Biomechanical and immunohistochemical analysis of high hydrostatic pressure-treated Achilles tendons.

BACKGROUND: Reconstruction of bone defects caused by malignant tumors is carried out in different ways. At present, tumor-bearing bone segments are devitalized mainly by extracorporeal irradiation or autoclaving, but both methods have substantial disadvantages. In this regard, high hydrostatic pressure (HHP) treatment of the bone is a new, advancing technology that has been used in preclinical testing to inactivate normal cells and tumor cells without altering the biomechanical properties of the bone. The aim of this study was to examine the biomechanical and immunohistochemical properties of tendons after exposure to HHP and to evaluate whether preservation of the bony attachment of tendons and ligaments is possible. METHODS: For this, 19 paired Achilles tendons were harvested from both hindlimbs of 4-month-old pigs. After preparation, the cross-sectional area of each tendon was determined by magnetic resonance imaging (MRI). For each animal, one of the two tendons was taken at random and exposed to a pressure of 300 MPa (n = 9) or 600 MPa (n = 10). RESULTS: The contralateral tendon served as an untreated control. The biomechanical properties of the tendons remained unchanged with respect to the tested parameters: Young's modulus (MPa) and tensile strength (MPa). This finding is in line with immunohistochemical labeling results,
as no difference in the labeling pattern of collagen I and versican was observed when comparing the
HHP group (at 600 MPa) to the untreated control group. CONCLUSIONS: We anticipate that during
orthopedic surgery HHP can serve as a novel, promising methodical approach to inactivate Achilles
tendon and bone cells without altering the biomechanical properties of the tendons. This should allow
one to preserve the attachment of tendon and ligaments to the devitalized bone and to facilitate
functional reconstruction.

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