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Operative Techniques in
Orthopaedics

Remnant Tissue–Preserving Technique for Anatomical Double-Bundle Anterior Cruciate Ligament Reconstruction

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Preservation of the anterior cruciate ligament (ACL) remnant tissue has attracted notice in ACL reconstruction. Remnant preservation has been expected to have several potential advantages to improve postoperative knee stability such as enhanced graft coverage, accelerated cell repopulation, and revascularization. Recently, we have developed a new remnant-preserving technique for anatomical double-bundle ACL reconstruction using the semitendinosus tendon. The anterior laxity values and the results of the pivot-shift test were significantly better in the remnant tissue–preserving procedure than in the remnant tissue–resecting procedure. The arthroscopic evaluation showed that the remnant-preserving procedure was significantly better than the remnant-resecting procedure concerning postoperative laceration or tear of the grafts as well as synovial and fibrous tissue coverage of the grafts. However, to establish the clinical use of remnant tissue preservation, further randomized clinical studies are needed to objectively examine the effects on rotatory stability and the long-term survival of graft function.

KEYWORDS anterior cruciate ligament, knee ligaments, double-bundle reconstruction, remnant tissue

Introduction

Recently, preservation of the anterior cruciate ligament (ACL) remnant tissue has attracted notice in the field of single-bundle ACL reconstruction.[1-6] Remnant preservation has been expected to have several potential advantages to improve postoperative knee stability such as enhanced graft coverage with fibrous tissues, accelerated cell repopulation and revascularization, maintenance of the native broad tibial enthesis, and reduction of bone tunnel enlargement, although these points are arguable.[4,7,8] Recently, we reported that preservation of the ACL remnant tissue–enhanced cell proliferation, revascularization, and regeneration of proprioceptive organs in the reconstructed ACL and reduced anterior translation using sheep ACL reconstruction model.[9] However, the effect of remnant tissue preservation on postoperative knee stability has not yet been established in single-bundle ACL reconstruction, because the reported clinical results have been inconsistent.[4,10,11]

Several biomechanical studies have shown that double-bundle reconstruction produces better stability in the knee, especially during rotatory loads, compared with the commonly performed single-bundle reconstruction.[12-14] However, no previous studies have shown clinical evidence regarding the use of ACL remnant tissue preservation in double-bundle ACL reconstruction as of yet. To verify whether preservation of the ACL remnant tissue can actually improve proprioceptive function and enhance revascularization, we should conduct a comparative trial with a sufficient number of patients to compare the 2 ACL reconstruction procedures with and without the remnant preservation in proprioception and revascularization of the graft. Recently,

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we have developed a new remnant-preserving technique for anatomical double-bundle ACL reconstruction using the semitendinosus tendon (Fig. 1).[8] Then, we compared clinical results after anatomical double-bundle ACL reconstruction procedures that preserve the remnant tissue and those that resect the remnant tissue.[15] In this article, the surgical procedure and clinical results of anatomical double-bundle ACL reconstruction with ligament remnant tissue preservation are explained.

Surgical Procedure

The procedure was performed in the supine position with the femur horizontal and the tibia flexed at approximately 90°, in the "Hanging leg position." This procedure was performed in patients who had an ACL remnant tissue of type I, II, or III, as reported by Crain et al.[16] The surgical setup and the fundamental double-bundle reconstruction procedure were previously reported.[17,18] After harvesting the semitendinosus tendon, we inserted a guidewire for the tibial posterolateral (PL) tunnel using a wire navigator device (Smith & Nephew Endoscopy, Tokyo, Japan), which was developed for the transtibial tunnel technique.[17] This device is composed of a NaviTip and a wire sleeve (Smith & Nephew Endoscopy). A feature of this device is that an axis of the NaviTip and an axis of the wire sleeve always coincide with each other (Fig. 1). When we determine the location and direction of the NaviTip in an arthroscopic visual field, an extra-articular insertion point and direction of the guidewire are automatically determined. Thus, the guidewire can be inserted so that the

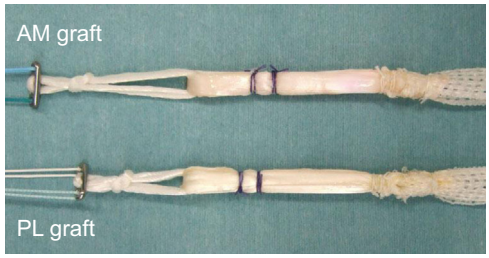

Figure 2 (A) The wire navigator is composed of a Navi-tip and a wire sleeve. The Navi-tip consists of sharp tibial and femoral indicators. (B) The axis of the wire sleeve passes through the tip of the tibial indicator. Keeping the tibial indicator at this point, the femoral indicator was aimed at a targeted point on the femur. (Color version of figure is available online.)

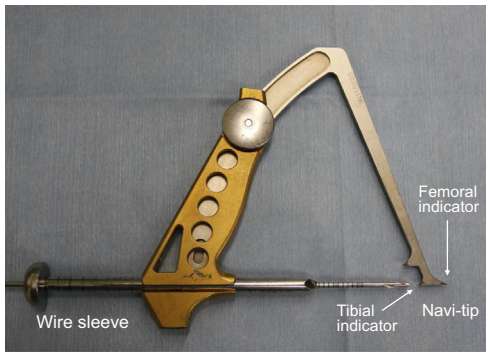

Figure 3 (A) The Navi-tip of wire navigator for the tibial posterolateral (PL) tunnels in arthroscopic surgery. (B) The Navi-tip of wire navigator for the tibial anteromedial (AM) tunnels in arthroscopic surgery. (Color version of figure is available online.)

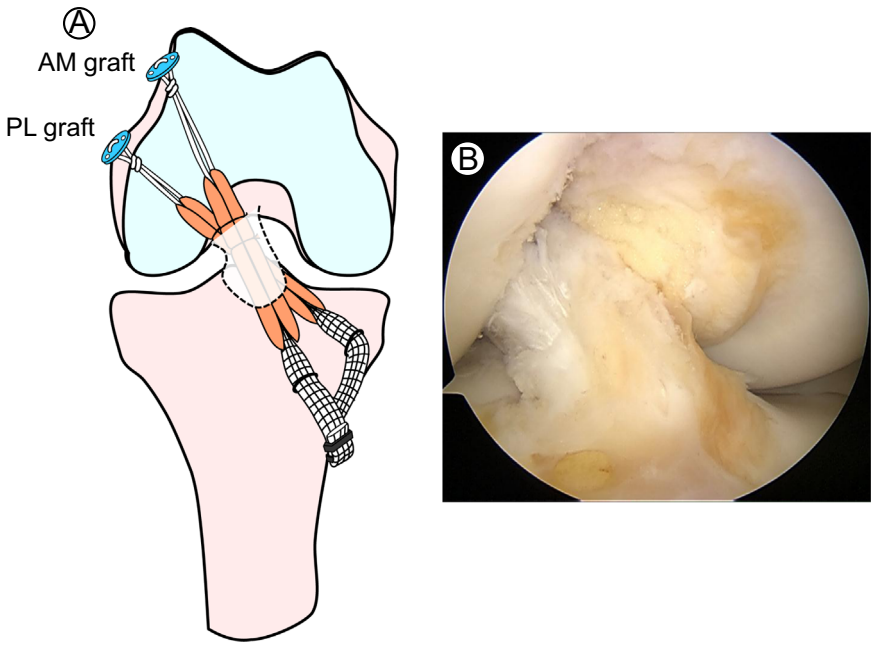

Figure 1 Anatomical double-bundle reconstruction with remnant tissue preservation. (A) A schematic picture of this procedure and (B) anatomical double-bundle ACL reconstruction procedure with hamstring tendon "hybrid" grafts. (Color version of figure is available online.)