Extraarticular repair of the unstable knee

Disappointing 6-year results of the Slocum and Ellison operations

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Thirty-nine clinically unstable knees caused by anterior cruciate ligament rupture were evaluated 5–8 years after medial and lateral extraarticular stabilization according to Slocum and Ellison. At the follow-up, 10 knees had been subjected to an intraarticular anterior cruciate ligament reconstruction, and one knee was not available for follow-up. The mean Lysholm score for the 28 reexamined knees was 84 out of a maximum of 100 points. Activity scores were generally low, and all the knees had increased anterior drawer instability. The combination of the pes anserinus and lateral extraarticular repair did not give acceptable long-term results.

The concept of using both medial (Slocum and Larsson 1968) and lateral (Ellison 1979) extraarticular stabilization to control anteromedial and anterolateral instability was used by Unverferth and Bagenstose (1979) with good early results. We report the long-term results in a group of patients operated on using a similar technique.

Patients and methods

During the period May 1979 to February 1982, 15 women and 24 men with instability due to an old anterior cruciate ligament rupture underwent medial and lateral extraarticular stabilization according to Slocum and Larsson (1968) and Ellison (1979). Their median duration of symptoms was 15 months, and their median age at the operation was 26 years (Table 1). The cause of the original injury was a rotatory trauma during sports activities in 36 patients and traffic accidents in 3. Indications for the extraarticular repair were instability symptoms, a positive anterior drawer sign, and a positive Lachman test. A retrospective review of preoperative symptoms from the patients' records showed that 15 patients had a clearly positive pivot shift sign, 12 patients had a positive anterolateral rotatory instability, and 10 patients were classified as having a combined anteromedial-anterolateral rotatory instability. There was no evidence of an increased occurrence of varus instability preoperatively.

Operative technique. The operation was performed in a bloodless field. Via a medial incision the pes anserinus and the lower border of the semitendinosus tendon were identified. The distal two thirds of the pes anserinus was freed from the medial surface of the tibia, reflected upwards, and the distal end was sutured to the tibial tubercle and patellar tendon. The lower border of the pes anserinus was sutured just below the joint line. A 15-cm-long lateral incision was then made, and a 15–16-cm-long and 1-cm-broad fascia lata strip was prepared with a bone block from Gerdy's tubercle. The strip was passed below the lateral collateral ligament dynamically without suturing it to the ligament, and the bone block was reinserted and fixed with a Richards staple anterior and distal to its original insertion with the tibia in outward rotation. The defect in the fascia lata was closed. Both the pes anserinus transfer and the lateral extraarticular procedure were performed with the knee in 60° of flexion. No intraarticular stabilization was made.

Aftercare. A plaster cast was applied for 6 weeks from the ankle to the proximal thigh with the knee in 45° of flexion. After the cast was removed, gradually increased weight bearing was allowed. Usually after 10 weeks, when mobility of the knee was restored to normal, active isometric, strength-training exercises were initiated. The postoperative rehabilitation was supervised by a physiotherapist. Jogging was permitted 4–5 months after the operation. The patients were recommended to wait for a year before resuming full sports activities.

Follow-up

Ten patients, 6 men and 4 women, with a median age at the index surgery of 20 (18–28) years, underwent reoperation with an intraarticular anterior cruciate recon-

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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	X	Y
1	M/29	42	R	10		(+)	+/+	96		51	5	–	1	(+)	2	4	1	10.0	6.0	3.0	0.5	6/2*	1/6*
2	M/23	12	R	10	A		+/+	94		44	5	–	1	+	3	4		11.0	8.0	1.0	1.0	6/4	4/6
3	M/18	12	L	13		+		88		99	25	+	3	(+)	2	3		10.0	6.0	3.0	2.0	4/4	4/5
4	F/42	36	R	9		+		86		91	25	+	6	–	3	3		10.0	4.0	2.0	1.0	5/3	3/5
5	F/23	96	L	13			+/+	84		90	25	+	4	Intervue by tel									
6	M/30	60	L	10	M	+		80		85	25	+	5	–	5	5		6.5	5.5	2.0	2.0	5/2*	3/6
7	M/20	3	R	12		+		78		90	20	+	8	+	2	3		10.0	6.0	2.0	1.0	8/5	4/7
8	M/26	72	L	10	L M	(+)	+/+	76		80	15	(+)	4	+	2	5		10.5	5.0	3.0	1.0	5/3	4/6
9	M/49	12	R	4		(+)		76		100	25	+	4	+	3	4		11.5	7.5	2.5	1.0	6/6	5/7
10	M/27	24	R	10	M		+/+	76		86	15	+	7	(+)	2	5		8.0	5.0	2.0	2.0	9/4*	6/8
11	F/20	3	L	3		+		73		100	25	+	8	+	2	4		11.0	7.5	3.0	2.5	6/5	5/6
12	M/18	36	R	13		(+)	/+	72		84	20	–	4	+	2	5		11.5	9.0	3.0	3.0	6/6	5/6
13	F/34	108	R	5		+		69		95	25	+	7	(+)	3	4		6.0	4.5	2.0	1.5	6/3	3/5
14	F/18	102	R	2	M	(+)	/+	69		72	5	–	2	+	2	4		15.0	9.0	3.0	2.0	6/2*	3/5
15	F/17	12	L	9		(+)	/+	69		81	10	+	5	+	2	3		12.0	5.0	4.0	1.0	5/4	4/5
16	F/35	5	L	9		(+)	/+	68		81	15	(+)	5	+	2	3		14.0	8.5	3.0	1.0	7/4	4/6
17	F/38	12	L	9	A	(+)	/+	68		67	15	–	3	+	3	3		8.0	6.0	2.0	2.0	5/3	3/5
18	F/32	156	L	5	M		+/+	66		67	15	(+)	2	+	2	3		12.5	7.0	2.5	2.0	7/2*	4/5
19	M/26	15	R	5			+/+	62		70	20	(+)	3	(+)	2	5		8.0	6.0	1.0	1.0	5/4	4/5
20	M/26	12	R	10		(+)	/+	62		76	20	(+)	4	(+)	2	4	2	12.0	5.0	3.5	1.0	6/3	5/5
21	F/20	12	L	5		(+)	/+	62		95	25	+	4	+	2	4		14.0	4.0	3.0	1.0	6/3	3/4
22	F/17	12	R	10		+		62		90	15	+	3	+	2	3		14.5	6.0	3.5	1.0	6/4	4/5
23	M/21	15	R	10	A	(+)	/+	62		90	25	+	7	(+)	2	4		8.5	5.0	1.5	1.0	7/6	5/6
24	M/26	15	L	10		+		61		86	25	(+)	4	+	3	4		8.5	8.0	3.0	3.0	6/3*	3/6*
25	M/28	60	L	10	M	(+)	/+	60		100	25	(+)	6	+	2	4		9.0	7.5	3.0	3.5	7/5	6/7
26	M/41	6	R	1		(+)	/+	58		91	25	+	4	+	2	5		11.0	6.0	2.0	1.0	6/4	4/5
27	M/48	12	R	10		+		58		98	25	+	3	(+)	3	4		4.5	4.0	1.0	1.0	6/3	4/6
28	M/19	14	L	7		+		53		90	15	(+)	7	Intervue by tel									
29	M/22	24	L	10		(+)		–						Not available									

*Arthrosis

Reoperated on knees

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
30	F/18	4	R	11		+			60	68	5	–		+	2	5
31	M/20	48	R	10	M	+			48	64	5	–		+	1	3
32	F/20	60	L	10	M A		+/+		48	40	0	–		+	2	5
33	F/18	30	L	3		+			48	48	5	–		+	2	3
34	M/27	24	L	8		(+)	+/+		42	64	5	–		(+)	2	5
35	M/20	60	R	10	L M		+/+		36	68	10	–		+	2	5
36	M/26	36	R	10	M A		/+		24	21	0	–		+	4	3
37	M/21	8	L	10		+			15	68	10	–		(+)	4	3
38	F/19	14	L	10		(+)	/+		13	80	10	–		+	2	5
39	M/28	20	L	10		+			Reop at other hospital					+		

A Case number.
B Sex and age at operation.
C Months between primary trauma and extra-articular stabilization.
D Side.
E Cause of primary knee injury: 1 badminton, 2 ball play, 3 basketball, 4 fall, 5 gymnastics, 6 handball, 7 motocross, 8 sailing, 9 skiing, 10 soccer, 11 volleyball, 12 waterskiing, 13 traffic.
F Surgery before extra-articular repair: A Ant cruciate lig suture. L Removal lat meniscus; M Removal med meniscus.
G Pivot shift sign preop: + pos (+) difficult to provoke
H Anteromedial/anterolateral rotatory instability preop.
I Months follow-up-time.
J Months between extra-articular surgery and intra-articular ACL-reconstruction
K Lysholm score at follow-up or before reoperation.
L Lysholm stability score at follow-up or before reoperation
M Satisfied+/not satisfied – with extra-articular repair.
N Activity score at follow-up.
O Pivot shift at follow-up or before reoperation: + pos, (+) difficult to provoke, – negative.
P Lachmann score at follow up or before operation. 5 normal, 4 slight < 1-2 cm; 3 moderate < 1 cm; 2 pronounced > 1 cm; 1 extreme > 2 cm
Q Varus instability at follow-up or before reoperation: 5 normal, 4 slight in flexion; 3 moderate in flexion; 2 moderate in extension; 1 pronounced.
R Other operations between index operation and follow-up. 1 removal medial meniscus, 2 suture medial meniscus.
S Arthrometer measurement: anterior drawer (mm) injured knee at 89 N pull.
T Arthrometer measurement: anterior drawer (mm) uninjured knee at 89 N pull.
U Compliance (mm) injured knee.
V Compliance (mm) uninjured knee.
X Radiographic examination: joint space (mm) injured knee, lateral compartment/medial compartment.
Y Radiographic examination: joint space (mm) uninjured knee, medial compartment/lateral compartment

struction after a mean observation period of 3 years. Their median duration of preoperative symptoms was 27 (4–60) months. Two knees had before the index operation an anterior cruciate ligament suture and medial meniscectomy. One knee had both medial and lateral meniscectomy, and one knee had medial meniscectomy before the index operation. All 10 knees had received their primary trauma during sports activities.

Twenty-six patients, 10 women and 16 men, with a median age of 26 (17–49) years at surgery, were reexamined 6 (5–8) years after surgery; and 2 patients, now residing outside Stockholm, were interviewed by telephone concerning subjective symptoms. One patient was not available. The median duration of symptoms preoperatively was 15 (3–156) months. Three patients had had an anterior cruciate ligament suture in conjunction with the original knee injury. A further 5 patients had their medial meniscus and 1 patient both the medial and the lateral meniscus removed before the extraarticular repair.

The patients were reexamined by 1 senior orthopedic surgeon (L.D.). The knees were tested for functional symptoms using the Lysholm functional score (Tegner et al. 1985). A modified Marshall score (Marshall et al. 1977) was used for objective evaluation of knee stability. Activity grading was performed according to Tegner et al. (1985). Measurement of the anterior drawer sign in millimeters from the reference position with knees in 25° of flexion was made with an arthrometer (KT-1000; Daniel et al. 1985) with a forward pull of 67 and 89 N. Compliance was calculated as the difference between the 89 and 67 N values in the exam ined knee.

Reference patients. Twenty-eight patients (median age 27 years) who were waiting for anterior cruciate ligament reconstruction were evaluated. They had a Lysholm score of 68 *10* (M *SD*), Tegner score of 5 *0.5* points, and Lachman score of 2.7 *0.5* points. Anterior drawer signs using 89 N forward pull were: injured knee 10 *2.4* mm, uninjured knee 5.8 *1.6* mm. The compliances were injured knee 2.5 *0.9* mm, uninjured knee 1.3 *0.5* mm.

Standard radiographs of both knees with full weight bearing on the examined leg were taken to detect evidence of arthrosis in the extraarticular stabilized group (Ahlbäck 1968): Narrowing of the joint space with reduction of half or more of the distance between the tibia and the femur of one compartment compared with the other compartment of the same knee joint, or the same compartment of the other knee, or less than 3 mm.

The Student *t*-test and the Mann-Whitney *U*-test were used, and $P < 0.05$ was considered significant.

Results

No immediate postoperative complications occurred in the 39 operated on patients.

Of the 10 patients who underwent reoperation with an intraarticular anterior cruciate ligament reconstruction after the index operation, 9 were reoperated on at our department and 1 patient was operated on elsewhere. Indications for reoperation had been continuous subjective instability in daily life or during strenuous exercise with give-way symptoms and objective signs of major knee instability. The group of 9 reoperated on patients at our department had low median scores before the anterior cruciate ligament reconstruction: Lysholm score 58 points, Lachman score 2.3 points, and anterior drawer 2.1 points. Eight patients had a clearly positive pivot shift sign before the reoperation.

In the follow-up group of 28 patients, 1 underwent medial meniscectomy and 1 a medial meniscus suture following the index operation. Two staples have been removed. Five patients stated that they were definitely not satisfied with the operation, pain during normal activities being the most common complaint. Only 6 patients had an activity score of 7–8 points. Four males were active in competitive downhill skiing, motocross, bandy, and lower division soccer, respectively. Two females were active in elite basketball and handball, and had no difficulties. The activity scores were otherwise generally low: median 4 (1–8) points.

The median Lysholm score among the 28 patients was 88 (44–100) points. Thirteen patients stated that they never experienced any subjective instability problems; they had a higher total Lysholm score in general, but 6 of them had a clearly positive pivot shift sign.

All the reexamined patients had increased anterior-posterior instability. The mean Lachman value was 2.3 (about 1-cm anterior displacement with the knee in 20° of flexion). The pivot shift sign was definitely positive in 16 patients. Twenty patients showed a slight to moderate varus instability, and of these 20 patients, 8 complained of instability.

Measurements of the anterior drawer sign showed that injured knees compared with the uninjured contralateral knees had increased anterior displacement and compliance (Table 2), with higher values in patients with a positive pivot shift sign compared with those without it. At 89 N pull, the mean displacement was 12 mm in the injured knees with a positive pivot shift sign compared with 8.4 mm in the knees without this sign. The displacements in the uninjured knees were respectively 6.9 and 5.1 mm ($P = 0.001$).

Compared with the group of nonoperated on chronic anterior cruciate ligament-deficient knees, there was

Table 2. Anterior displacement (mm) measured from the reference position using 89 N arthrometer pull. (M *SD*). Injured knees (I) hade increased anterior displacement ($P < 0.001$) and compliance ($P < 0.001$) compared with uninjured knees (U)

	Anterior displacement		Compliance	
	I	U	I	U
Men	9.4 *2.0*	6.2 *1.4*	2.3 *0.9*	1.6 *0.8*
Women	11.7 *3.0*	6.2 *1.8*	2.8 *0.7*	1.5 *0.6*
Reference group	10.2 *2.4*	5.8 *1.6*	2.5 *0.9*	1.3 *0.5*

Compliance is calculated as the difference between the 89 N and 67 N pull values in the same knee.

no difference regarding the anterior drawer sign. The extraarticular-stabilized knees, however, had a better mean Lysholm functional score (84 ±14 and 68 ±10 points, respectively).

Ahlbäck´s (1968) criteria for arthrosis were fulfilled by 6 patients, of whom 4 had medial meniscectomies performed before the index operation. Osteophytes were found in 2 additional patients without signs of arthrosis. There were signs of arthrosis in two of the contralateral knees.

Discussion

The use of both medial and lateral extraarticular stabilization to control anteromedial and anterolateral instability in the treatment of chronic anterior cruciate ligament insufficiency has given good early results (Unverferth and Bagenstose 1979). At our 6-year follow-up, however, the results were unacceptable. In the total group of 38 patients followed for 6 years after the operation with the combined pes anserinus transfer and Ellison´s procedure, 10 patients were reoperated on with an intraarticular anterior cruciate ligament reconstruction for continuous instability symptoms. These 10 cases were considered as failures. Similar results have been reported after pes anserinus transfer only (Hovelius et al. 1985).

Considering the Tegner activity score and Lysholm´s functional score, the results in our patients were comparable with results reported after only the Ellison or pes anserinus procedure (Odensten et al. 1983a). Kennedy et al. (1978), in their analysis of the Ellison procedure, reported on 13 patients operated on using medial and lateral extraarticular stabilization with a mean follow-up of 1 year. Only 2 of these patients still had subjective instability at follow-up; but all of them had a positive anterior drawer sign, which agrees with our results; and all but 1 had a positive pivot shift sign. Early functional improvement after a modified Ellison procedure is followed by deterioration after 3 years (Odensten et al. 1983b). We could also document that improved function seen just 1 year after surgery is temporary.

In our material, patients with an unequivocal positive pivot shift sign had increased sagittal laxity in both their injured and noninjured knees. These patients were not tested for generalized laxity. Increased varus instability has been reported by Hanks et al. (1981) and Teitge et al. (1980), and was found also in 20 of our patients. We believe that this finding could be caused by decreased restraint of the distal iliotibial band and probably by an elongation of the lateral collateral ligament.

Other studies (Jacobsen 1977, Feagin et al. 1982) have shown the development of arthrotic changes in anterior cruciate ligament-deficient knees. Balkfors (1982) concluded that arthrosis may be the consequence of meniscectomy and osteophytosis a result of instability. In our material, there was evidence of arthrosis in 6 patients of whom 4 had had medial meniscectomies. The 2 patients with osteophytes were not meniscectomized.

Our reexamined extraarticular-stabilized knees had a sagittal instability of the same magnitude as nonoperated on chronic anterior cruciate ligament-deficient knees, but had a better functional score, both when compared with our reference group and with the results of others (Daniel et al. 1985, Odensten et al. 1983). The increased Lysholm functional score is probably due to the patients´ adaptation to their unstable knee with decreased activity and not a sign of improved knee function. We conclude that the pes anserinus transfer and the Ellison procedure have proved unreliable.

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