muscles, connective tissues, brain sections, viral peptides, and large protein aggregates. Collagen fibrils are the most important structural elements of various connective tissues, including ligaments, tendons, cartilage, and cardiac valves and chordae tendineae. Mechanical properties and functions of tissue strongly depend on collagen fiber formation, governed by proteoglycans (decorin, biglycan, fibromodulin). We used x-ray microdiffraction technique to study cartilage, bone and cardiac collagenous tissues and observed different fibril distribution patterns as well as different collagen types in leaflet and annulus of valves. Combined with TEM, these data may reveal the correlation of collagen fibril structure with its macromolecular ligands and their effect on the mechanical properties of connective tissues. Further, these studies may help understanding structural changes seen in of cardiac disease and arthritis.