Safety of Early Anterior Cruciate Ligament Reconstruction and Impact on Early Muscle Strength Recovery

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INTRODUCTION:

There has been considerable debate regarding the optimal timing for anterior cruciate ligament (ACL) reconstruction. Early reconstruction has been associated with an increased risk of stiffness. A delay in surgical reconstruction is recommended for achieving a full range of motion (ROM). However, recommendations to delay surgery are based on studies from over 20 years ago with outdated surgical techniques and rehabilitation. It has been reported that early surgery using arthroscopy and an accelerated rehabilitation protocol did not increase the risk of knee stiffness. Moreover, there were no functional disadvantages between early and delayed ACL reconstruction. However, the definition of early operation was not standardized in these reports, and no clear evidence was provided to determine the optimal timing of surgery. Early muscle strength recovery is important to return to sports. If early reconstruction is safe and provide clinical benefits, we can activity recommend this operation. Thus, it is necessary to evaluate and compare the outcome between early and delayed reconstruction.

This study aimed to evaluate the muscle strength, and various complications to assess safety in early ACL reconstruction. We divided the patients into three groups (within 2 weeks, 2 to 6 weeks, and 6 to 12 weeks from injury to ACL reconstruction) to evaluate the optimal timing of surgery. We hypothesize that early operations did not increase the risk of complications and are related to early recovery of muscle strength and return to the same level of sports as before the injury.

METHODS:

The ethics committee of Ichihara Hospital reviewed and approved this retrospective study. Patient consent was implemented via opt-out. This study included 291 patients who had undergone primary ACL reconstruction at our hospital between September 2018 and August 2021. Patients who had undergone arthroscopic anatomical single-bundle ACL reconstruction using hamstring autograft and the outside-in technique and follow-up examination for a minimum of 15 months were included. Patients who underwent the following were excluded: ACL reconstruction over 3 months after injury, ACL reconstructions using other operative techniques (double bundle, transtibial tunnel approach), other ligament injury, quadriceps tendon graft or bone patella tendon bone graft, revision ACL reconstruction, and bilateral ACL reconstruction. Moreover, patients who had undergone an operation between each period were excluded.

We classified patients who had undergone ACL reconstruction into three groups based on the time from injury to their initial visit at our hospital: within 2 weeks after the injury (early group), 2 to 6 weeks, and 6 to 12 weeks after the injury. The surgical technique and postoperative rehabilitation protocol were the same in all three groups. We compared the characteristics of patients (preoperative age, height, weight, sex, Tegner activity score, and meniscus tear) and postoperative muscle strength, ROM, knee laxity, Lysholm score, Tegner activity scale, the period of the return to sport, and various complications (graft rupture, contralateral injury, need of manipulation for loss of ROM, infection, and fracture around the knee after operation). Muscle strength, isokinetic concentric quadriceps, and hamstring strength were measured using Biodex system 3 (SAKAI MED, Tokyo, Japan) at 60 °/s.

Patients' age, height, weight, Lysholm score, Tegner activity score, ROM, and muscle strength between the three groups were evaluated using the Kruskal-Wallis test. When used as a post hoc test, Bonferroni test was performed. The patient's sex, knee laxity, and complications were evaluated using $\chi 2$ test. A p value of <0.05 was considered statistically significant.

RESULTS SECTION:

There were 16 cases in the early group, 38 cases in the 2-6 weeks group, and 27 cases in the 6-12 weeks group. The groups did not differ significantly in terms of sex, age, height, weight, Lysholm score, Tegner activity scale.

There were no significant differences in knee joint range of motion, knee laxity, the period of the return to sport, and various complications among the three groups. In the early group, there were no joint fibrosis that occurred after surgery. In isokinetic knee muscle strength, the early reconstruction group was significantly higher than the other groups in knee extension muscle strength 3 months after surgery (early group vs. 2-6 weeks group; p=0.024・r=0.35, early group vs 6-12 weeks group; p=0.023・r=0.41). No significant differences were identified in the other items.

DISCUSSION:

Early ACL reconstruction does not cause adverse events such as joint fibrosis and joint instability and is safe and advantageous for early recovery of muscle strength.

Our results suggested that early surgery using arthroscopy and current rehabilitation with early knee movement was safe and important for preventing joint stiffness. Early ACL reconstruction can lead to early restoration of postoperative muscle strength. It is possible that the postoperative muscle strength was high because the early ACL reconstruction was performed before the muscle weakness in the preoperative period occurred.

There were several limitations to this study. First, this study was a non-randomized retrospective study, and some data was missing, especially muscle strength and stability tests. Second, the sample size of this study was small and unequal. Further studies should include a higher and equal number of patients.

SIGNIFICANCE/CLINICAL RELEVANCE:

Early ACL reconstruction can contribute to shortening the sports withdrawal time.