The Knee 22 (2015) 304–308

Contents lists available at ScienceDirect

The Knee

Does adjustable-loop femoral cortical suspension loosen after anterior cruciate ligament reconstruction? A retrospective comparative study

Matthew J. Boyle [a,*], Tyler J. Vovos [a], Cameron G. Walker [b], Kathryne J. Stabile [a], Jonathan M. Roth [a], William E. Garrett Jr. [a]

[a] Duke Sports Medicine, Department of Orthopaedic Surgery, Duke University Medical Center, 280 Frank Bassett Drive, Durham, NC 27710, USA
[b] Department of Engineering Science, The University of Auckland, 70 Symonds Street, Auckland, New Zealand

ARTICLE INFO

Article history:
Received 7 January 2015
Received in revised form 9 April 2015
Accepted 28 April 2015

Keywords:
ACL reconstruction
Anterior cruciate ligament
Knee stability
Graft failure

ABSTRACT

Background: Recent biomechanical research has suggested that adjustable-loop graft suspension constructs in anterior cruciate ligament (ACL) reconstruction may loosen after deployment. Our objective was to compare short-term knee stability and graft failure rate between adjustable-loop and fixed-loop femoral cortical suspension in patients undergoing primary ACL reconstruction.
Methods: A consecutive series of 188 patients who underwent primary ACL reconstruction using hamstrings autograft by a single surgeon were divided into two groups; 73 received adjustable-loop (TightRope RT (Arthrex Inc., Naples, FL)) and 115 received fixed-loop (RetroButton (Arthrex Inc., Naples, FL)) femoral cortical suspension. The two groups were compared at six months, one year, and two years postoperatively using KT-1000 arthrometer testing and graft failure rate (revision surgery, grade 2+ Lachman test, any pivot shift, >5 mm side-to-side KT-1000 difference).
Results: There was no significant difference between the two groups in maximum side-to-side difference in KT-1000 testing at six months (mean 1.51 mm (adjustable-loop group) vs. 1.79 mm (fixed-loop group), $p = 0.23$), one year (mean 1.44 mm vs. 1.64 mm, $p = 0.48$), or two years (mean 1.14 mm vs. 1.07 mm, $p = 0.90$) postoperatively. There was no significant difference between the two groups in rate of graft failure (10% vs. 11%, $p = 0.71$) or timing of graft failure in affected patients (mean 11.4 months vs. 13.8 months, $p = 0.51$).
Conclusions: We found no significant difference in postoperative knee stability or graft failure rate between adjustable-loop and fixed-loop femoral cortical suspension in patients undergoing primary ACL reconstruction. Our results suggest that adjustable-loop suspension does not clinically loosen after ACL reconstruction.
Level of Evidence: III (retrospective cohort study)

1. Introduction

The optimal femoral soft tissue graft fixation technique in anterior cruciate ligament (ACL) reconstruction remains controversial, with the most common techniques including interference screw fixation, cross pins, and cortical suspension [1,5,6,15]. Although positive clinical outcomes have been reported for all three techniques, interference fixation has been associated with graft slippage and lower ultimate failure loads [22,23] and cross pins have been associated with several complications [14,18].

Adjustable-loop femoral cortical suspension devices such as the TightRope RT (Arthrex Inc., Naples, Florida) and ToggleLoc with ZipLoop (Biomet Inc., Warsaw, Indiana), and fixed-loop femoral cortical suspension devices such as the RetroButton (Arthrex Inc., Naples, Florida) and EndoButton (Smith & Nephew Inc., Andover, Massachusetts), have demonstrated satisfactory biomechanical properties and high loads to failure and are widely used in ACL reconstruction [11,15,19]. Adjustable-loop devices, which allow for tightening of the suspension loop after insertion, provide the additional benefits of eliminating the need for multiple loop sizes, providing greater ease of insertion, and maximizing the amount of graft within the femoral tunnel available for incorporation, which is particularly important with the relatively short femoral tunnels frequently produced with anatomic ACL reconstruction. Several laboratory studies have compared the biomechanical properties of adjustable-loop and fixed-loop femoral cortical suspension devices [4,7,9], with recent concern that adjustable-loop devices may loosen during the early post-operative period [4]. Despite these laboratory findings, there have been no clinical studies comparing knee stability between adjustable-loop and fixed-loop devices. It therefore remains unclear whether adjustable-loop fixation truly loosens in patients undergoing ACL reconstruction, resulting in clinical knee instability or graft failure.

The objective of this retrospective comparative study was to compare short-term knee stability and graft failure rate after primary ACL reconstruction using hamstrings autograft with either adjustable-loop

* Corresponding author. Tel.: +1 919 402 6044; fax: +1 919 681 6357.
E-mail address: drmattboyle@hotmail.com (M.J. Boyle).

http://dx.doi.org/10.1016/j.knee.2015.04.016
0968-0160/

or fixed-loop femoral cortical suspension. We hypothesized that knee stability and graft failure rate would be identical between these two femoral fixation techniques.

2. Material and methods

After institutional review board approval was obtained from the Duke University Health System Institutional Review Board (Study ID: Pro00052597), a consecutive cohort of 435 patients who underwent ACL reconstruction by a single surgeon at a single institution between November 2006 to February 2013 was identified through a retrospective review of a prospectively collected patient database. A total of 188 of these patients (114 males, 74 females) with a mean age of 25.9 years (12.6 to 54.6 years) met inclusion and exclusion criteria and were included in the study. The inclusion criteria were primary ACL reconstruction using quadruple-looped hamstring tendon autograft (semitendinosus and gracilis), femoral cortical suspension fixation using either a TightRope RT (Arthrex Inc., Naples, Florida) or RetroButton (Arthrex Inc., Naples, Florida) device, and at least six months follow-up at our institution. The TightRope RT (Fig. 1) is an adjustable-loop femoral cortical suspension device that allows for loop tightening after cortical button deployment, while the RetroButton (Fig. 2) is a fixed-loop femoral cortical suspension device; both implants consist of a flat titanium button and an ultra-high molecular weight polyethylene loop. The exclusion criteria were ACL reconstruction using any allograft tissue, ACL reconstruction using patellar tendon autograft, a history of previous ACL reconstruction on the ipsilateral or contralateral knee (due to potential influence on side-to-side difference in KT-1000 testing), surgical management of associated ligamentous injury (medial collateral ligament, lateral collateral ligament, posterior cruciate ligament, posterolateral corner), and less than six months of follow-up.

Patients included in the study were divided into two groups according to femoral fixation (Table 1); 73 patients who received adjustable-loop cortical suspension using TightRope RT fixation, and 115 patients who received fixed-loop cortical suspension using RetroButton fixation. The two patient groups were comparable at baseline, although there was a small but statistically significant difference in graft size between the two groups (Table 1). Of the 188 patients identified who achieved a minimum of six-months follow-up, 110 patients (58.5%) also achieved one-year follow-up and 21 patients (11.2%) achieved two-years follow-up; there was no significant difference in duration of follow-up between the two patient groups (Table 1).

Fig. 1. TightRope RT (Arthrex Inc., Naples, Florida) device demonstrating adjustable loop (white) and lead suture (blue). This image provided compliments of Arthrex Inc.

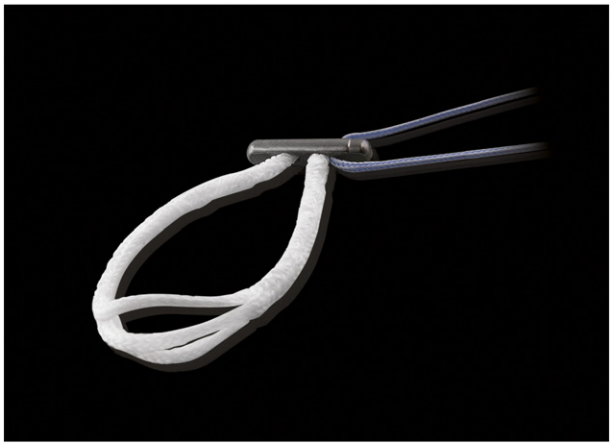

Fig. 2. RetroButton (Arthrex Inc., Naples, Florida) device demonstrating fixed loop (white) and lead suture (blue). This image provided compliments of Arthrex Inc.

2.1. Operative technique

All ACL reconstructions were performed arthroscopically by a single senior surgeon who was experienced with both femoral fixation techniques. An outside-in technique was used to create both the femoral and tibial tunnels, using a Flipcutter (Arthrex Inc., Naples, Florida) device as described by Lubowitz et al. [16], and a commercially available tibial guide, respectively. Care was taken to ensure that the femoral and tibial tunnels were created within the center of the native femoral and tibial ACL footprints, respectively, in every patient. An ipsilateral semitendinosus and gracilis autograft was used in every case. Either an adjustable-loop or fixed-loop cortical suspension device was used for femoral fixation, with device application according to the manufacturer's guidelines [2,3]. Satisfactory deployment of the suspension device against the lateral femoral cortex was confirmed by direct vision and/or palpation. In all cases the graft was then manually tensioned and tibial fixation was applied, which was a single pointed staple and interference screw in every patient.

Table 1
Baseline information and operative characteristics for the two study groups.

	Adjustable-loop group	Fixed-loop group	P-value
Number of patients	73	115	
Patient age (years)[a]	25.8 ± 11.7	26.1 ± 11.0	0.86
Gender female[b]	0.32 ± 0.05	0.44 ± 0.05	0.08
BMI[c]	24.5 ± 3.8	26.0 ± 4.4	0.40
Mechanism of injury[d]			0.15
– Soccer	18 (24.7)	35 (30.4)	
– Football	15 (20.5)	10 (8.7)	
– Basketball	14 (19.2)	22 (19.1)	
– Skiing	4 (5.5)	6 (5.2)	
– Other	22 (30.1)	42 (36.5)	
Medial meniscectomy[b]	0.30 ± 0.05	0.23 ± 0.04	0.31
Lateral meniscectomy[b]	0.25 ± 0.05	0.31 ± 0.04	0.33
Medial meniscal repair[b]	0.07 ± 0.03	0.14 ± 0.03	0.14
Lateral meniscal repair[b]	0.26 ± 0.05	0.39 ± 0.05	0.10
Autograft diameter (mm)[a]	8.25 ± 0.49	7.92 ± 0.73	<0.001
Months of follow-up[a]	10.7 ± 5.3	11.8 ± 4.7	0.15

[a] Mean ± standard deviation.
[b] Proportion of group ± standard deviation.
[c] BMI, Body Mass Index (kg/m^2).
[d] Number of patients (percent of group).