

Abstract:

Arthroscopically assisted anterior cruciate ligament (ACL) reconstruction using the central third bone-patellar tendon-bone as a free autologous graft is now a widely used procedure. Little has been published, however, regarding its long-term success. In this retrospective study, we report on the results of 32 patients who were followed up over five years after their reconstruction.

Twenty-five patients had improved on their pre-reconstruction Lysholm & Tegner Activity scores and the same number denied having any symptoms of instability. The mean Lysholm knee score was 88.5. All patients had within 10 degrees of full flexion and 28 had KT-1000 arthrometer readings within 3mm of their uninjured knee. Only three patients exhibited clinical evidence of failure of the graft.

We conclude that this technique compares favourably with other alternatives in the long-term treatment for ACL rupture.

Introduction:

The anterior cruciate ligament (ACL) is a major stabiliser of the knee joint and is commonly ruptured through injury. Jones in 1963 (1) described ACL reconstruction using the central one third of the patellar tendon, via an arthrotomy. Currently, arthroscopically assisted ACL reconstruction using the central third bone-patellar tendon-bone as a free autologous graft is a popular and well-accepted form of treatment.

There has been recent debate on the long-term results of an isolated central graft of the patellar tendon and an additional extra-articular reconstruction has been suggested as more beneficial (2). We report on the results of this technique in 32 patients, all with over five years follow-up.

Patients & Methods:

Between 1989 and 1993, 44 patients underwent arthroscopically assisted central third bone-patellar tendon-bone ACL reconstruction. Interference screw fixation of the femoral bone block and AO cancellous screw to fix the block in the tibial tunnel were used. Indications for reconstruction were symptomatic instability associated with positive Lachman and pivot shift tests. Patients with associated posterior, medial or lateral ligament instability and patients with bilateral ACL injury were excluded from the study. All operations were performed by the senior author (AJH). Thirty-two of the original 44 patients who met the inclusion criteria were available for follow-up over five years after their reconstruction.

The mean age in these 32 patients at reconstruction was 33 (range 18-53). There were 8 females and 24 males. Twenty-eight patients sustained their injuries through sporting activities, two were involved in traffic accidents and two fell down stairs. All patients had an examination under anaesthetic and arthroscopic assessment prior to reconstruction. Previous operations on the injured knee were noted and the results of the arthroscopic assessment were recorded.

The patients were functionally evaluated with the Tegner and Lysholm Activity Score (3). Pre-injury, pre-operative and final follow-up activity scores were recorded. The mean duration of instability prior to reconstruction was approximately 4 years (range 7 weeks- 15 years). Nine patients had an ACL reconstruction within six months of their injury.

At follow-up, a Lysholm knee score (3) was recorded. Each patient was examined for range of motion, Lachman and pivot shift tests. Objective assessment of anterior-posterior knee laxity was made using the KT-1000 arthrometer. The difference between the uninjured and injured joint was recorded at the manual maximum excursion. Bilateral radiographs of the patients' knees were taken. Radiological features of osteoarthritis were recorded according to Fairbank (4) and the Blackburne- Peel Index (5) of patellar height was measured in both knees. All patients were asked if they were satisfied with the result of their operation.

The operative technique was common to all cases in this group. A midline incision from the lower pole of the patella to the tibial tubercle was used to expose the patellar tendon. A central strip of approximately 9mm was harvested freehand. The two bone blocks were trimmed to fit within a 9mm sizing tube. Ethibond sutures were attached through 2mm drill holes in the bone blocks. The arthroscope was inserted via the main incision into a portal on the lateral side of the patella and the defect in the patellar tendon was used to insert instruments. After treating any meniscal pathology, the remnants of the anterior cruciate ligament and soft tissue from the lateral side of the intercondylar notch were removed. No bone was removed from the notch. A jig was used to introduce the guide wire for the tibial tunnel and an appropriately sized drill (for the size of bone block) was used to ream out the tunnel. This was usually 9mm. The femoral guide wire was placed in position through the tibial tunnel at a point located arthroscopically, with the knee fully flexed, approximately 5mm in front of the rear margin of the notch at 11 o'clock for the right knee and 1 o'clock for the left knee. The femoral tunnel was drilled to the exact depth of the proximal bone block and the graft was pulled into position by extracting the guide wire through the lateral thigh. The bone blocks were secured with a 9mm x 20mm interference screw

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in the femur and a 30mm AO cancellous screw in the tibia. The wound was closed without drainage. There were no graft length mismatches.

Results:

Two patients had previously undergone a Pes Anserinus Transfer unsuccessfully. Seven patients had undergone a partial meniscectomy prior to their ACL injury. All patients had positive Lachman and pivot shift tests on examination under anesthesia. During arthroscopic assessment ten patients had concomitant medial meniscal tears, and three had lateral meniscal tears. All meniscal lesions were treated with partial meniscectomy. One patient had a medial femoral condyle articular cartilage crater and another had a medial chondral flap tear. Twelve patients had isolated ACL ruptures.

The mean follow-up was 70 months (range 60-102 months). The results of the Tegner & Lysholm Activity scores are shown in Table 1. Eighteen patients had a pre-injury activity score of seven. Thirteen patients returned to their pre-injury activity score and 25 patients improved on their pre-reconstruction activity score at follow-up. Lysholm knee scores are shown in Table 2. Twenty-five patients denied having any symptoms of instability during exercise at follow-up.

All patients had within 10 degrees of full flexion in the knee (compared with the uninjured knee) at follow-up. No patients had a fixed flexion deformity. Three patients had a positive Lachman test, pivot shift test with a jerk and KT-1000 side to side differences of greater than 3mm at the manual maximum excursion. These three cases represent failures in this series. The results of the KT-1000 arthrometer measurements are shown in Table 3.

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Three patients had operations to remove cyclops lesions within two years of their ACL reconstruction and one patient had a proximal tibial osteotomy for osteoarthritis. Two patients subsequently had meniscal surgery. Two patients were dissatisfied with their treatment.

The length of the patellar tendon was increased on the reconstructed knee by 5-10% (when compared to the uninjured knee) in 8% of cases and was shortened in 16% of cases by a similar margin. There was no correlation between patellar tendon height and symptoms of pain or difficulty with stairs.

Greater femoro-tibial osteoarthritis was present on the reconstructed knees (on radiographs by Fairbanks' criteria) than the uninjured knee in 28% of cases (mean 1.8 vs 0.5 respectively). All patients who had meniscal surgery had radiographic evidence of femoro-tibial osteoarthritis at follow-up.

Discussion:

The results of the 32 patients in this study were based on a retrospective review of patients.

However we feel they are of importance as there are few reports on the long term use of arthroscopically assisted central third bone-patellar tendon bone ACL reconstruction.

We are only aware of one other report on the results of arthroscopically assisted central third bone-patellar tendon-bone ACL reconstruction with all patients having over five years follow-up.

Aglietti et al in 1997 (6) reviewed 89 patients at a mean follow-up of seven years with an arthroscopically assisted central third bone-patellar tendon-bone ACL reconstruction. Fixation was achieved on the femoral side using non-absorbable sutures tied over a Hewson ligament button. Patients were evaluated using the International Knee Documentation Committee (IKDC) evaluation form. They reported that 8% of patients had pain and symptoms of instability. Eleven percent had a pivot shift with a clunk and medial meniscectomy was associated with radiographic osteoarthritis.

It is difficult to compare outcomes between different reports of ACL reconstruction because of the varying scoring systems used. The commonest Tegner & Lysholm Activity Score in our group of patients prior to injury was seven (examples of a seven activity score include recreational soccer and competitive tennis). The mean Activity Score in our group of patients prior to injury was six (examples of a six activity score include recreational tennis and downhill skiing). Seventy eight percent of patients improved on their pre-reconstruction activity score at follow-up and 40% had returned to their pre-injury level of sporting activity. GrØntvedt et al (7) found similar pre-activity and five year follow-up Tegner Activity scores in their series of patients who had ACL repair augmented with central third bone-patellar tendon-bone graft.

Similar increases in activity scores after reconstruction were also found by Howe et al (8) in a series of patients at 1-10 year follow-up using the middle third of the patella with its extension into the quadriceps tendon.

The mean Lysholm knee score in our series was 88.5, range 40-100 and 78% of cases had no symptoms of instability. There was one patient only with a knee score of 40, the patient was aged 53 years had tricompartmental arthritis at reconstruction and was one of the failures in this study. This accounted for the broad range in our knee scores. Otero & Hutcheson (9) found mean Lysholm knee scores between 84 and 88 at three years follow-up using arthroscopic central third patellar tendon technique. Fifty six percent of patients in Jarvinen's series (10) had Lysholm knee scores greater than 82 using a similar technique at 2.2 years follow-up. GrØntvedt et al (7) found the mean knee scores at five years to have slightly fallen from the two year follow-up knee scores; 93.3% to 94.7% respectively. The majority of our patients who had not returned to their pre-injury activity score despite having good knee scores, suggested changes in lifestyle such as having children and increased career demands as explanations for their limitations. Another common reason for not returning to more active sports was fear of rupturing the graft. Similar patient concerns have been reported (8,11,12).

At over five years follow-up, 87% of patients had KT-1000 arthrometer readings within 3mm of their uninjured knee. Shelbourne et al (13), using a similar operative technique, found similar KT-1000 measurements at over two years follow-up. In O'Brien's series (12) using an open central third patellar tendon technique at two years follow-up, 77% of patients had side to side KT-1000 measurements of 3mm or less. Aglietti et al (14), using an arthroscopic central third

patellar tendon technique at 3-5 years follow-up, reported only 56% of cases had side to side differences of 3mm or less. The femoral component of the graft was fixed with sutures over a polyethylene button. However, 97% of their patients reported no symptoms of instability. The difference in results may represent either variation in measurements of arthrometer readings or genuine sub-clinical laxity.

Our results are comparable to reports of ACL reconstruction after more than five years follow-up using either the medial or lateral third of the patellar tendon. Mitsou et al (15) reported a series of patients with 5-9 years follow-up, using the lateral third of the patellar tendon as a free autograft. They found that 89.5% of their patients had satisfactory Tegner and Lysholm knee scores, and 78% had a side to side KT-1000 difference within 3mm at 89 Newtons (20 lbs). Unfortunately, this technique was associated with a high incidence of patellar fractures. Mok and Dowd (11) studied patients used in the two year follow-up of Patterson and Trickeys' series (16) at a mean of 7.5 years follow up (medial third patellar tendon technique). They found that 27 out of 30 patients had good/excellent Lysholm knee scores and their results had not appreciably changed from the two year follow-up study.

Changes in patellar tendon length to 5-10% of the uninjured side were observed in 24% of cases and no association was found between either shortening or lengthening with anterior knee pain symptoms. Similar findings have been noted at 3-5 years follow-up by Aglietti et al (6) using a similar technique.

All patients who had meniscal surgery prior to or at reconstruction were noted to have radiographic osteoarthritis of the femoro-tibial compartment. Of the 11 cases of isolated ACL ruptures only one patient (aged 41 at reconstruction) had radiographic osteoarthritis of the femoro-tibial compartment of both knees. These findings stress the importance of normal meniscal function.

There were three failures in this series, based on clinical examination and KT-1000 measurement. All patients had meniscal lesions prior to or at the time of reconstruction. One of the failures was aged 53 and had known tricompartmental osteoarthritis prior to reconstruction; she reduced her activity score from six to three, had a knee score of 40. With hind sight it was inappropriate to reconstruct her ACL. Another patient, aged 29, had dropped his activity score from seven to four. Both these patients complained of instability and were the only two cases dissatisfied with the result of their reconstruction. Interestingly, the last of the three failures was aged 34, denied any symptoms of instability and had maintained his activity score of seven. All three patients had radiographic evidence of tricompartmental osteoarthritis of the knee.

In summary, greater than five years after central third bone patella tendon bone ACL reconstruction:- 78% of patients improved on their pre-reconstruction scores, 40% continued with their pre-injury activity scores; the mean knee score was 88.5%; 87% of patients had KT-1000 arthrometer readings within 3mm of their uninjured knee; and 9% of cases demonstrated clinical signs of graft insufficiency.

We conclude that this technique compares favourably with other alternatives in the long-term treatment for ACL rupture.

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Table 1: Lysholm & Tegner Activity Scores

	Pre-Injury	Pre-Reconstruction	Follow-up >60months
Mean Score	6.3	3.1	5.1
Range of Score	3-8	1-5	3-7

Table 2: Lysholm knee scores at follow-up beyond 60 months

	Limp	Suppor	Locking	Instability	Pain	Swelling	Stairs	Squatting	Total
	/5	t/5	/15	/25	/25	/10	/10	/5	/100
Mean	4.4	4.9	13.5	23.3	20.6	7.6	9.8	4.4	88.5
Range	0-5	2-5	2-15	10-25	5-25	2-10	6-10	4-5	40-100

Table 3: Difference between the uninjured and injured limb at the manual maximum excursion at follow-up.

	0-3 mm	3.5-5 mm
Manual Maximum	28 cases / 87%	4 cases / 13%