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TECHNICAL NOTE

Arthroscopic anterior cruciate ligament double-bundle reconstruction using hamstring tendon grafts-fixation with two interference screws: technical note

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Abstract In this article, an original double-bundle anterior cruciate ligament reconstruction technique is described. The procedure is developed using hamstring tendon grafts while maintaining tibial osseous insertion. Two tibial tunnels are drilled and a simplified and precise outside-in double tunnel femoral drilling technique is utilized. The graft fixation is made using only two interference screws.

Keywords Anterior cruciate ligament · Hamstring tendon autograft

Introduction

Arthroscopic reconstruction of the anterior cruciate ligament (ACL) is a routine procedure. Numerous studies have been carried out to analyze surgical techniques, different types of grafts, fixation modes, postoperative rehabilitation protocols, and above all, failure. Long-term failure rates still remain a problem, and a rate of residual pivot shift of approximately 15% has been reported in a literature review [1]. With better knowledge of ACL anatomy and function, many different ACL reconstruction techniques have been developed. Double-bundle ACL reconstruction is appealing because it is claimed to closely replicate the original ACL anatomy and function.

Since 1999, several surgeons have reported anatomic double-bundle ACL reconstruction [2, 3]. Some concerns exist in terms of the amount of hardware utilized to secure the graft. The aim of this technical note is to describe double-bundle ACL reconstruction using less amount of fixation material.

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Technique

An approximately 4 cm long longitudinal incision is made over the anteromedial portion of the proximal tibia. The semitendineous and gracilis tendons are dissected and their tibial osseous insertions maintained. First, using the arthroscopic technique, the anteromedial (AM) and posterolateral (PL) tibial tunnels are drilled.

The AM tunnel is drilled in the usual manner with the exiting point at the anteromedial aspect of the tibial footprint of the ACL. The PL tibial tunnel starts anteriorly to the tibial insertion site of the superficial medial collateral ligament and ends at the posterolateral aspect of the tibial footprint of the ACL. The guidewires of the tibial tunnel for the anteromedial and posterolateral bundles are subsequently overdrilled to 6 mm in diameter. The tibial tunnel for the posterolateral bundle is drilled 45° to the sagittal and horizontal planes, and the tibial tunnel for the anteromedial bundle has a more sagittal orientation−20° to the sagittal and 50° to the horizontal planes (Fig. 1). Then the femoral AM and PL tunnels are drilled utilizing the outside-in technique with the aid of an appropriate femoral

guide. A lateral 3–4 cm incision is made at the distal femur to position the guide. The AM tunnel is located 5 mm anterior to the posterior lateral femoral cortex in the 9 o'clock position in the right knee (3 o'clock position in the left knee). The PL femoral tunnel is located 6 mm distal and 30° posterior to the AM tunnel (Fig. 2).

The graft is introduced into the joint through the PL tibial tunnel and brought out on the lateral surface of the thigh through the PL femoral tunnel. The graft is subsequently tensioned and fixed with an interference screw (metallic or bioabsorbable) on the lateral aspect of the distal femur with the knee at 15° of flexion (Fig. 3). The remaining graft is reintroduced into the joint by the AM femoral tunnel. Finally, the graft is tensioned and fixed in the tibia, also with an interference screw, with the knee flexed at 50° (Fig. 4).

Discussion

Autologous hamstring soft tissue grafts are used in most double-bundle techniques [2, 4–6]. In most patients, these grafts are fixed at the femoral site with two buttons or interference screws, and at the tibial site with two posts, staples, screws or buttons [2, 4–7]. In comparison with other double-bundle ACL reconstructions, the main advantage of our technique is that less amount of fixation material is used. The PL bundle has two fixation points-one at the anatomic tibial insertion of the tendons and the other in the femoral tunnel using the interference screw. The AM

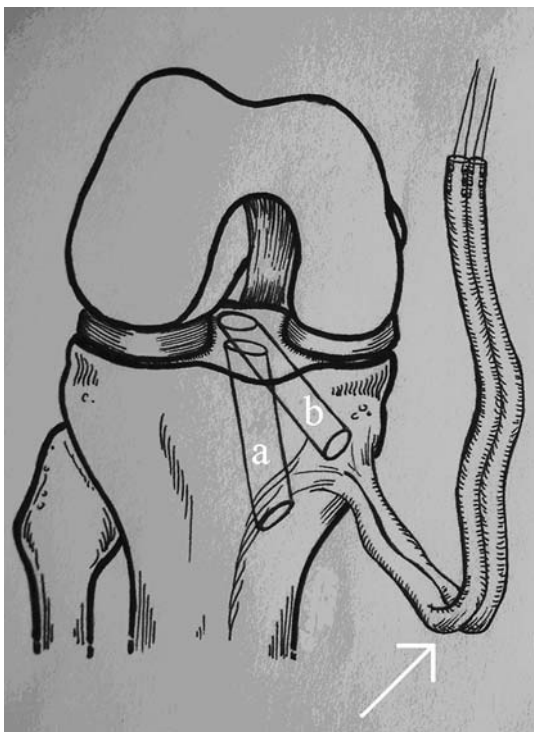

Fig. 1 Hamstrings tendons dissected maintaining their osseous tibial insertions (*white arrow*): *a* AM tibial tunnel, *b* PL tibial tunnel

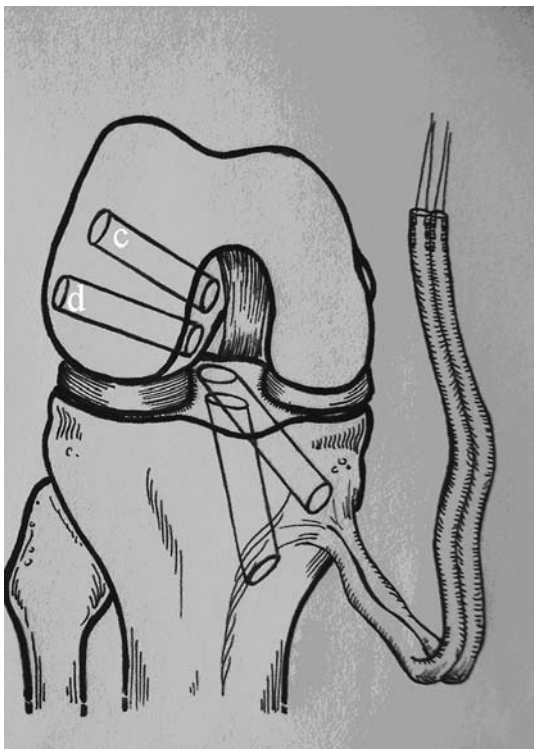

Fig. 2 Femoral tunnels: *c* anteromedial, *d* posterolateral

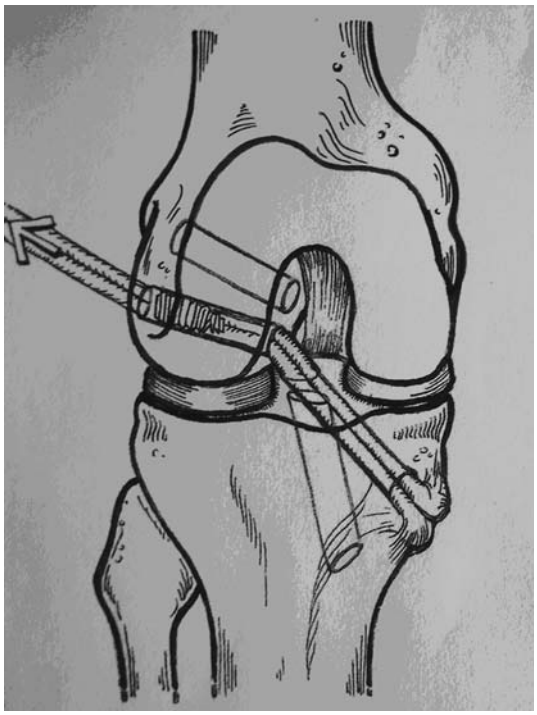

Fig. 3 "Outside-in" femoral fixation of the posterolateral bundle with the knee in 15° of extension

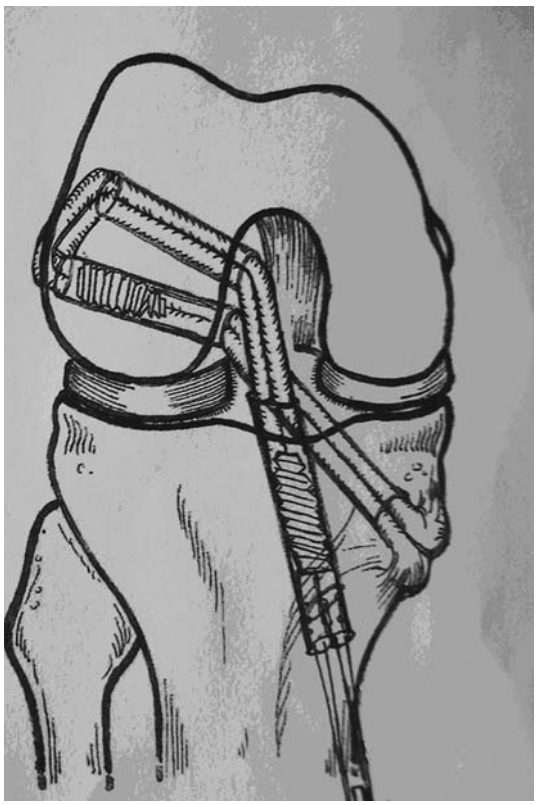

Fig. 4 Tibial fixation of the anteromedial bundle with the knee in 50° of flexion

bundle also has two fixation points-one at the PL femoral tunnel with the interference screw and the other using the interference screw in the AM tunnel. These fixations permit both bundles to work functionally, with the AM tensioned in flexion and the PL tensioned in extension reproducing the functional anatomy of the native ACL. This technique is simple in terms of the learning curve and costs, since only two interference screws are used.

In conclusion, we introduce a novel arthroscopic technique in which anatomic footprints of the AM and PL bundles are used and the fixation of each bundle is made with a low demanding and cost-effective method.

Conflict of interest statement The authors report no conflict of interest.

References

1. Nedeff DD, Bach BR Jr (2001) Arthroscopic anterior cruciate ligament reconstruction using patellar tendon autografts: a comprehensive review of contemporary literature. Am J Knee Surg 14:243–258
2. Muneta T, Sekiya I, Yagishita K, Ogiuchi T, Yamamoto H, Shinomiya K (1999) Two-bundle reconstruction of the anterior cruciate ligament using semitendinosus tendon with EndoButtons: operative technique and preliminary results. Arthroscopy 15:618–624
3. Yasuda K, Kondo E, Ichiyama H et al (2004) Anatomic reconstruction of the anteromedial and posterolateral bundles of the anterior cruciate ligament using hamstring tendon grafts. Arthroscopy 20:1015–1025
4. Hamada M, Shino K, Horibe S et al (2001) Single-versus bi-socket anterior cruciate ligament reconstruction using autogenous multiple-stranded hamstring tendons with EndoButton femoral fixation: a prospective study. Arthroscopy 17:801–807
5. Takeuchi R, Saito T, Mituhashi S, Suzuki E, Yamada I, Koshino T (2002) Double-bundle anatomic anterior cruciate ligament reconstruction using bone-hamstring-bone composite graft. Arthroscopy 18:550–555
6. Zaricznyj B (1987) Reconstruction of the anterior cruciate ligament of the knee using a doubled tendon graft. Clin Orthop 220:162–175
7. Crawford C, Nyland J, Landes S et al (2007) Anatomic double bundle ACL reconstruction: a literature review. Knee Surg Sports Traumatol Arthrosc 15:946–964