

Development of Anisotropic Composite Hydrogels with Superior Mechanical and Adhesive Properties to Mimic Tendons or Ligaments

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Tendon and ligament (T/L) are connective tissues connecting bone to muscle and bone to bone, respectively. Replacement or regeneration of injured T/L using biomaterials is highly challenging due to its structural characteristics. Although T/L is made of collagen which is a kind of soft material, it has very high strength and toughness attributed to their hierarchical, anisotropic structure. Furthermore, the interface between bone and T/L with strong adhesiveness is also hard to achieve. Herein, we propose an adhesive and strong composite hydrogel mimicking T/L based on tough interpenetrating polymer network hydrogel consisting of alginate and polyacrylamide. Linear remodeling of polymer networks, incorporation of porous nanofillers with high surface area, and application of adhesive chemical functional groups led to T/L-mimicking hydrogels. This new hydrogel could provide a new strategy for preparing artificial tendons and ligaments.