Extraarticular transposition of the patellar tendon for anterolateral instability of the knee

Poor results in 52 patients after 5–14-year follow-up

Torbjørn Grøntvedt[1], Lars Engebretsen[1], Pål Benum[1] and Svein Anda[2]

Several extraarticular surgical procedures have been proposed to eliminate the anterolateral rotatory instability of an anterior cruciate-deficient knee. We examined the outcome in 52 patients with an extraarticular transposition of the lateral third of the patellar tendon to the lateral femoral condyle. The mean follow-up time was 9 years. The evaluation was based on the patients' subjective assessment, the Tegner activity level score, range of motion, Lysholm functional score, assessment of knee instability using manual testing as well as arthrometer measurements, and weight-bearing radiographs. At follow-up, 37 patients stated that they had good-to-excellent knee function. The mean Tegner score dropped from a preinjury level of 7 to 5. 43 patients had a good-to-excellent Lysholm score. 20 patients had a positive Lachman sign of grade 2 or 3, and 23 patients had a side-to-side difference of more than 3 mm as measured by an arthrometer. 17 had a positive pivot shift sign. 12 patients had meniscal resections performed after the primary operation, and 27 had radiographic evidence of arthrosis.

Although the outcome of this technique is equivalent to or better than results reported for other extraarticular procedures, the recurrence rate of symptomatic instability and the deterioration of subjective knee function are too high.

Departments of [1]Orthopaedics and [2]Radiology, Trondheim University Hospital, N-7006 Trondheim, Norway
Tel +47 73-998614. Fax -998722
Submitted 94-08-10. Accepted 95-04-20

Anterolateral rotatory instability is the main cause of pain and discomfort in patients in the early period after an isolated rupture of the anterior cruciate ligament. To prevent this instability, Benum (1982) reported a method using transposition of the lateral one third of the patellar tendon, with a patellar bone block to the lateral femoral condyle. This ligament was felt to have sufficient strength to prevent the stretching observed with other extraarticular procedures (Noyes et al. 1983b, Bray et al. 1988, Dahlstedt et al. 1988, Reid et al. 1992). 0.5–2.5 years follow-up of the first 11 patients showed promising results, with no recurrence of rotational instability (Benum 1986).

Engebretsen et al. (1990) in a cadaver experiment found that the forces in the transposed patellar tendon were less than in the intact anterior cruciate ligament when the knee was subjected to a standardized anterior tibial load. The graft prevented anterolateral rotatory instability. However, the transposed patellar tendon held the tibia in an externally rotated state during motion, thereby preventing the normal screw home mechanism at full extension. In addition, the transposed tendon was subjected to high forces during unloaded flexion, which would probably produce abnormally high joint contact loads. These factors may lead to elongation and dysfunction of the transposed tendon, followed by cartilage degeneration.

We evaluated the long-term outcome of this extraarticular patellar tendon transposition procedure in 52 patients.

Patients and methods

Patients

During the period 1979–1989, we performed extraarticular transposition of the patellar tendon in 107 patients with a torn anterior cruciate ligament and disabling anterolateral rotatory instability. One patient had a deep postoperative infection resulting in an arthrodesis of the knee. Another patient died and one moved abroad before the follow-up examination. During the follow-up period, 11 patients sustained an anterior cruciate rupture in the contralateral knee and 7 underwent an intraarticular reconstruction with bone-patellar tendon-bone autografts because of recurrence of gross instability and pain in their primarily operated knee. These 7 patients were the only

Copyright © Scandinavian University Press *1995. ISSN 0001–6470. Printed in Sweden – all rights reserved.*

ones who had stabilizing surgery performed on their primarily operated knee during the follow-up period. Of the remaining 86 patients, 52 were living in our region and agreed to participate in the study. The mean time from injury to surgery was 3 years (4 months–20 years). There were 24 men and 28 women. The mean age at surgery was 29 (16–58) years. Sporting activities accounted for 43 of the injuries, soccer (19 patients) and team handball (17 patients) being the major contributors. The follow-up evaluation was performed at a mean of 9 (5–14) years.

The operation

Before surgery, all patients underwent an arthroscopic examination to assess the rupture of the anterior cruciate ligament and to evaluate the condition of the joint surfaces and menisci.

Follow-up evaluation

The patients answered a questionnaire, providing a subjective assessment of their knee function. The patients were also asked if postoperative changes in activity were secondary to knee symptoms or to other unrelated changes in lifestyle. Knee function was also graded according to the score designed by Lysholm and Gillquist (1982). The preinjury and current levels of activity were graded with the Tegner activity level score (Tegner and Lysholm 1985). Mobility was evaluated on physical examination, and instability by manual and arthrometer testing. Anterior instability in 20 degrees of flexion was assessed by the Lachman test and the KT-1000 arthrometer (MEDmetric, San Diego, CA, U.S.A.) at 20 degrees of flexion and 89 newtons of load. Anterolateral rotatory instability (pivot shift) was graded by the McIntosh, Slocum and flexion-rotation drawer tests. Knees with a Lachman or pivot shift grade of 2 or 3 were considered unstable. Knees with more than 3 mm of anterior laxity measured by the arthrometer were classified as unstable. Weight-bearing radiographs were evaluated for degenerative changes by an experienced radiologist (SA) and an orthopedist (TG) and were graded according to Ahlbäck (1968). Grade 0 indicated no changes, grade 1 minor changes, grade 2 major changes, and grade 3 indicated severe arthrosis.

Results

None of the patients experienced any serious new trauma to the knee during the follow-up period. 14 patients had meniscal resections performed before or at the time of stabilizing surgery, while 12 had meniscal surgery after the primary operation. Of the 52 patients examined, 8 stated that they had normal knee function, 29 felt they had good function, 14 fair and 1 poor.

The mean Tegner score before injury was 7 (3–10). The score decreased to 5 (3–7) at follow-up (Table 1). This reduction in activity could be attributed to knee-related symptoms in 23 of the patients, whereas 29 patients reported other reasons.

Knee function, as assessed by the Lysholm score, was excellent in 16 patients, good in 27, fair in 9 and no patient was rated poor.

None of the patients had a significant extension deficit. 2 of the patients had a flexion deficit between 11 and 20 degrees and 4 patients had a flexion deficit between 5 and 10 degrees.

20 patients had a grade 2 or 3 anterior instability, as determined by the Lachman test, while 17 patients had a positive pivot shift sign (Table 2). Anterior laxity, measured with the arthrometer, was more than 3 mm in 23 patients (Table 3).

Table 1. Tegner activity level. Number of patients

Tegner activity level	Before injury	At follow-up
0–4	6	18
5–6	5	20
7–10	41	14

Table 2. Lachman and pivot shift tests. Number of patients

	Grade			
	0	1	2	3
Lachman [a]	7	25	17	3
Pivot shift [b]	15	20	13	4

[a] Grade 0 no side-to-side difference, solid end-point, 1 side-to-side difference of < 5 mm, solid end-point, 2 6–10 mm, no end-point, 3 >10 mm, no end-point

[b] Grade 0 stable, 1 trace positive, 2 moderate shift, 3 subluxation.

Table 3. Anterior instability tested with the KT-1000 arthrometer. Number of patients

Load	Side-to-side difference (mm)		
	0–3	4–5	>5
15 lb	39	11	2
20 lb	29	17	6
Max. manual	19	15	18

The radiographic examination showed grade I arthrosis in 17 patients and grade II in 10, but no patient had grade III arthrosis.

Discussion

Extraarticular procedures for the prevention of anterolateral rotatory instability in anterior cruciate-deficient knees were popular in the 1970s and early 1980s, but the results seemed to deteriorate with time, with recurrence of the instability. It was thought that the structures used for stabilization (usually the iliotibial band) were ellongated (Bray et al. 1988, Reid et al. 1992).

Our extraarticular surgical procedure was designed to prevent this stretching. The lateral third of the patellar ligament is considerably stronger than the iliotibial band (Noyes et al. 1983a). Our early results were promising, with no recurrence of instability at 0.5–2.5 years (Benum 1986). However, we now found a substantial deterioration in the subjective and objective outcomes occuring after a follow-up of 9 years. Nearly half of the patients reduced their activity level because of knee-related symptoms. Four fifths of the patients had a Lysholm functional score in the good-to-excellent group, which may be partly due to the reduced activity level. Close to half of the patients had an anterior and one third had a recurrence of anterolateral rotatory instability. This outcome appears to be better than the results reported by Reid et al. (1992), who found a 76 percent recurrence of a positive pivot shift sign after the Ellison procedure. Although the recurrences of instability in at least one third of the patients in our study seem high, they compare favorably with long-term follow-ups of intraarticular reconstructions. Howe et al. (1991), in their 6-year follow-up of 70 patients reconstructed intraarticularly with quadriceps-patellar tendon grafts, found a recurrence of instability in one fifth of the patients. Aglietti et al. (1992) reinforced their intraarticular bone-patellar tendon-bone grafts with an extraarticular iliotibial band tenodesis. After a mean 7-year follow-up of 44 patients, they found anterior instabiity in one third of the patients.

One potential benefit of stabilizing a knee with an anterior cruciate ligament rupture is to prevent further injury to secondary restraining structures, especially the menisci. We found a 23 percent rate of meniscal rupture after the extraarticular stabilizing procedure in one fifth of the patients. The patellar tendon transposition did not seem to prevent meniscal damage.

24 of our 52 patients had radiographically normal knees and 10 had severe arthrosis. This outcome is somewhat better than results reported for untreated anterior cruciate ruptures with the same follow-up time. For example, Kannus and Jarvinen (1987) reported that two thirds of their patients with untreated anterior cruciate injuries had radiographic degenerative changes at 8 years. In our study the incidence of major degenerative changes was half of that reported by Reid et al. (1992), 12 of 32 patients, in their 7–15-year follow-up of patients with Ellison iliotibial band transfers. The still high rate of arthrosis in our study may reflect the long period from injury to surgery (mean 3 years), and the high frequency of meniscal injuries before and after surgery.

Although the results of this extraarticular patellar tendon transposition did not deteriorate so much with time as with other reported techniques, the long-term follow-up of our technique was disappointing. We do not recommend this method as a routine procedure for stabilizing knees with an anterolateral rotatory instability.

References

Aglietti P, Buzzi R, D'Andria S, Zaccherotti G. Long-term study of anterior cruciate ligament reconstruction for chronic instability using the central one-third patellar tendon and a lateral extraarticular tenodesis. Am J Sports Med 1992; 20: 38–45.

Ahlbäck S. Osteoarthrosis of the knee. A radiographic investigation. Acta Radiol Diagn (Suppl 277) 1968; 39: 7–72.

Benum P. Anterolateral rotary instability of the knee joint. Results after stabilization by extraarticular transposition of the lateral part of the patellar ligament. A preliminary report. Acta Orthop Scand 1982; 53: 613–7.

Benum P. Extracondylar transposition of the lateral third of the patellar ligament in anterolateral rotatory instability of the knee. In: Proceedings of the 43rd Meeting of the Scandinavian Orthopaedic Association, Trondheim, Norway, 1986.

Bray R C, Flanagan J P, Dandy D J. Reconstruction for chronic anterior cruciate instability. A comparison of two methods after six years. J Bone Joint Surg (Br) 1988; 70: 100–5.

Dahlstedt L J, Dalen N, Jonsson U. Extraarticular repair of the unstable knee. Disappointing 6-year results of the Slocum and Ellison operations. Acta Orthop Scand 1988; 59: 687-91.

Engebretsen L, Lew W D, Lewis J L, Hunter R E, Benum P. Anterolateral rotatory instability of the knee. Cadaver study of extraarticular patellar-tendon transposition. Acta Orthop Scand 1990; 61: 225–30.

Howe J G, Johnson R J, Kaplan M J, Fleming B, Jarvinen M. Anterior cruciate ligament reconstruction, using quadriceps patellar tendon graft. Part I. Long-term follow-up. Am J Sports Med 1991; 19: 447–57.

Kannus P, Jarvinen M. Conservatively-treated tears of the anterior cruciate ligament. Long-term results. J Bone Joint Surg (Am) 1987; 69: 1007–12.

Lysholm J, Gillquist J. Evaluation of knee ligament surgery results, with special emphasis on use of a scoring scale. Am J Sports Med 1982; 10: 150–4.

Noyes F R, Butler D L, Paulos L E, Grood E S. Intraarticular cruciate reconstruction. I: Perspectives on graft strength, vascularization, and immediate motion after replacement. Clin Orthop 1983a; 172: 71–7.

Noyes F R, Mooar P A, Matthews D S, Butler D L. The symptomatic anterior cruciate-deficient knee. Part I: The long-term functional disability in athletically -active individuals. J Bone Joint Surg (Am) 1983b; 65: 154–62.

Reid J S, Hanks G A, Kalenak A, Kottmeier S, Aronoff V. The Ellison iliotibial band transfer for a torn anterior cruciate ligament of the knee. Long-term follow-up. J Bone Joint Surg (Am) 1992; 74: 1392–402.

Tegner Y, Lysholm J. Rating systems in the evaluation of knee ligament injuries. Clin Orthop 1985; 198: 43–9.