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COMPARISON OF TENDON TO BONE HEALING USING FLEXOR TENDON AND BONE-PATELLAR TENDON- BONE GRAFTS IN A MODEL OF ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION IN SHEEP.

Nowadays, the two most frequently used grafts for anterior cruciate ligament (ACL) reconstruction are the autologous bone patellar-tendon bone graft (BPTB) and the tendon graft (FT). The BPTB graft with bone plugs at both ends is supposed to offer the advantages of both, faster integration into the surrounding bone and also retention of the normal direct ligament insertion. It is assumed that bone to bone healing is faster and easier than tendon to bone healing. In addition, tendon to bone healing often progress via development of an indirect ligament insertion with so called Sharpey fibers anchoring the tendon to the bone. However, the BPTB graft also undergoes tendon-to-bone healing at its bone tunnel aperture site. Recently, anatomic fixation with interference screws showed to promote insertion site healing via a direct ligament insertion. As graft healing is essential for the long-term stability of the ACL reconstruction, a detailed histological comparison of both graft types using anatomical fixation with interference screws is required.

Twenty eight mature sheep underwent ACL reconstruction using a FT graft or a BPTB graft. Grafts were fixed with a poly- L- lactide interference screw or a Composite interference screw with hydroxyapatite and tricalcium phosphate (Arthrex®). Sheep were euthanized at 6 and 52 weeks and the tibia and femur were extracted. Axial to the bone tunnel, slices were taken for histological evaluation. Analyses were performed using normal light and polarized light. Additionally, an in-vivo polychromic sequential labeling, using three fluorochromes enabled retrospectively evaluation of bone grow during the graft healing period under fluorescent microscopy. A semi quantitative score has been developed to evaluate the direct ligament insertion. (class 0= no direct ligament insertion, class 1= non-calcified chondroid like cells, class 2= calcified chondroid like cells, class 3= immature direct ligament insertion and class 4= mature direct ligament insertion).

Both grafts developed graft anchorage at the bone tunnel aperture site after 6 weeks. Chondroid like cells were found at the anterior tibial bone tunnel aperture site (tensile site) at 6 weeks, most notably in the BPTB group (2x class 1 and 4x class 2). The FT group showed ligament insertion in one out of 7 specimen with non- calcified chondroid like cells ligament insertion and in another case calcified chondroid cells (1x class 1 and 1x class 2). The bone

plug of BPTB grafts was well integrated into the surrounding bone. Both graft types groups revealed a hypercellular and hypervascular pattern, while the FT graft showed necrosis around the holding sutures and the BPTB graft in the region of the patellar tendon bone plug junction at 6 weeks.

At 52 weeks both grafts showed a maturated direct ligament insertion at the bone tunnel aperture site. The tunnel aperture was narrowed almost separating the ligament insertion site from the intraosseous tendon part. Both groups showed vacuoles instead of graft anchorage in some areas between bone tunnel wall and intraosseous tendon part of the graft. The bone plug of the BPTB grafts was completly integrated into the surrounding bone.

Using interference screw fixation, both graft types showed anchorage via development of a direct ligament insertion. Interestingly, graft anchorage in both groups was observed at the tunnel aperture site proceeding from the anterior portion (tensile site). ACL-reconstruction with either free tendon graft or BPTB grafts using interference screw fixation showed the same longtime outcome regarding tendon to bone healing. Only in the early healing period did the BPTB grafts reveal an advanced graft anchorage.