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Original research-Orijinal araştırma

A new double bone-double bundle patellar tendon-bone graft model: A calf model study

Yeni bir çift kemik-çift bant patellar tendon-kemik greft modeli: Dana model çalışma

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Abstract

Aim. The aim of this study is to improve a new graft model for anatomic double bundle Anterior Crucial Ligament reconstruction (ACL). The aim of ACL reconstruction is to reproduce the functions of the native ACL. **Method.** An anatomic double bundle ACL reconstruction utilizes two separate grafts to replace the Anterior Medial (AM) and Posterior Lateral (PL) bundles of the ACL. Bone-Patellar Tendon-Bone (BPTB) Graft was harvested from calf knee. Patellar tendon and distal bone were split as longitudinal. **Results.** A new Double Bone-Double Bundle Patellar Tendon-Bone (DB-DBPT-B) graft model was obtained. We applied a new graft model for double-bundle anterior crucial ligament reconstruction on the calf knee. **Conclusion.** We think that a new graft model may be an alternative in open surgery and arthroscopic double-bundle ACL reconstruction.

Keywords: Anterior crucial ligament, double-bundle reconstruction, tendon graft, tendon reconstruction

Özet

Amaç. Bu çalışmanın amacı, anatomik çift bant ön çapraz bağ (ÖÇB) tamiri için yeni bir greft modeli sunmaktır. ÖÇB tamirinin amacı, doğal ÖÇB fonksiyonlarını yeniden sağlamaktır. **Yöntem.** Anatomik çift bant ÖÇB tamiri, ÖÇB'nin Anterior Medial (AM) ve Posterior Lateral (PL) bantı sağlamak için greft iki ayrılarak sağlanır. Kemik-Patellar Tendon-Kemik (KPTK) grefti dana dizinden elde edildi. Patellar tendon ve distal kemik boylamasına ikiye ayrıldı. **Bulgular.** Yeni bir Çift kemik-Çift Bant Patellar Tendon-Kemik (ÇK-ÇBPT-K) greft modeli elde edildi. Biz yeni tendon greft modelini dana dizinde çift bant ön çapraz bağ tamiri için uyguladık. **Sonuç.** Biz yeni greft modelinin açık ve atroskopik çift bant ÖÇB tamirinde alternatif olabileceğini düşünüyoruz.

Anahtar sözcükler: Ön çapraz bağ, çift bant tamiri, tendon greft, tendon tamiri.

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Introduction

As traditional single bundle Anterior Crucial Ligament (ACL) reconstruction could not fully restore rotatory knee stability, investigators have explored anatomic double bundle ACL reconstruction for ACL replacement [1-2]. But there are still controversies about graft selection for primary ACL reconstruction. The aim of this study is to improve a new graft model for anatomic double bundle ACL reconstruction in this study.

Material and methods

Tendon graft model

We studied this model in Cumhuriyet University Experimental Animal Laboratory. Bone-Patellar Tendon-Bone (BPTB) Graft with width of 12 mm was harvested from calf knee, which had been obtained from butcher's shop (Figure 1).

Figure1. Bone-Patellar Tendon-Bone (BPTB) Graft

Patellar tendon and distal bone were split as longitudinally. A new Double Bone-Double Bundle Patellar Tendon-Bone (DB-DBPT-B) Graft Model was obtained (Figure 2).

Figure2. Double Bone-Double Bundle Patellar Tendon-Bone (DB-DBPT-B) Graft

A Hewson suture passer was then used to pass 2 No. 5 no absorbable sutures through the distal 2 holes in the free double bone plug. A guide pin was placed in the "over the top" position with a 12 mm offset guide, the femoral tunnel was drilled to a depth of 30 mm with a 12-mm acorn reamer(Figure 3).

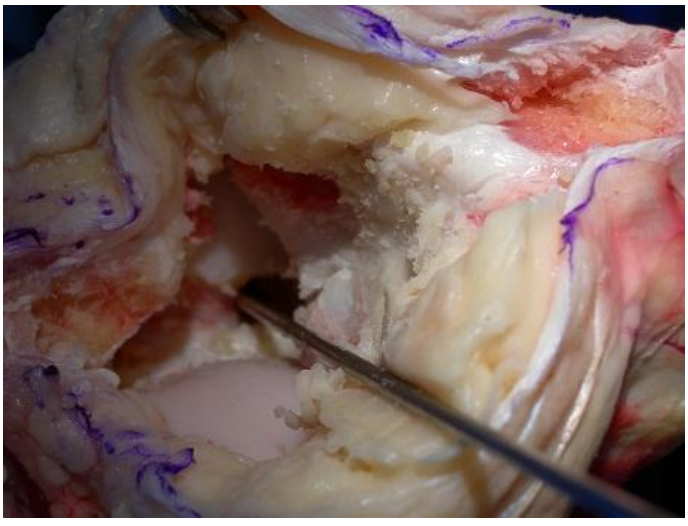

Figure3. Femoral tunnel

The graft fixation was made with interference screw to femoral tunnel (Figure 4). After The anterior-medial (AM) and posterior-lateral (PL) tibia tunnels were drilled using a 6 mm compaction reamer (Figure 5).

The graft fixations were made with interference screws (Kurusaga screw) to AM and PL tunnel (Figure 6). A double bundle ACL had been reconstructed with DB-DBPT-B Graft Model (Figure 7).

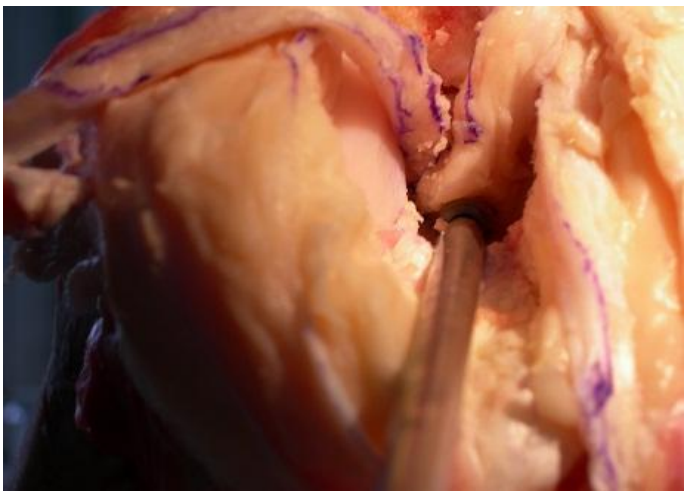

Figure4. The graft fixation with interference screws

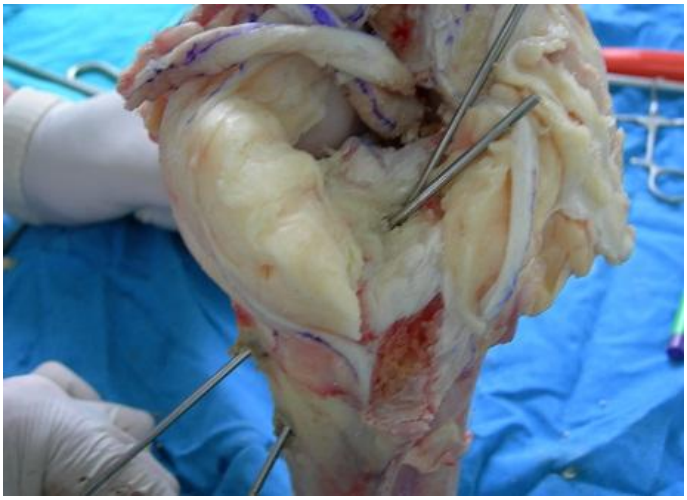

Figure5. The anteromedial (AM) and posterolateral (PL) tibial tunnels

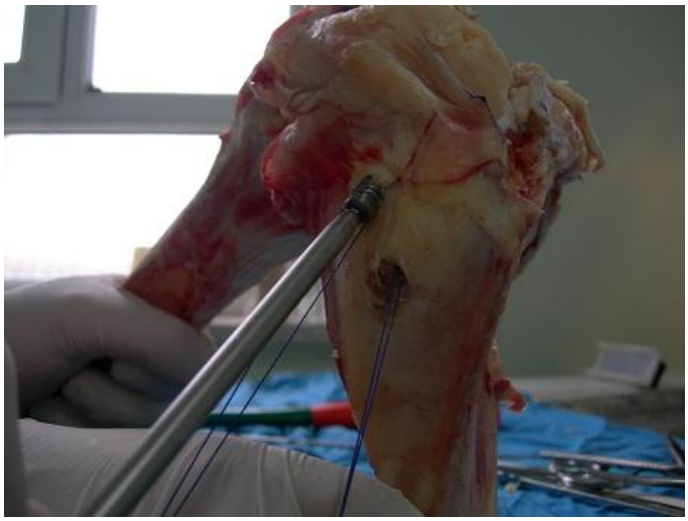

Figure6. The graft fixation with interference screws to AM and PL tunnels

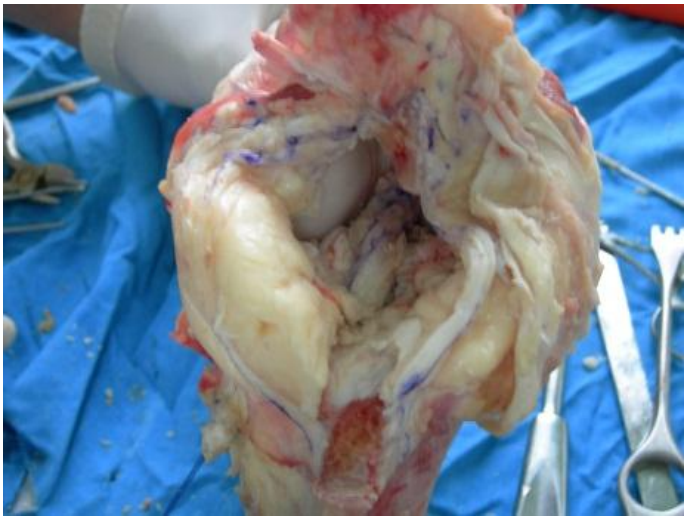

Figure7. A new double bundle ACL (Anterior Crucial Ligament)

Discussion

Over the years, a variety of autograft and allograft have been used for ACL reconstruction. Synthetic grafts had also been tried and are seldom used because of poor results. For autograft, the bone-patellar tendon-bone (BPTB) and hamstrings tendons are the most common, albeit some surgeons also use the quadriceps tendon and the iliotibial band. BPTB autografts have been proclaimed as the "gold standard" in ACL reconstruction. Recently, issues relating to donor site morbidity, such as arthrofibrosis, kneeling/patello-femoral pain, and quadriceps weakness, have caused a paradigm shift from 86.9% to 21.2% between 2000 to 2004 to quadrupled semitendinosus and gracilis tendon (QSTG) autografts [3-4]. We believe that available autografts and allografts are insufficient for anatomic double bundle ACL reconstruction. We designed a new DB-DBPT-B Graft model, which may be used as either autografts or allografts for anatomic double bundle ACL reconstruction. An anatomic double bundle ACL reconstruction utilizes two separate grafts to replace the AM and PL bundles of the ACL. Biomechanical studies have revealed that an anatomic double bundle ACL reconstruction has clear advantages in terms of achieving kinematics at the level of the intact knee with concomitant improvement of the in situ forces in the ACL graft closer to those of the intact ACL, even when the knee is subjected to rotatory loads [5]. We think that a new graft model successfully may be used with 2 tibia tunnel and 1 femoral tunnel in open surgery or arthroscopic double-bundle ACL reconstruction. BPTB has the advantage of having bone blocks available for graft fixation in the osseous tunnels that leads to better knee stability for earlier return to sports [6]. Early and improved graft-tunnel healing is obviously desirable. Grafts that allow for bone-to-bone healing generally heal faster, i.e., 6 weeks. In contrast, soft tissue grafts require tendon-to-bone healing and take 10-12 weeks [7]. Biomechanical speaking, for a tendon graft with a bone block on one or both ends (e.g., quadriceps tendon, Achilles tendon, and BPTB), interference screws have been successfully used [8]. DB-DBPT-B Graft model has bone graft in the each double bundle tendon's tips. We think that it may be superior to other tendon grafts due to either more stability or faster healing. Some authors reported that an original double-bundle ACL reconstruction technique using a quadriceps tendon graft. The graft consists of a patellar bone block with its attached tendon split into superior and inferior portions, which yields 2 bundles [9-10]. We believe that our tendon model is superior to another model because of being bone plug in each three tip and modification of BPTB.

There have been many tools, including buckle transducers, load cells, strain gauges, and so on, designed to measure the forces within the ACL when a load is applied to the knee

[11]. Robotic/UFS testing system can be used to measure the in situ force vectors of the ACL and the ACL graft in response to applied loads to the knee. This system is capable of accurately recording and repeating translations and rotation of less than 0.2 mm and 0.2°, respectively [12].More recently, computer modeling and simulations have also been used to estimate the forces in the ACL during gait [13].We weren't able to get results of biomechanical and anatomic study, because we did not have any biomechanical and anatomic instruments at our institution. It is weakness of our study the lack of biomechanical and anatomic study on DB-DBPT-B Graft model. (After completion of the data, it can be used in open surgery or arthroscopic double-bundle ACL reconstruction. However our tendon model may be used in patients as an autograft because it is a modification of BPBT.

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