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IU Health Physicians Orthopedics & Sports Medicine

ANTERIOR CRUCIATE LIGAMENT (ACL) RECONSTRUCTION: GRAFT OPTIONS

Bryan M. Saltzman, M.D.

Indiana University Health Physicians

Assistant Professor of Orthopaedic Surgery, Indiana University
Sports Medicine, Cartilage Restoration, Shoulder/Elbow

IU Health Methodist Hospital – 1801 N Senate Ave, Indianapolis, IN 46202

IU Health North – 201 Pennsylvania Pkwy #100, Carmel, IN 46280

317-944-9400

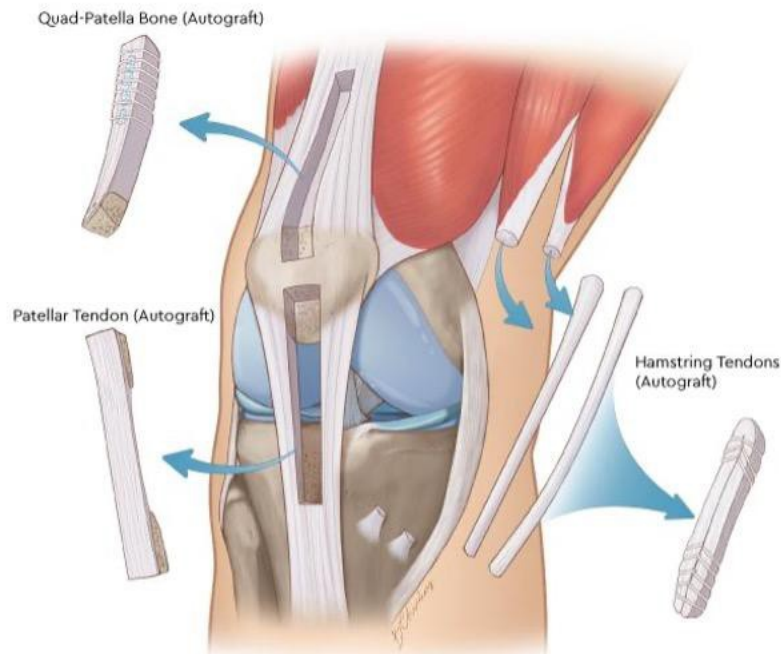
www.bryansaltzmanmd.com

ACL reconstruction requires the use of transplanted tissue, also known as a graft. Grafts either come from the patient (ie., an autograft) or a cadaver (ie., an allograft). Overall, young, active patients are at an increased risk for failure with an allograft and, as such, it is often recommended that most active patients under the age of 30 receive an autograft.

The ideal graft should have properties similar to your native ligament, permit strong fixation and rapid biologic incorporation, and limit your pain and morbidity. The three most commonly used autografts include bone-patellar tendon-bone (BTB), hamstring tendon (HT), and quadriceps tendon (QT) autografts (Figure 1).



Graft Locations



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Bone-patellar tendon bone (BTB) autograft
Hamstring tendon (HT) autograft
Quadriceps tendon (QT) autograft

1. **BTB autograft:** The BTB graft involves removing a small piece of bone from the lower kneecap (also known as the patella), the central third of the patellar tendon and a small portion of the bone from the shin. The bone blocks at the end of the graft allow for reliable, strong and rigid fixation of the graft in the bone tunnels which is not possible with soft tissue (HT and QT) allografts. This may also expedite the healing time of the graft. This is the most commonly used graft among professional and elite athletes, and studies suggest that it has the lowest re-rupture rate and highest chances of allowing patients to return to their preinjury



levels of activity. The incision associated with this graft is larger than either the HT or QT, and it is associated with a higher incidence of pain in the front of the knee as well as with pain when kneeling. There are also very rare post-operative complications such as kneecap fractures and patellar tendon ruptures.

2. **HT autograft:** The hamstring tendons are also commonly used as an ACL autograft. The graft is obtained through a smaller incision and the procedure is associated with less pain immediately post-operatively compared to a BTB reconstruction. Occasionally, the diameter of the hamstring tendons is too small for a reliable reconstruction which has been shown to be a risk factor for post-operative failure. If this situation is encountered during the operation, allograft is added to augment the reconstruction; however, the addition of allograft has not been proven to reduce the risk of post-operative failure. There are also concerns regarding removing the hamstring tendons, as hamstring weakness is a known risk factor for ACL tears. While some large database studies have found an increased risk of failure compared to BTB, other studies have demonstrated no increased risk of failure. Although rates of infection following ACL reconstruction are low, HT autografts have been associated with the highest chance of infection.
3. **QT autograft:** The QT autograft is the newest autograft and the least frequently used and studied. Despite this, its use is increasing. The graft can be obtained with a bone block from the kneecap on one end; however, most often it is taken as a soft tissue graft. The QT is a significantly more robust (wider and thicker) graft compared to the patellar tendon, and patients have less pain in the front of the knee and while



kneeling post-operatively compared to a BTB reconstruction. The harvest incision length is variable based on surgeon preference, but the graft can be obtained from a small, minimally invasive incision.

4. **Allograft:** Allograft tissue comes from a deceased donor. The benefits include decreased morbidity associated with taking a graft from the patient and decreased surgical time. However, there are reports of early graft failure, particularly in young active patients.

ACL Outcomes data (within 3 years) from the largest available investigations:

1. Among international database studies comparing BTB and HT it has been found that:
 - a. Among some registries (including in the United States), HT were 1.41x-1.82 more likely to result in a revision surgery compared to BTB autografts.
 - b. Among other registries, there was no difference between HT and BTB revision rates. QT was not investigated
2. Among 7 studies comparing BTB versus HT:
 - a. 3 studies found that BTB reduced the risk of revision ACL surgery. Data highlighted included: A decreased risk of revision with BTB by 37%
 - b. A 4x increased risk of revision ACL reconstruction within 1 year of surgery with a HT autograft
 - c. A 5-year revision rate among 15-19 year-old patients of 9.5% with HT and 3.5% with BTB
 - d. 4 studies identified no difference between HT and BTB autograft



3. Among a large analysis of 47,613 ACL reconstructions, BTB grafts ruptured at a rate of 2.8% compared to 2.84% for HT. This was found to be a “statistically” higher rate, but such a small difference is likely to be clinically insignificant.
4. Among 10 studies comparing BTB, HT, and QT autografts, failure rates of 3.6% for the QT, 3.6% for the BTB, and 3.7% for the HT were identified. Pain in the front of the knee was higher in the BTB compared to both the HT and QT groups.
5. Allograft reconstructions have been found to have an acceptable failure rate (~8%) in patients older than 40 years old. The rate of failure is higher in younger, more active patients.

Bottom Line:

1. BTB autograft is associated with increased pain in the front of the knee and kneeling pain after surgery
2. Some studies show a decreased failure rate of BTB when compared to HT autograft
3. No studies have identified a difference in failure rates between BTB versus QT or HT versus QT
4. Allograft demonstrates acceptable failure rates in patients older than 40