Restoration of Knee Extension During the Early Postoperative Period Predicts Successful Return to Sport following Anterior Cruciate Ligament Reconstruction

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INTRODUCTION:
Rupture of the anterior cruciate ligament (ACL) is a common orthopaedic injury, affecting more than 200,000 individuals in the United States annually. Following ACL reconstruction (ACLR), rehabilitation with an emphasis on range of motion and strength plays a crucial role in optimizing outcomes, such as successful return to sport (RTS). The aim of this study was to identify predictive factors for successful RTS following ACLR with QT autograft, hypothesizing that restoration of full knee extension during the early postoperative period would yield a higher rate of successful RTS.
METHODS: Data was retrospectively collected on consecutive patients who underwent ACLR with QT autograft within our Sports division between 2010-2020. Patient demographics, operative knee range of motion (ROM), injury characteristics, and intraoperative data were collected from the electronic medical record. Full RTS was considered as the patient returning to their prior level of sport successfully, and the presence of a subsequent clinical note documented the RTS without further complications. Univariate and multivariate cox regression were utilized to conduct time-to-event analysis to identify predictors of early RTS clearance by surgeon. Additionally, both logistic regression analysis and generalized estimating equations were used to identify significant predictors of successful full RTS. Software was utilized for all analyses with statistical significance set to $p < 0.05$.
RESULTS: A total of 307 patients were included, consisting of 176 males (57.3%) and 131 females (42.7%), with an average age of 20.7 $\pm$ 7.1 years and 14.5 $\pm$ 8.9 months follow up. Ten patients were professional or semi-professional (3.3%) athletes, 38 collegiate athletes (12.4%), 144 were high school athletes (46.9%), and 115 were recreational athletes (37.5%). According to multivariate analyses, full knee extension at 3 months (HR: 1.55, 95% CI: 1.13 – 2.12, $p = 0.007$) and 6 months (HR: 1.49, 95% CI: 1.05 – 2.12, $p = 0.025$) postoperatively were predictors of higher rates of RTS clearance by the operating surgeon. More specifically, patients who achieved full knee extension ROM at 3 months follow up revealed a greater incidence rate of RTS (1.02 per person-years) compared to patients who did not achieve full RTS at 3-months (0.83 per person-years). Similarly, an association among patients who did and did not achieve full knee extension at 6-months was observed (1.04 per person-years and 0.90 per person-years, respectively). When considering successful RTS, only full knee extension at 4-6 weeks (OR:2.02, 95% CI:1.02 – 4.03, $p = 0.045$) and at 3 months (OR:2.36, 95%CI: 1.12 – 4.99, $p = 0.024$) postoperatively were predictive of full RTS. No other significant predictors were identified.
DISCUSSION AND CONCLUSION: Restoration of full knee extension was strongly associated with both surgeon clearance and successful RTS. The role of full knee extension in the ability to regain strength at 6 months, as measured by limb symmetry indices, as well as predisposing to cyclops lesion formation following ACLR has been previously described. While both ROM and strength play crucial roles in the rehabilitation process, restoration of full ROM typically precedes restoration of full strength. Lacking full extension 4-6 weeks postoperatively necessitates closer patient monitoring, and the lack of full extension 3 months postoperatively may necessitate further intervention, including imaging and operative treatment, if indicated. Identifying suboptimal knee extension at these timepoints is needed and may improve the patient's ability to return to their previous level of sporting activities.