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Original Article

Patellar tendon donor-site healing during six and twelve months after Anterior Cruciate Ligament Reconstruction

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ABSTRACT

Background: Bone-Patellar Tendon-Bone Graft is one of the most acceptable methods of treatment for Anterior Cruciate Ligament rupture (ACL). This study evaluates the recovery process of the graft donor site.

Methods: This study evaluates the graft donor site recovery in 23 patients with ACL reconstruction, 6 and 12 months after the patellar tendon graft surgery.

Results: In 70 percent of the cases, the healing process was completed after 6 months and the remaining 30 percent recovered after 12 months.

Conclusion: Time is an important factor in the recovery process of the patellar tendon for reconstruction of the ACL.

1. Introduction

The Anterior Cruciate Ligament (ACL) is most frequently injured structure of the knee and ligament in the body. Given the increasing injury prevalence, there is undoubtedly a growing need for clinical decision-making among healthcare providers. It is estimated that 175,000 ACL reconstructions were performed in the year 2000 in the United States at a cost of more than $2 billion.[1–6] Besides the immediate associated morbidity and costs, an ACL tear significantly increases the risk of premature knee osteoarthritis.[1,7–9] It is estimated that osteoarthritis develops in 50% of patients with ACL tears 10–20 years after the injury, while they are still young.[1,7,8,10,11]

Based on previous studies, the rupture of the Anterior Cruciate Ligament (ACL) is the most common and most neglected—in terms of diagnosis—acute knee injury.[12] It may be impossible to diagnose this injury with a simple stress test since the muscle pain and spasm associated with it could mislead doctors.[13] Hence, it can only be diagnosed with specific instruments, such as arthroscopy. Therefore, the decision

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to treat ruptured ACLs and the various options for treatment have further increased the importance of diagnosis.

The ACL increases the stability along the anterior-posterior line of the knee. In addition, it plays an important role in preventing hyperextension and excessive axial rotation of the knee.[14] However, many cases presenting with normal knee function have, in fact, experienced an ACL rupture in arthrotomy.[15,16] It should be mentioned that ACL rupture becomes apparent when other fractures are simultaneously present, such as injury or degeneracy of the meniscus posterior horn and its subsequent meniscectomy, or even a gradual stretching and capsular injury with medium intensity[16]. Furthermore, many believe that ACL rupture is the beginning of the destruction of the knee, which has led to a vast number of studies regarding the anatomy and function of the ACL.[17]

The surgical approach to ACL tears for the past two decades has involved the reconstruction of the ACL with the use of a graft (a piece of tendon) passed through tunnels drilled into the tibia and femur at insertion points of the ligament to approximate normal anatomy, with the goal of eliminating ACL instability. Reconstruction is preferred over repair since randomized trials have shown that ACL repair is no better than non-operative treatment[3,18] and that ACL reconstruction significantly improves knee stability and the likelihood of return to pre-injury activity over repair alone or repair with augmentation (insertion of a tendon graft or synthetic graft).[3,19]

The commonly used sources of tendon in this surgery are quadriceps tendon, patellar tendon, hamstring tendon, and iliotibial band. Study results have shown that the patellar tendon is the preferred graft in replacing the ACL.[20]

Noyes et al have demonstrated that a patellar tendon graft has an acceptable strength in comparison to the ACL, where a 9 or 10 mm graft has approximately 112% of a normal ACL's strength. Additionally, in many studies, it has been demonstrated that bone tunnel widening is only slightly seen when patellar tendon is used, which has no effect on clinical outcomes.[21] Hence, these characteristics have made the patellar tendon graft a good replacement in ACL injuries.

In this study, we have evaluated the restoration of the patellar tendon graft donor site by ultrasonography in patients whose ACL has been replaced with this graft 6 and 12 months after harvesting in Anterior Cruciate Ligament Reconstruction.

2. Methods

2.1. Human subjects and entry criteria

Between 2008 and 2011, 23 patients with an average age of 30.17 ± 5.7, a history of knee torsion and positive Lachman, and positive pivot and anterior drawer tests, were diagnosed as having an ACL tear by an orthopedic surgeon, and reconstruction was performed. ACL reconstruction with an autogenous bone–patellar tendon–bone graft method at two orthopedic surgery hospitals (Baher Clinic) who were invited to participate. Patients were included if 1) they were moderately active, evidenced by a Tegner scale of 5 or greater before injury, 2) they only suffered from pure ACL rupture or ACL and meniscal lesion, and 3) they were candidates for ACL reconstruction with an autogenous bone-patellar tendon-bone graft. Subjects were excluded if they had an earlier injury or operation to either knee, evidenced by osteoarthritis via radiograph, simultaneous fracture, concurrent injury to the posterior cruciate ligament (PCL), or articular cartilage lesions with exposed bone observed during arthroscopy. Patients who were candidates for ACL-HTO (High Tibial Osteotomy) combination, Medial Collateral Ligament (MCL) repair, MCL reconstruction, combined ligament reconstruction, and other grafts were included.

The investigation was approved by our institutions' Committee on Human Research before commencement, and all subjects signed informed-consent forms before participation. Also, the patients and/or their families were informed that data from the case would be submitted for publication, and gave their consent. The surgeries were carried out by one surgeon using the bone-patellar tendon-bone grafting technique. At the time of arthroscopy, the knee was examined, and associated joint pathology was documented. The femoral notch was enlarged as necessary to improve visualization and to avoid later impingement against the graft.

2.2. Surgical technique

2.2.1. Bone-patellar tendon-bone grafting technique

After standard arthroscopic examination of the joint, followed by removal of irreparable fragments of torn menisci, the bone-patellar tendon-bone graft was constructed from the central third of the tendon of the ipsilateral knee. The graft was removed from the tibial tubercle and patella, and the patellar defect was grafted with cancellous bone trimmed from the bone blocks or with bone curetted from the bed of the tibial donor site. An Acufex drill-guide system was used to place guide-pins in the center of the tunnels to be reamed in the tibia and femur. The tibial pin was located at the junction of the middle and posterior thirds of the normal site of attachment of the anterior cruciate ligament to the tibia. The bone blocks of the graft were trimmed to appropriate sizes. The graft was pulled through the tunnels so that the patellar bone block was within the femoral tunnel and the tibial bone block was within the tibial tunnel. The graft was positioned and an interference-fit screw was used in the femoral tunnel to fix the bone block. Tension was then placed on the distal part of the graft, and the knee was cycled through a range of motion. The knee was then extended, and the graft was pulled in a distal direction. Next, the graft was recessed and was fixed at an appropriate tension within the tibial tunnel with use of an interference screw.

2.3. Postoperative rehabilitation program

A hinged brace for knee immobilization was placed on the knee and was worn constantly for four weeks. Patients walked in a toe-touch, weight-bearing manner using crutches, and quadriceps activity against gravity was permitted. Moreover, hamstring contractions were permitted. Hamstring strengthening physical therapy was started right away after surgery focusing on the hamstring (semitendinosus) and hip for 35 sessions for all patients. Additionally, quadricepses were strengthened partially during the first three months and completely over nine months.