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Abstract: Most biomechanical studies for evaluation of the structural properties of meniscal repairs have been performed in tensile loading scenarios perpendicular to the circumferential meniscal fibers. However, meniscal repair constructs are also exposed to shear forces parallel to the circumferential meniscal fibers during healing, particularly in the midportion of the meniscus. Material properties of meniscal repair devices cannot be extrapolated from tensile to shear load scenarios. Controlled laboratory study. In 84 harvested and isolated bovine lateral menisci following removal of adjacent soft tissue, a standardized vertical lesion was set followed by repair using all-inside flexible (FasT-Fix, FasT-Fix AB, RapidLoc) and rigid (Meniscus Screw, Meniscus Arrow) meniscal repair devices. Vertical and horizontal 2.0 Ethibond sutures were used as controls. The repaired meniscal construct was tested in a tensile (parallel to the axis of the tested repair device) and shear load scenario (perpendicular to the axis of the tested repair device) at 5 mm/min and 37 degrees C environmental temperature. Maximum load to failure, stiffness, and failure mode were recorded. The absolute load to failure values of each repair device in the shear scenario were only marginally different from the tensile load scenario. However, the stiffness of several tested devices was markedly reduced in the shear scenario. In both scenarios, large differences of the load to failure and
the stiffness between the implant types up to 5-fold were found (P< .05). The failure mode of several all-inside flexible repair devices was different in the shear versus tensile load scenario, while the failure mode of the rigid systems was similar in both scenarios. All-inside meniscal repair devices exposed to shear load scenarios have comparable maximum loads to failures as tensile load scenarios. However, the stiffness of the majority of the flexible meniscal repair implants in a shear load scenario is markedly reduced. The applied scenario also affects the failure mode in several flexible meniscal repair devices. Meniscal repair devices with sufficient stiffness and stability against shear loads may be favored for meniscal repair, especially within the midportion of the meniscus where shear loads occur during healing.