

## Case Report

# Complications Following Hamstring Anterior Cruciate Ligament Reconstruction With Femoral Cross-Pin Fixation

Robert G. Marx, M.D., M.Sc., F.R.C.S.C., and Christopher R. Spock, B.A.

---

**Abstract:** Cross-pin fixation of hamstring grafts for anterior cruciate ligament reconstruction was developed with hopes of improving on potential problems associated with interference screw and button fixation methods. However, cross-pins are a relatively new method of graft fixation and there are limited data on this technique. We report 2 cases in which reoperation was necessary after complications associated with cross-pin fixation. In one case, the cross-pin was left too proud and in the other it penetrated the medial side of the femur and was prominent. Surgeons who use cross-pin fixation should pay close attention so as not to leave the cross-pin proud laterally or medially to avoid the necessity of reoperation for hardware removal. **Key Words:** ACL reconstruction—Cross-pin—Hamstring—Femoral.

---

**C**urrent techniques in anterior cruciate ligament (ACL) reconstruction include a variety of autograft and allograft tissues to replace the native ligament.<sup>1-11</sup> Reconstruction of the ACL with a hamstring (semitendinosus and gracilis) tendon autograft is a standard method of reconstruction.<sup>1,2,5-10,12-15</sup> Hamstring grafts, when compared with bone–patellar tendon–bone autografts, offer potential advantages including decreased extensor mechanism morbidity and favorable biomechanical properties. The strength of the quadrupled semitendinosus and gracilis construct has been shown to be equal to or greater than the strength of a bone–patellar tendon–bone graft of similar dimension at time zero<sup>16</sup> and with cyclical loading.<sup>17</sup>

Graft fixation has been considered the weak link

following ACL reconstruction with hamstring tendons. The demands for accelerated rehabilitation after ACL reconstruction require optimal fixation properties.<sup>18,19</sup> The current options for fixation of soft tissue to bone include the use of an interference screw, a button, and cross-pin fixation. Interference screw fixation for quadrupled hamstring grafts has failure strengths that may not be adequate for daily activities and a progressive rehabilitation program.<sup>20</sup> One problem that can potentially develop from button fixation at a distance from the joint line is the so-called “bungee effect.”<sup>21,22</sup>

Cross-pin fixation techniques were introduced with hopes of improving on the potential problems associated with interference screw and button fixation methods. Within the femoral tunnel, the pins either penetrate the 4-strand graft or the 2 strands of the hamstring and wrap 180° around the pin to create a quadrupled graft.<sup>20</sup> However, cross-pins are a relatively new method of fixation and there are limited data on this technique.

As with all new technology, there is the potential for a learning curve and early complications. We present 2 cases of complications in which different bioabsorbable cross-pins were used by the initial surgeon who performed the ACL reconstruction. In one case the cross-pin was left too proud and in the other

---

*From the Sports Medicine and Shoulder Service (R.G.M.) and the Foster Center for Clinical Outcome Research (R.G.M., C.R.S.), The Hospital for Special Surgery, New York, New York, U.S.A.*

*Address correspondence and reprint requests to Robert G. Marx, M.D., M.Sc., F.R.C.S.C., Sports Medicine and Shoulder Service, The Hospital for Special Surgery, 535 East 70th St, New York, NY 10021, U.S.A. E-mail: marxr@hss.edu*

© 2005 by the Arthroscopy Association of North America

*Cite this article as: Marx RG, Spock CR. Complications following hamstring anterior cruciate ligament reconstruction with femoral cross-pin fixation. Arthroscopy 2005;21:762.e1-762.e3 [doi:10.1016/j.arthro.2005.04.006].*

0749-8063/05/2106-4480\$30.00/0

doi:10.1016/j.arthro.2005.04.006



**FIGURE 1.** Coronal magnetic resonance imaging view of the knee showing the cross-pin that is proud laterally (arrow).

it penetrated the medial side of the femur and was prominent.

### CASE 1

A 25-year-old male actor underwent left ACL reconstruction with semitendinosus and gracilis autograft tendons. Four months later, he presented for evaluation by the senior author (R.G.M.) with discomfort at the lateral femur when walking. He was found to have a prominent cross-pin at the lateral distal femur (Figs 1 and 2). He had full range of motion, no effusion, and negative Lachman and pivot-shift tests.

The patient was taken to the operating room and the site of the lateral cross-pin was exposed. The cross-pin was 4 mm prominent and it was impacted using a punch. Postoperatively, the patient had no difficulty and his lateral pain resolved. The subsequent postoperative course was uneventful and the pain was eliminated by 6 months after surgery with return to all activities.

### CASE 2

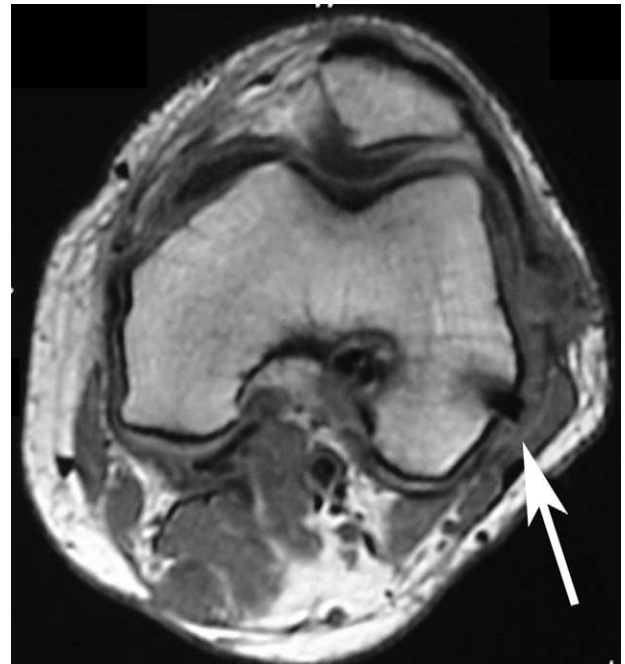
A 21-year-old female university student had undergone ACL reconstruction with patellar tendon autograft 4 years previously. She developed laxity and knee instability 2 years after her initial surgery and underwent revision with ipsilateral semitendinosus and gracilis autograft with cross-pin fixation. She pre-

sented to the senior author 5 months postoperatively complaining of pain on the medial side of her knee. On physical examination, she had full range of motion with a stable knee. There was a prominence over the distal femur just proximal to the superomedial aspect of the patella. The prominence was painful to palpation and corresponded to the medial tip of the cross-pin on magnetic resonance imaging (Fig 3). The cross-pin was seen to be intra-articular and arthroscopy was recommended to remove the tip of the pin.

The patient was taken to the operating room and the tip of the pin was visualized at arthroscopy. It measured approximately 7 mm in length and was removed using a shaver. The postoperative course was uneventful, the pain was gone by the 6-month follow-up, and she was able to return to all sporting activities.

### DISCUSSION

Femoral cross-pins can provide rigid fixation for ACL reconstruction with soft-tissue grafts. However, as with all new technologies, there are potential pitfalls. This report outlines 2 cases of complications using cross-pin fixation with 2 different implants. Both required reoperation, one where the cross-pin was left proud and the other where it penetrated the medial cortex of the femur. In both cases, the promi-



**FIGURE 2.** Axial magnetic resonance imaging view of the distal femur showing the femoral cross-pin left proud laterally (arrow), requiring reoperation for lateral knee pain.



**FIGURE 3.** Axial magnetic resonance imaging view of the distal femur showing the intra-articular cross-pin medially (arrow), requiring arthroscopy for debridement of the tip of the pin due to pain.

ment cross-pin led to symptoms requiring surgery and in both cases the symptoms resolved once the problem was corrected. Surgeons who use cross-pin fixation should pay close attention so as not to leave the cross-pin proud laterally or medially to avoid the necessity of reoperation for hardware removal.

## REFERENCES

1. Aglietti P, Buzzi R, Menchetti PM, Giron F. Arthroscopically assisted semitendinosus and gracilis tendon graft in reconstruction for acute anterior cruciate ligament injuries in athletes. *Am J Sports Med* 1996;24:726-731.
2. Aglietti P, Buzzi R, Zaccherotti G, De Biase P. Patellar tendon versus doubled semitendinosus and gracilis tendons for anterior cruciate ligament reconstruction. *Am J Sports Med* 1994;22:211-218.
3. Buss DD, Warren RF, Wickiewicz TL, Galinat BJ, Panariello R. Arthroscopically assisted reconstruction of the anterior cruciate ligament with use of autogenous patellar-ligament grafts. Results after twenty-four to forty-two months. *J Bone Joint Surg Am* 1993;75:1346-1355.
4. Hoffmann F, Friebl H, Schiller M. [The semitendinosus tendon as replacement for the anterior cruciate ligament]. *Zentralbl Chir* 1998;123:994-1001.
5. Maeda A, Shino K, Horibe S, Nakata K, Buccafusca G. Anterior cruciate ligament reconstruction with multistranded autogenous semitendinosus tendon. *Am J Sports Med* 1996;24:504-509.
6. Marder RA, Raskind JR, Carroll M. Prospective evaluation of arthroscopically assisted anterior cruciate ligament reconstruction. Patellar tendon versus semitendinosus and gracilis tendons. *Am J Sports Med* 1991;19:478-484.
7. Muneta T, Sekiya I, Ogiuchi T, Yagishita K, Yamamoto H, Shinomiya K. Effects of aggressive early rehabilitation on the outcome of anterior cruciate ligament reconstruction with multi-strand semitendinosus tendon. *Int Orthop* 1998;22:352-356.
8. Muneta T, Sekiya I, Yagishita K, Ogiuchi T, Yamamoto H, Shinomiya K. Two-bundle reconstruction of the anterior cruciate ligament using semitendinosus tendon with EndoButtons: Operative technique and preliminary results. *Arthroscopy* 1999;15:618-624.
9. Nebelung W, Becker R, Merkel M, Ropke M. Bone tunnel enlargement after anterior cruciate ligament reconstruction with semitendinosus tendon using EndoButton fixation on the femoral side. *Arthroscopy* 1998;14:810-815.
10. Noojin FK, Barrett GR, Hartzog CW, Nash CR. Clinical comparison of intraarticular anterior cruciate ligament reconstruction using autogenous semitendinosus and gracilis tendons in men versus women. *Am J Sports Med* 2000;28:783-789.
11. Otero AL, Hutcheson L. A comparison of the doubled semitendinosus/gracilis and central third of the patellar tendon autografts in arthroscopic anterior cruciate ligament reconstruction. *Arthroscopy* 1993;9:143-148.
12. Goradia VK, Grana WA. A comparison of outcomes at 2 to 6 years after acute and chronic anterior cruciate ligament reconstructions using hamstring tendon grafts. *Arthroscopy* 2001;17:383-392.
13. Siegel MG, Barber-Westin SD. Arthroscopic-assisted outpatient anterior cruciate ligament reconstruction using the semitendinosus and gracilis tendons. *Arthroscopy* 1998;14:268-277.
14. Spicer DD, Blagg SE, Unwin AJ, Allum RL. Anterior knee symptoms after four-strand hamstring tendon anterior cruciate ligament reconstruction. *Knee Surg Sports Traumatol Arthrosc* 2000;8:286-289.
15. Zysk SP, Kruger A, Baur A, Veihelmann A, Refior HJ. Tripled semitendinosus anterior cruciate ligament reconstruction with EndoButton fixation: A 2-3-year follow-up study of 35 patients. *Acta Orthop Scand* 2000;71:381-386.
16. Hamner DL, Brown CH Jr, Steiner ME, Hecker AT, Hayes WC. Hamstring tendon grafts for reconstruction of the anterior cruciate ligament: Biomechanical evaluation of the use of multiple strands and tensioning techniques. *J Bone Joint Surg Am* 1999;81:549-557.
17. Simonian PT, Williams RJ, Deng XH, Wickiewicz TL, Warren RF. Hamstring and patellar tendon graft response to cyclical loading. *Am J Knee Surg* 1998;11:101-105.
18. Howell SM, Taylor MA. Brace-free rehabilitation, with early return to activity, for knees reconstructed with a double-looped semitendinosus and gracilis graft. *J Bone Joint Surg Am* 1996;78:814-825.
19. Shelbourne KD, Nitz P. Accelerated rehabilitation after anterior cruciate ligament reconstruction. *Am J Sports Med* 1990;18:292-299.
20. Ahmad CS, Gardner TR, Groh M, Arnouk J, Levine WN. Mechanical properties of soft tissue femoral fixation devices for anterior cruciate ligament reconstruction. *Am J Sports Med* 2004;32:635-640.
21. Hoher J, Livesay GA, Ma CB, Withrow JD, Fu FH, Woo SL. Hamstring graft motion in the femoral bone tunnel when using titanium button/polyester tape fixation. *Knee Surg Sports Traumatol Arthrosc* 1999;7:215-219.
22. Uchio Y, Ochi M, Sumen Y, et al. Mechanical properties of newly developed loop ligament for connection between the EndoButton and hamstring tendons: Comparison with Ethibond sutures and EndoButton tape. *J Biomed Mater Res* 2002;63:173-181.