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## Technical Notes

# Prediction of graft length by body height in anatomic double-bundle anterior cruciate ligament reconstruction

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## ABSTRACT

To investigate the intra-articular graft length and the length of the bone tunnels after anatomic double-bundle (DB) ACL reconstruction with semitendinosus (ST) tendon, and predict the required length of ST tendon, 178 patients who underwent anatomic DB ACL reconstruction with ST tendon were analyzed. The length of the intra-articular graft was measured by CT. A regression analysis was performed to determine the correlation between the intra-articular graft length and patient height. There was a statistically significant correlation between the intra-articular graft length and patient height. Therefore, the required length of ST tendon can be predicted from patient height.

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## Introduction

Anatomic double-bundle (DB) anterior cruciate ligament (ACL) reconstruction has a theoretical advantage and can result in effective restoration of rotational stability.<sup>1,2</sup> In anatomic DB ACL reconstruction, the semitendinosus and gracilis (STG) tendons are commonly used grafts.<sup>3–5</sup>

However, Tadokoro et al.<sup>6</sup> evaluated patients who underwent ACL reconstruction with hamstring graft, and the isometric peak torque was reduced to 49.1% when the isometric hamstring strength was examined in a prone position at 110 degrees of flexion. Gobbi et al.<sup>7</sup> compared the internal rotation peak torque between patients who underwent ACL reconstruction with semitendinosus (ST) tendon alone and patients who underwent ACL reconstruction with STG tendons at one year after surgery. They reported that the internal rotation torque deficit was significantly higher in the STG group, demonstrating that only ST tendon should be used when performing ACL reconstruction with hamstring tendon. In our institution, anatomic DB ACL reconstruction is usually performed using only ST tendon autograft. However, it is unknown when the ST tendon is too short to prepare the grafts of antero-medial bundle

(AMB) and postero-lateral bundle (PLB).

Because the femoral tunnel position in anatomic ACL reconstruction was more posterior in arthroscopic view than in isometric ACL reconstruction and the tibial tunnel position was more anterior in arthroscopic view, the length of intra-articular graft was getting longer and the graft in the tibial bone tunnel was relatively shorter.<sup>11</sup> As a result, the suture of the graft sometimes appeared in the intra-articular exit of the tibial tunnel in clinical situation (Fig. 1). However, there was no study to evaluate the required length of the graft for anatomic DB ACL reconstruction.

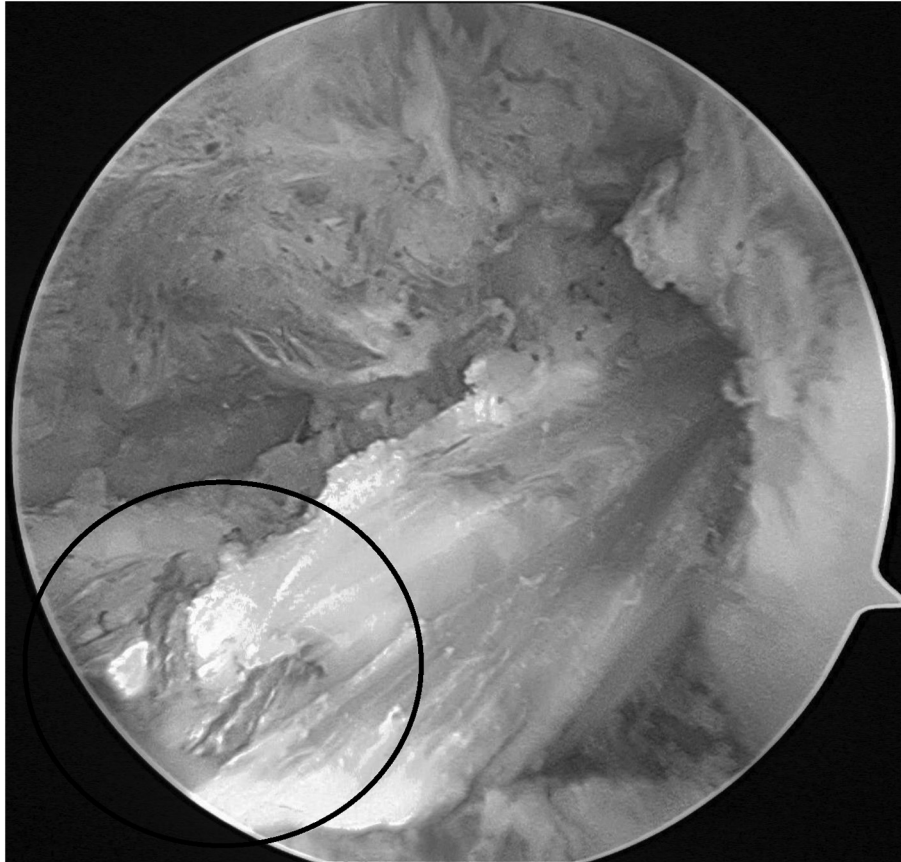
The purpose of this study was to investigate the intra-articular graft length and the length in the bone tunnels after anatomic DB ACL reconstruction with ST tendon, and predict the required length of ST tendon.

## Materials and methods

From May 2013 to December 2015, 266 consecutive patients underwent anatomic DB ACL reconstruction with hamstring tendon at the author's hospital. Preoperatively the authors recorded patient height. At one week after surgery, all knees were routinely scanned by computed tomography (CT) for another study.<sup>8</sup> The ethics review board of Meiwa Hospital approved this study [No. 29–12].

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**Fig. 1.** The suture of the graft appeared in the intra-articular exit of tibial tunnel (circle).

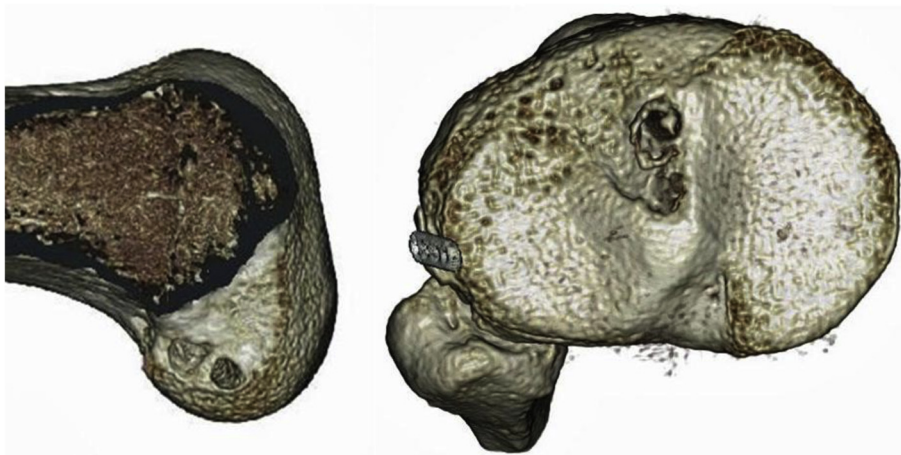
#### *Surgical procedure*

All surgeries were performed by the three senior authors (M.Y., A.M., K.S.) under general anesthesia. One half of ST tendon was doubled for AMB reconstruction, and the other half of ST tendon was also doubled for PLB reconstruction. Both ends were firmly sutured side-by-side (approximately 15 mm in length) using No. 2 Ultrabraid (Smith and Nephew, Andover, MA). The length of AMB and PLB grafts was then measured. The composite

tendon graft was fixed with an EndoButton CL (Smith and Nephew, Andover, MA) proximally and a post screw distally. An appropriately sized EndoButton CL was selected so that the graft length in the femoral tunnel was above 10 mm.

#### *Inclusion criteria*

- 1) Anatomic DB ACL reconstructions were performed with ST tendon alone.



**Fig. 2.** The femoral tunnels were located between the resident's ridge and the posterior articular cartilage margin of the lateral femoral condyle. The tibial tunnel of AMB was located just lateral to the medial intercondylar ridge and just posterior to the anterior ridge, and the tibial tunnel of PLB was located just lateral to the medial intercondylar ridge and between the tibial tunnel of AMB and the anterior intertubercular ridge.

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