



Knee stability after arthroscopic anterior cruciate ligament reconstruction using the middle third of the patellar ligament and quadrupled hamstring tendons grafts – A two-year follow-up



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ABSTRACT

Knee stability after surgical anterior cruciate ligament (ACL) reconstruction using quadrupled hamstring tendons graft (gracilis and semitendinosus) was compared with that using the middle third of the patellar ligament. All subjects participating in this study had ACL rupture diagnosed by clinical examination and MRI and underwent identical surgical procedure apart from the choice of graft. A total of 112 patients with either patellar ligament or quadrupled hamstring tendons graft were evaluated for 24 months following surgery. Patients were similar in terms of age, sex, activity level, knee instability level and rehabilitation programme. Clinical tests and a measuring instrument, the KT-1000 arthrometer, were used to evaluate knee stability after reconstruction. During the 24-month study there were no significant differences in clinical stability of the knee and the use of both grafts resulted in satisfactory knee stability. The difference between the groups according to the graft was noticed 6 months after reconstruction when the results obtained by a measuring instrument showed that knee stability was significantly higher with the patellar ligament graft (Fisher's exact test, $p = 0.022$).

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Introduction

Knee injury with ACL rupture is well known to lead to functional instability, which interferes with performing everyday or sports activities [1–3], increases the risk of a meniscal injury [1,4,5] and leads to early degenerative changes in the knee [6–9]. As conservative treatment generally fails to restore knee stability, surgical reconstruction is necessary. As ruptured ligaments cannot be primarily reconstructed, various grafts are used in such procedures. The use of arthroscopic technique has significantly improved the procedure.

ACL reconstruction is currently most often performed with patellar graft (using the middle third of the patellar ligament with

bony insertions) and hamstring tendons graft (gracilis and semitendinosus) [10].

The use of patellar ligament graft increases the risk of patella fracture, patellofemoral pain and rupture of the patellar ligament [11,12], whereas the use of hamstring tendons graft weakens the knee flexors and presents a problem in terms of adequately fixating the graft onto the bone, which can be solved by applying interferential screws [13,14]. Structural strength of a hamstring tendons graft measured under tension was 4590 N, whereas in patellar ligament it was 2977 N [15,16]. Hence, both grafts had greater structural strength than the original ligament when measured in laboratory conditions. Furthermore, both grafts were compared prospectively and retrospectively. The studies that have been conducted so far showed no significant differences in overall results [17–21]. However, in most studies the compared grafts were fixated in different ways, which led to noticeable differences in overall results. In this study, knee stability during the 24 months following arthroscopic ACL reconstruction with the middle third of the patellar ligament was compared with that with quadrupled hamstring tendons graft (gracilis and semitendinosus). Both grafts

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were fixated in the same way, applying Rigidfix femoral fixation and resorptive interferential screw on the lower leg. All patients were operated on by the same orthopaedist using the same surgical technique and postoperative rehabilitation.

Materials and methods

Subjects

A total of 112 patients with ruptured ACL were operated on from November 2004 to the end of 2007 using the middle third of the patellar ligament, 10 mm wide, and quadrupled hamstring tendons grafts.

The study included 31 female (27.7%) and 81 male (72.3%) patients; 54 patients (48.3%) with an average age of 28 years (± 7.47) received patellar ligament graft and 58 patients (51.7%) with an average age of 26 years (± 7.94) received hamstring tendons graft. The average time elapsed from the injury until surgery was 9 months. Indications for surgical reconstruction were subacute and chronic ACL rupture diagnosed by clinical examination and MRI. Also, patients had knee instability when performing daily and sports activities or they wanted to maintain the level of activity they had prior to injury.

Evaluation

The average duration of hospitalisation was 8 days. Patients received physical therapy during that time. Clinical evaluation included wound examination and suture removal after 12 days. Regular follow-up examinations were conducted 1, 3 and 6 months after surgery, in which range of movement was measured and possible complications were noted (swelling, pain, contracture, muscle hypotrophy, infection and instability).

The Lachman test and Pivot shift test were used in clinical examination of the stability of knee ligaments. The Lachman test was either negative (anterior tibial translation of 0–2 mm) or positive with results graded from 1 to 3: grade 1 showed anterior tibial translation of 3–5 mm, grade 2 the translation of 6–10 mm and grade 3 the translation of more than 10 mm. The Pivot shift test shows anterolateral rotator knee instability after ACL rupture and was presented as either positive or negative (+ or –).

Objective anteroposterior knee stability after surgery was determined using the KT-1000 arthrometer with manual tension of 89 N and 134 N at a knee flexion of 25°. Stability was measured on two occasions in both uninjured and injured knee joint, and the average result was taken. Anterior tibial translation was noted as the difference in shift between injured and uninjured knee joint. The results obtained by measurements were graded as normal (0–2 mm), moderate instability (3–5 mm), considerable instability (6–10 mm) and great instability (>10 mm).

Results

Instability of the injured knee under load was present in all subjects, and the use of the Lachman and Pivot shift test in clinical examination under anaesthesia showed positive results. In the patellar ligament graft group, 23 patients (42.6%) had positive Lachman test grade 2 and 30 patients (55.6%) had positive result grade 3, whereas in the hamstring tendons graft group, 30 patients (51.7%) had positive Lachman test grade 2 and 28 patients (48.3%) had positive result grade 3 (Table 1).

The Lachman test was positive in 20 patients (18.5%) 6 months after surgery, in 19 patients (18.1%) after 12 months and in 17 patients (17.3%) after 24 months; five of the 17 patients (10.4%) at 24 months had patellar ligament graft and 12 patients (24%) had hamstring tendons graft (Fig. 1).

Table 1

Preoperative clinical stability of the injured knee according to graft groups.

Preoperative tests	Patellar ligament graft group	Hamstring tendons graft group	Total	p^a
	N (%)	N (%)	N (%)	
Pivot shift test	54 (100)	58 (100)	112	
Lachman test				
Grade 1 (+)	1 (1.9)	0	1 (0.9)	0.396
Grade 2 (++)	23 (42.6)	30 (51.7)	53 (47.3)	
Grade 3 (+++)	30 (55.6)	28 (48.3)	58 (51.8)	
Total	54 (100)	58 (100)	112 (100)	

^a χ^2 test.

Clinical (manual) examination 6 months after surgery showed a positive Pivot shift test in two patients (3.8%) in the patellar ligament graft group and two patients (3.7%) in the hamstring tendons graft group. At 12 months after surgery there was a positive result in one patient (2%) in the patellar ligament graft group and two patients (3.7%) in the hamstring tendons graft group. After 24 months, there was a positive result in one patient (2%) in each group. The time elapsed from injury until surgery was more than 2 years in all patients with a positive Pivot shift test (Table 2).

Anterior knee stability and instability after surgery in the two different graft groups were measured using the KT-1000 arthrometer. The results showed that 6 months after surgery the average anterior translation under a load of 89 N was 1.5 (± 0.6) mm in the patellar ligament group versus 1.89 (± 0.6) mm in the hamstring tendons graft group; under a load of 134 N the average translation was 2.1 (± 0.8) mm and 2.6 (± 0.8) mm, in the two groups, respectively. At 12 months after surgery the average anterior tibial translation under a load of 89 N was 1.6 (± 0.7) mm and 24 months

Table 2

Presentation of clinical stability of the knee joint after surgery.

Clinical stability of the knee		Graft group			p^a
		Patellar ligament – N (%)	Tendon – N (%)	Total – N (%)	
<i>Lachman test</i>					
6 months	No	46 (88.5)	42 (75)	88 (81.5)	0.197
	Grade 1	5 (9.6)	12 (21.4)	17 (15.7)	
	Grade 2	1 (1.9)	2 (3.6)	3 (2.8)	
	Total	52 (100)	56 (100)	108 (100)	
12 months	No	44 (86.3)	42 (77.8)	86 (81.9)	0.523
	Grade 1	6 (11.8)	10 (18.5)	16 (15.2)	
	Grade 2	1 (2)	2 (3.7)	3 (2.9)	
	Total	51 (100)	54 (100)	105 (100)	
24 months	No	43 (89.6)	38 (76)	81 (82.7)	0.171
	Grade 1	4 (8.3)	11 (22)	15 (15.3)	
	Grade 2	1 (2.1)	1 (2)	2 (2)	
	Total	48 (100)	50 (100)	98 (100)	
<i>Pivot-shift test</i>					
6 months	Positive	2 (3.8)	2 (3.6)	4 (3.7)	p^b 0.662
	Negative	50 (96.2)	54 (96.4)	104 (96.3)	
	Total	52 (100)	56 (100)	108 (100)	
12 months	Positive	1 (2)	2 (3.7)	3 (2.9)	0.522
	Negative	50 (98)	52 (96.3)	102 (97.1)	
	Total	51 (100)	54 (100)	105 (100)	
24 months	Positive	1 (2.1)	1 (2)	2 (2)	0.742
	Negative	47 (97.9)	49 (98)	96 (98)	
	Total	48 (100)	50 (100)	98 (100)	

^a χ^2 test.

^b Fisher's exact test.

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