

Injuries of Kaplan fibers in ACL deficient and reconstructed knees – redefining the structure and risk assessment on MRI using injury patterns

Edna A. Iordache, MD¹, Michael T. Hirschmann, MD^{1,2}, Felix Amsler³, Schu-Ren Yang, MD⁴, Silvan Hess, MD¹, Anna Hirschmann^{2,4}

¹Department of Orthopaedic Surgery and Traumatology, Kantonsspital Baselland (Bruderholz, Liestal, Laufen) Bruderholz, Basel, Switzerland, ²University of Basel, Basel, Switzerland, ³Amsler Consulting, Basel, Switzerland, ⁴University Hospital Basel, University of Basel, Clinic of Radiology and Nuclear Medicine, University of Basel, Basel, Switzerland

Objectives: To determine an injury pattern of knee structures along torn Kaplan fibers in ACL deficient knees and to observe the healing process of Kaplan fibers in ACL reconstructed knees.

Methods: A total of 101 knee MRIs obtained between January 2004 and April 2020 with full-thickness ACL tears were retrospectively assessed for visibility and impairment of three Kaplan bundles (proximal, distal and epicondylar band) and for associated injuries by two fellowship-trained independent musculoskeletal radiologists. A subgroup of 33 follow-up knee MRIs after ACL reconstruction was assessed to observe the natural evolution of Kaplan fibers injury. Descriptive statistics and Spearman correlation coefficients ($P < .05$) were used to determine injury patterns.

Results: Kaplan fibers were injured in 43 of 101 (43%) acute ACL deficient knees. Proximal Kaplan fibers were visible in less than 48 of 101 (50%) knees as opposed to the distal Kaplan fibers and epicondylar Kaplan band which were both visible in 98 of 101 (97%) knees. Injury to the Kaplan complex was significantly associated with anterolateral ($\rho, 0.36; P < .001$) and lateral collateral ligament impairment ($\rho, 0.21; P < .05$) and medial femoral bone marrow edema ($\rho, 0.21; P < .05$). After ACL reconstruction, only two of 33 (6%) patients showed torn Kaplan and 13 of 33 (39%) distal Kaplan fibers were scarred.

Conclusion: Torn Kaplan fibers are associated with anterolateral and lateral collateral ligament injuries in ACL deficiency, indicating a more severe anterolateral and rotatory instability. Injury patterns in ACL deficient knees can eliminate the uncertainty of proximal Kaplan fibers identification. Kaplan fiber tears tend to heal following ACL reconstruction.

The Orthopaedic Journal of Sports Medicine, 9(6)(suppl 2)

DOI: 10.1177/2325967121500182

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