Recovery of Full Hyperextension after ACL Reconstruction Is Associated with Better Functional Outcomes but Greater ACL-Related Laxity after a minimum of 24 months follow up.

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Patients with ligament hypermobility or knee hyperextension are at high risk for new ACL injury. In patients with hyperextension, there is still no consensus on how the ACL graft should be fixed, whether in 15/20-degree flexion, complete extension, or hyperextension. This is extremely important because the degree of extension that the graft is fixed can interfere with the postoperative amplitude gain, especially in patients with great hyperextension.

Shelbourne and Klotz have long advocated that for patients to have full knee function, the full extension should be reestablished as early as possible, including hyperextension. Specifically, in patients with hyperextension, few studies report the degree of movement in the postoperative period. It is known that patients who evolve with knee flexion contracture (extension less than zero) have worse results, but there is a gap in the literature about patients who can recover full extension but do not recover the hyperextension they have in the contra-lateral knee.

Thus, the objective of this study is to evaluate patients submitted to anterior cruciate ligament (ACL) reconstruction with preoperative hyperextension and compare physical examination and patient reported outcomes measures of patients who recovered the entire hyperextension with patients who did not. We hypothesize that patients who do not recover full hyperextension will have worse results than those who recover the entire range of motion.

Patients submitted to ACL reconstruction surgery from June 2013 to June 2021 were evaluated retrospectively, although with prospective data collection. Patients aged 18 to 60 years and knee hyperextension of more than 5 degrees submitted to anatomical ACL reconstruction with at least 24 months of follow-up were included. Patients with associated surgical procedures such as collateral ligament reconstruction, posterior cruciate ligament (PCL) reconstructions, osteotomies, or major procedures for chondral treatment injuries were excluded. Patients with previous injuries or surgeries in the contralateral knee were excluded. Patients with ACL reconstruction performed more than 24 months after the initial injury, patients who lost follow-up, and patients presenting graft rupture during follow-up were also excluded. Patients with graft failure were excluded, as due to the retrospective nature of the study, it could be imprecise to exactly know at the time the graft failure happened, if the patients had complete recovered hyperextension or not.

ACL reconstruction was performed with a single bundle. The hamstrings graft fixation was performed with two interference screws with the knee around 20 to 30 degrees of flexion, and the patellar tendon graft was fixed with the press-fit technique in the femur and with an interference screw in the tibia in full extension. Only patients with preoperative complete range of motion were submitted to surgery.

Data were collected from medical records and databases of operated patients completed prospectively during normal patient follow-up. The following data were collected: age, sex, time from injury to surgery, passive knee hyperextension, pre-and postoperative KT-1000 arthrometer laxity and pivot-shift, associated meniscal injury and treatment (meniscectomy or repair), type of graft used, intra-articular graft diameter, associated extra-articular procedure, follow-up time, postoperative Lysholm Knee Scoring Scale, International Knee Documentation Committee (IKDC) subjective scores, Global Perceived Effect (GPE), and Forgotten Joint Score (FJS), and complications.

Patients that recover full knee hyperextension were compared to patients that could recover full knee extension but could not recover full knee hyperextension. Numerical variables were described as mean and standard deviation for normally distributed groups or as median and interquartile range when non-normal distribution, according to the Shapiro-Wilk test and histogram analysis. Categorical variables were described by the absolute number and percentage within the group.

Comparisons of numerical variables between groups were performed using the Student's t-test or Mann-Whitney U test, according to the normality of the variables. For categorical variables, Fisher's test was used in the respective contingency tables.

RESULTS:

Initially, 282 patients with more than 5 degrees of knee hyperextension were identified. Of these cases 57 were excluded, leaving a sample of 225 for analysis.

Among the 225 patients, 48 (21.3%) did not recover preoperative hyperextension, with a mean extension loss of 4.6+/- 2.1 degrees (range 2-10), and 177 recovered a symmetrical range of motion to the contralateral limb.

Regarding the pre- and intraoperative variables, there was no difference between the groups regarding age, sex, degree of preoperative hyperextension, time of injury, graft used in ACL reconstruction, associated extra-articular procedure, preoperative KT-1000 and the pivot-shift tests, and meniscal injury and its associated treatment. Patients who did not recover hyperextension had a larger diameter graft than patients who recovered hyperextension (8.7 \pm 0.7mm vs. 8.3 \pm 0.7mm; p = 0.018).

Regarding the postoperative variables evaluated, the follow-up time between the groups was similar. Patients who recovered the preoperative hyperextension showed statistically significant improvement on all scales evaluated (IKDC, Lysholm, FJS, and GPE) compared to patients who did not recover the range of motion. However, patients who recovered hyperextension showed more laxity measured by the KT-1000 (1.8 +/- 0.8 vs. 1.1 +/- 1.0; p= 0.0006) and the pivot-shift (Grade 0 - 62.1%, Grade 1 - 37.9% vs. Grade 0 - 79.2%, Grade 1 - 20.8%; p=0.027). Complications were similar between groups (p=0.705).

DISCUSSION AND CONCLUSION: Patients with knee hyperextension who regained range of motion after ACL reconstruction have worse knee laxity than patients who regained full extension but not hyperextension. However, patients who recover full range of motion showed higher scores on subjective function scales, including a greater number of patients who achieved PASS IKDC.