

Why should we sacrifice the gracilis in ACL hamstring reconstruction?

Alberto Gobbi, Konrad Malinowski, Matteo Vitali and Milco Zanazzo

From: Orthopaedic Arthroscopic Surgery International
Via Amadeo 24, 20133 Milano Italy
Tel. +39 02 7610310
Fax +39 02 70124931
Info@oasiortopedia.it
sportmd@tin.it



INTRODUCTION

The use of hamstring tendons for ACL reconstruction has become more accepted in the recent years. Many authors have shown good results using semitendinosus and gracilis grafts (1, 2, 3) while others have had similar results using the quadrupled semitendinosus alone (4, 5, 6). Some, however, have been concerned about the possibility of muscular weakness and its effects on strength and stability after sacrifice of hamstrings (7, 8, 9, 13,14,15,18).

In our study, we sought to determine if there was a difference in the clinical results of ACL reconstruction when using the semitendinosus tendon (ST) alone versus the semitendinosus and gracilis (STG) construct.

MATERIALS AND METHODS:

From January 1996 to December 2001, 230 consecutive patients underwent ACL reconstruction using hamstring autografts. In our prospective randomized study we followed a group of 97 patients operated with either an ST graft (50) or STG graft (47). No statistically significant differences were found for the age, time of surgery, gender, leg involved, or meniscal treatment among two grafts groups ($p>0.05$).

The patients were evaluated according to standard knee scales (IKDC, Noyes, Lysholm, Tegner), self evaluation score - SANE(10), clinical findings, computerized knee laxity analysis and functional tests. Isokinetic flexion, extension and internal rotation-external rotation testing were also performed. Subjects were evaluated preoperatively and 3, 5,12 months after surgery by the surgeon and physical therapist. Independent examiners conducted the final evaluation at a mean follow-up of 36 months. Patients were asked about their satisfaction with the treatment, and if they were able to return to the same pre-injury activity level and sport.

RESULTS:

We compared data for the ST and STG groups and did not find any significant difference between the two groups with standard knee scores, self evaluation scores, clinical findings, computerized knee laxity analysis, flexion - extension and external rotation strengths, as well as functional tests. We noted, however, that the internal rotation torque deficit was significantly higher in the STG group ($p=0.039$). Likewise, the external to internal rotation ratio was significantly greater ($p=0.006$) in the STG group.

DISCUSSION:

The use of a doubled STG graft versus a quadrupled ST graft is still a matter of contention. Recent studies have explained some disadvantageous effects after harvesting hamstring tendons. Tashiro et al (13) in a prospective, randomized study reported a significant decrease of hamstring strengths in both groups when studied at 70° or more flexed position; furthermore, the double tendon group had considerably less strength than the single tendon harvest group at 18 months. The difference was seen especially at high flexion angles. Ohkoshi et al(9) reported no difference in peak flexion torque or total work after semitendinosus harvest from uninjured knee, but the presence of the different shape of isokinetic curve at deep flexion after harvesting.

In another study, Nakamura et al (7) reported a significantly lower mean maximum standing knee flexion angle in the STG group compared to the ST group. Adachi et al(18) compared ST and STG group with allogenic fascia lata graft and reported that peak torque value and total work in each group, compared to normal knees, was not statistically different; however, the more hamstring tendons were harvested, the more loss of active knee flexion was observed.

Other authors (8,14,15) noted persistent weakness in internal rotation after harvest of the semitendinosus and gracilis tendons, and suggested that hamstring sacrifice would compromise dynamic stability, especially under rotational loads.

Cross(16), Eriksson (17), Leis(19) revealed a potential for the hamstring tendons to regenerate and for the semitendinosus muscle to recover, although the degree of recovery in the case of internal rotation strength is, at minimal, one year as confirmed in this study(16, 17).

In a recent study, Hioki et al(20) reported that the redevelopment of hamstring tendons after graft harvest was not equal, and they distinguished three different patterns: similar shape to intact knee, smaller proximally with distal tendon-like structure, and considerably smaller proximally without tendon-like structures. The greatest knee strength was in the first, and the lowest in third group.

CONCLUSION:

The use of ST or STG for ACL reconstruction offers good clinical results and we did not find important differences with the final outcome, but isokinetic tests revealed internal rotation weakness in the ST group. There are still plenty of questions without answer, but many studies recommended sacrifice one hamstring tendon only.

In our opinion, the surgeon should always consider reconstruction using only semitendinosus tendon, especially in specific, demanding deep flexion and maximal rotational strength sports activities such as hurdles, long-, high- and triple jumps, skiing or soccer.

Maybe this strength weakness, revealed after hamstring ACL reconstruction, is one of the reasons of failure in returning athletes to sport.

REFERENCES:

1. Marcacci M, Zaffagnini S, Iacono F, et al: Intra- and extra-articular anterior cruciate ligament reconstruction utilizing autogenous semitendinosus and gracilis tendons: 5-year clinical results. *Knee Surg Sports Traumatol Arthrosc* 11:2-8, 2003
2. Howell SM, Deutsch ML: Comparison of endoscopic and two-incision techniques for reconstruction a torn anterior cruciate ligament using hamstring tendons. *Arthroscopy* 15:594-606, 1999
3. Howell SM: Gold standard-DLSTG graft. Presented at AAOSM Specialty Day New Orleans, Louisiana 2003
4. Gobbi A, Tuy B, Panuncialman et al: Quadrupled bone-semitendinosus ACL reconstruction : a clinical investigation in a group of athletes. *Arthroscopy* 19:691-699, 2003
5. Cooley V, Deffner K, Rosenberg T: Quadrupled semitendinosus anterior cruciate ligament reconstruction: 5-year results in patients without meniscus loss, *Arthroscopy* 17:795-800, 2001
6. Goradia V, Grana W:A comparison of outcomes at 2 to 6 years after acute and chronic anterior cruciate ligament reconstructions using hamstring tendon grafts, *Arthroscopy* 17:383-392, 2001
7. Nakamura N, Horibe S, Sasaki S, et al: Evaluation of active knee flexion and hamstring strength after anterior cruciate ligament reconstrction using hamstring tendons. *Arthroscopy* 18: 598-602, 2002
8. Segawa H, Omori G, Koga Y, et al: Rotational muscle strength of the limb in anterior cruciate ligament reconstruction using semitendinosus and gracilis tendon. *Arthroscopy* 18: 177-182, 2002

9. Ohkoshi Y, Chiharu I, Yamune S, et al: Changes in muscle strength properties caused by harvesting of autogenous semitendinosus tendon for reconstruction of contralateral anterior cruciate ligament, *Arthroscopy* 14:580-584, 1998
10. Williams G, Gangel T, Arciero R, et al: Comparison of the single Assessment Numeric Evaluation method and two shoulder rating scales. Outcomes measures after shoulder surgery. *Am J Sports Med*, 27:214-221, 1999
11. Daniel DM, Stone ML, Riehl B et al. A measurement of lower limb function: the one-leg hop for distance. *Am J Knee Surg*; 1: 212- 214, 1988
12. Daniel D, Malcolm L, Stone ML, et al. Quantification of knee stability and function. *Contemp Orthop* 5: 83-92, 1982
13. Tashiro T, Kurosawa H, Kawakami A, et al: Influence of medial hamstring harvest on knee flexor strength in the patient with anterior cruciate liament reconstruction: a detailed evaluation in deep knee flexion with comparison of single and double tendon harvest. *Am J Sports Med*, 31:522-529, 2003
14. Armour T, Litchfield R, Amendola A, et al.: Doubled semitendinosus and gracilis tendon grafts compared to doubled semitendinosus grafts alone in ACL reconstruction: a prospective randomized clinical trial. Isakos presentation outlines paper 48,4.25,2001
15. Viola R, Sterett W, Newfield D et al: Internal and external tibial rotation strength after anterior cruciate ligament reconstruction using ipsilateral semitendinosus and gracilis tendon autografts. *Am J Sports Med*, 28:552-555, 2000
16. Cross M, Roger G, Kujawa P: Regeneration of the semitendinosus and gracilis tendons following their transection for repair of the anterior cruciate ligament. *Am J Sports Med* 20:221-223, 1991
17. Eriksson K, Hamberg P, Jansson E et al: Semitendinosus muscle in anterior cruciate ligament surgery: morphology and function. *Arthroscopy* 17:808-817, 2001.
18. Adachi N, Ochi M, Uchio Y, et al: Harvesting hamstring tendons for ACL reconstruction influences postoperative hamstrig muscle performance. *Arch. Ortop. Trauma Surg.* 123(9): 460-5 Nov 2003
19. Leis HAT, Sanders TG, Larsen KM, et al: Hamstring regrowth following harvesting for ACL reconstruction: The lizard tail phenomenon. *J Knee Surg.* 2003 Jul;16(3):159-64
20. Hioki S, Fukubayashi T, Ikeda K et al: Effect of harvesting the hamstrings tendon for anterior cruciate ligament reconstruction on the morphology and movement of the hamstring muscle: anovel MRI technique. *Knee Surg Sports Traumatol Arthrosc* (2003) 11 : 223-227