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CORR Insights

CORR Insights®: Hamstring Autograft versus Patellar Tendon Autograft for ACL Reconstruction: Is There a Difference in Graft Failure Rate? A Meta-analysis of 47,613 Patients

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Where Are We Now?

Several factors need to be taken into account before an ACL reconstruction can be considered "successful," including patient selection, graft selection, fixation selection, tunnel placement selection, rehabilitation protocol selection, and timing of return to play. In their study, Samuelsen and colleagues shed light on one of these criteria: Graft selection.

Currently, the most-commonly used grafts for ACL reconstruction include patellar tendon autograft, hamstring tendon autograft (including double-, triple-, and quadruple-stranded grafts), quadriceps tendon autograft, and a variety of allografts. In their study of more than 47,000 knees, Samuelsen and colleagues found no difference in graft failure rates between patellar tendon and hamstring tendon autografts. However, the question of graft failure is not simply a question of the graft used. Previous studies have demonstrated the importance of effective graft length on the stiffness of a cruciate ligament construct [1, 2]. In fact, one study found that a graft diameter of more than 8 mm is effective in preventing recurrent instability leading to graft rupture or reoperation [2].

It is also important to know what rehabilitation protocols are used for each type of graft. While "accelerated rehabilitation" protocols are popular, they may not be ideal for all types of grafts and fixation methods. A patellar tendon autograft has bone-to-bone healing potential, immediate rigid fixation, and a short effective graft length

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that makes it stiff at the time of implantation. Thus, patients typically can begin weight bearing as tolerated, immediate ROM, and an "accelerated" rehabilitation protocol to include return to sports at 6 months assuming strength has returned [1].

Still, hamstring tendon grafts come in many different varieties. Some surgeons advocate double-, triple-, or quadrupled-tendon grafts, using either a single- or double-tendon construct. When only a single tendon is used, the graft by definition will only have a limited amount of tissue available for tunnel healing (10 mm to 15 mm, at most). However, there is no consensus regarding this amount of tissue in a tunnel [3]. I prefer a minimum of 20 mm to 25 mm of tendon for fixation in a tunnel, and this can only be achieved with the harvest of both the semitendinosis and gracilis tendons.

Once this tissue is in the tunnel, the surgeon must decide on the type of fixation, generally either suspensory or articular fixation. Given the lack of immediate rigid fixation, the surgeon must consider protecting the graft from undue forces by using a brace and making the patient partial weight bearing for the first 6 weeks. From a biomechanical perspective, articular fixation is preferred to achieve a stiffer graft, to prevent graft/suspension stretching or tunnel widening, and to minimize the risk of graft failure.

When deciding on whether to use a hamstring tendon or patellar tendon, it is important to consider how the graft will be harvested, configured, and fixed prior to making a decision for a given patient. Today, I believe most sports medicine experts and team physicians will still recommend a patellar tendon autograft for a high-level athlete. But the question of anterior knee pain, kneeling pain, and postoperative stiffness is not inherent to any specific type of graft, but rather to how the graft is harvested and fixed, and what kind of rehabilitation the patient performs. Based on my experience, if a patellar harvest site is bone grafted, the patellar tendon defect closed and the paratendon closed as separate layers, there is no difference in resultant anterior knee pain between patellar tendon and hamstring tendon grafts.

Where Do We Need to Go?

Before crowning a specific type of collagen tissue as the "graft of choice," more research and engineering needs to be done for graft fixation.

If one only looks at graft load to failure, a quadrupled-hamstring tendon autograft is stronger than a patellar tendon autograft. Therefore, the variable that comes into play when comparing the two grafts must be the fixation device used. We still do not have an ideal soft-tissue fixation device that has the same biomechanical effect for the hamstring grafts as interference screws have for patellar tendon grafts. When used for soft-tissue grafts, interference screws have been shown to have the weakest pull-out strength when compared to suspensory devices and other types of articular fixation.

That said, a hamstring tendon graft offers the potential to better reproduce native ACL biomechanics. The ACL has been described to have two main functional bundles. While a patellar tendon graft cannot be separated into two bundles, a soft-tissue graft can. Most surgeons no longer perform double-bundle-double-tunnel reconstructions. However, there is still an opportunity to achieve more physiologic biomechanical properties by designing an improved "single tunnel-double bundle" configuration of the graft.

How Do We Get There?

The future of ACL reconstruction likely will center on tissue engineering. In order to achieve a truly "anatomic" ACL graft, the anatomy and physiology of the native graft must be reproduced. Current replacement grafts such as patellar, hamstring, and quadriceps tendons, do not replicate the native ACL. As a result, the approaches of "ACL repair" and/or "ACL regrowth" will need to be revisited. While "ACL repairs" have historically done poorly, the use of newer growth factors, biologic products such as PRP, bone marrow aspirates, and fibrin glues may hold the key to improved graft healing and strength following an ACL repair. Furthermore, research is needed for new tissue engineering approaches that can either "regrow" or "heal" a torn ACL. Current techniques include cell-seeded collagen scaffolds, growth factor impregnated scaffolds, and stem cells. Ultimately, native ACL biomechanics must be reproduced if our surgical reconstructions or repairs have any hope to allow a fully functional, pain-free knee that will not develop long-term degenerative change.

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