Reconstruction of the medial patellofemoral ligament for patellar instability using a semitendinosus autograft

Ernesto FERNANDEZ, Diego SALA, Miguel CASTEJON

From The Hospital de la Ribera, Alzira, Spain

Between 1999 and 2001 thirty knees underwent a semitendinosus tendon plasty to recreate the medial patellofemoral ligament for recurrent patellar dislocation. The mean follow-up was 38 months. The mean improvement of the patellofemoral congruence angle after surgery was 14 ± 7 degrees. All patients ended up with a full range of motion, except one patient, whose flexion was limited to 120° due to superficial wound infections. Dislocation did not recur. According to the Larsen and Lauridsen outcome score the clinical results were excellent in 27 patients, good in 2 and fair in one. In conclusion this procedure is indicated for the chronic dislocation and cases of severe femoral dysplasia with marked laxity. The procedure assures the stabilisation of the patella, although it doesn't restore the patellofemoral congruence angle to normal values.

INTRODUCTION

Recurrent patellar dislocation and subluxation is a common problem affecting the extensor mechanism of the knee. Patients who have experienced patellar dislocation are at a high risk of recurrence and frequently experience disability due to pain and giving way (*1, 6, 11, 13*). Several aetiologic factors have been described such as patellar and femoral dysplasia, lateral displacement of the anterior tibial tubercle, and many surgical techniques have been reported in the literature.

In recent years, some authors have described the influence of the medial patellofemoral ligament (MPFL) as the primary restraint among the medial patellar stabilisers (*4, 7, 13, 19, 21, 25, 26, 31, 33, 35, 36*).

Surgical findings show that the medial retinaculum is torn as the patella dislocates (*11, 21*) and inadequate healing can lead to subsequent instability and recurrent dislocation (*2*).

Based on the results of other authors about the anatomy of the MPFL and its surgical repair (*23, 29*), we conducted a prospective study to assess the effect of a plasty using the semitendinosus tendon to recreate the MPFL in cases of patellar dislocation and instability.

PATIENTS AND METHOD

Between 1999 and 2001, MPFL reconstruction using autologous semitendinosus tendon was performed for recurrent patellar dislocation on 30 knees (28 patients). There were 20 females and 8 males, with an average age of 23 years (range : 17 to 28). Three had bilateral involvement : two patients with cerebral palsy and one with Marfan's syndrome. Three patients had previous proximal realignment procedures.

■ Ernesto Fernandez, MD, PhD, Staff Surgeon.
■ Miguel Castejon, MD, Staff Surgeon.
Department of Orthopaedics and Traumatology. Hospital de la Ribera, Alzira, Spain.
■ Diego Sala, MD, PhD, Staff Surgeon.
Department of Orthopaedics and Traumatology. Hospital Clínico Universitario, Valencia, Spain.
Correspondence : Ernesto Fernández García, Calle Don josé Meliá Sinisterra. N° 1, Pta. 10, 46023 – Valencia, Spain.
E-mail : ersi@ono.com

Table I. — Arthroscopic and radiographic findings in the study group.

Case	Chondromalacia	OF	PA	CS	Bump	Wiberg	OP
1	Grade 2	+	+	+	+	3	
2	Grade 2			+		3	+
3	Grade 2			+		3	
4	Grade 2		+	+	+	3	
5	Grade 2			+		3	
6	Grade 2					3	
7	Grade 2		+	+	+	3	
8	Grade 2			+		3	+
9	Grade 3			+	+	3	
10	Grade 2	+		+	+	2	
11	Grade 2					2	
12	Grade 1		+	+	+	3	
13	Grade 2			+		3	+
14	Grade 2		+	+	+	3	
15	Grade 1					1	
16	Grade 1		+	+		3	
17	Grade 2				+	3	
18	Grade 2			+		3	
19	Grado 2		+	+		3	
20	Grade 1					3	
21	Grade 1		+	+	+	3	
22	Grade 2		+	+	+	1	
23	Grade 2		+	+	+	3	
24	Grade 2		+	+		3	
25	Grade 2			+		1	

Chondromalacia : Grade of chondral lesions according to Outerbridge classification, OF : Osteochondral fracture, PA : Patella alta, CS : Crossing sign, Bump : Bump sign, Wiber : Type of patella according to Wiber classification, OP : Presence of osteophytes.

The average duration of symptoms before operation was 2.9 years (range : 1 to 10). All patients underwent a physiotherapy program for a minimum of 6 months and surgical treatment was indicated if pain and instability were still present after this period of time.

All patients had radiographic and CT-scan evaluation. The patellar height was measured as described by Insall and Salvati (30, 35), patellar shape following Wiberg (24) and trochlear dysplasia were noted. Patella alta was present in 44% of the cases and a crossing sign, according to Dejour, was present in 80% (18). Eleven knees (37%) had a pathological trochlear bump (18). Twenty knees had a type III, four a type II and four a type I shape of the patella according to the Wiberg classification. Increased subchondral sclerosis was visible in three knees and two showed osteophyte formation of the patella (table I).

CT-scan was used to measure patellar tilt and lateral subluxation. The mean femoral sulcus angle was 145° (range : 135 to 150). The mean preoperative patello-femoral congruence angle was 25° ± 15° (range : -7 to +60). Sixty percent of the knees had a patellofemoral congruence angle greater than 16°.

Arthroscopic inspection was performed in all cases ; the condition of the articular cartilage was recorded. Using the Outerbridge classification, 18 knees (60%) were qualified as a grade II chondromalacia and 2 knees (7%) as a grade III chondromalacia. Osteochondral or chondral loose bodies were present and removed in 3 knees (10%). Lateral retinacular release was done in two cases due to evident patellar tilt. In two patients, medial transfer of the tibial tubercle was associated to the MPFL reconstruction because of a Q-angle greater that 25 degrees.

The surgical procedure started by obtaining the semi-tendinosus tendon through a 3-cm incision over the pes anserinus, 1 cm medial to the anterior tibial tubercle, with a sharp tenotome. Two baseball sutures (Ethibond #2) were placed at each end of the 10-cm long graft. A second incision was made at the medial margin of the
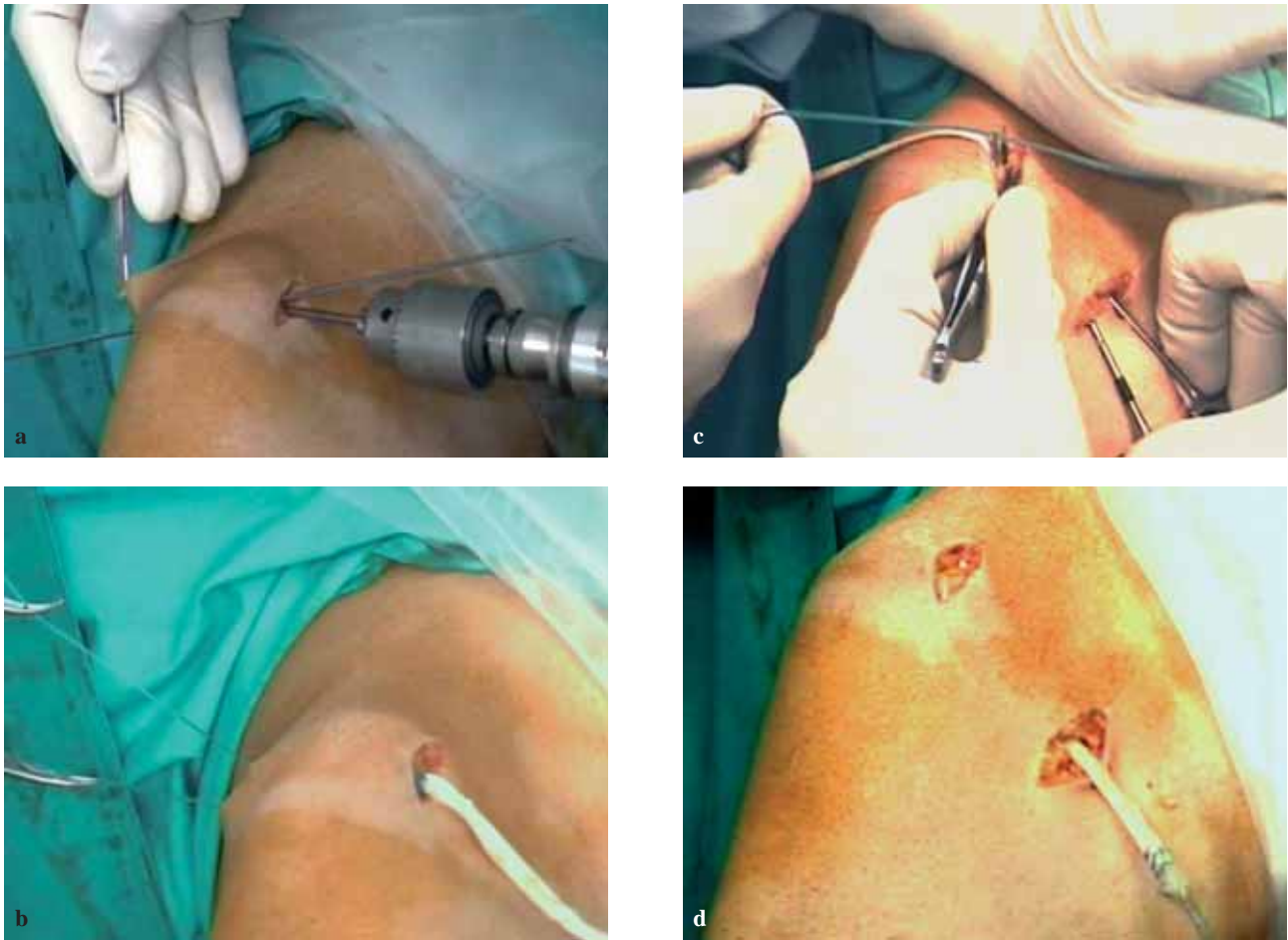
Fig. 1. — **a)** A long tunnel was drilled in the patella using a 4.5-mm drill. Two parallel tunnels were then drilled from the first tunnel until the lateral margin of the patella ; **b)** The sutures at one end of the graft were then placed and pulled until the graft was inserted in the tunnel ; **c)** The graft was passed from the medial margin of the patella to the *adductor magnus* tubercle.

patella starting at the proximal angle and finishing 2 cm distally. A 1-cm long tunnel was drilled in the patella from its medial margin to the lateral margin, using a 4.5 mm drill. Two parallel tunnels were then drilled from the first tunnel through the lateral margin of the patella with 2.5 mm drill bits. The sutures at one end of the graft were then placed trough each of the 2.5 mm tunnels and pulled until the graft was engaged in the 4.5 mm tunnel. Another 2 cm incision was done over the adductor tubercle. Subsequently, subcutaneous dissection was done between the anterior joint capsule and the medial retinaculum to communicate with the second incision. The other end of the graft was passed from the medial margin of the patella to the adductor tubercle (fig 1). The knee was placed at 90° of flexion and the graft was fixed just distally to the tubercle using a soft tissue staple.

Afterwards the subcutaneous tissues and skin were closed and a compressive dressing was applied without drainage.

After surgery the patients were placed in a knee immobiliser with the knee in extension for one week, allowing immediate weight bearing. After one week, progressive flexion exercises were started. The knee immobiliser was kept for walking during 6 weeks. Full activity was allowed at 12 weeks.

The clinical results were evaluated according to the Larsen and Lauridsen scoring scale (27) as excellent (19-20 points), good (17-18 points), fair (15-16 points) and poor (less than 14 points). Postoperative x-ray evaluation was made in all cases, CT-scan was done in 15 patients, and clinical examination was done after a mean follow-up of 38 months (range : 12 to 48). To
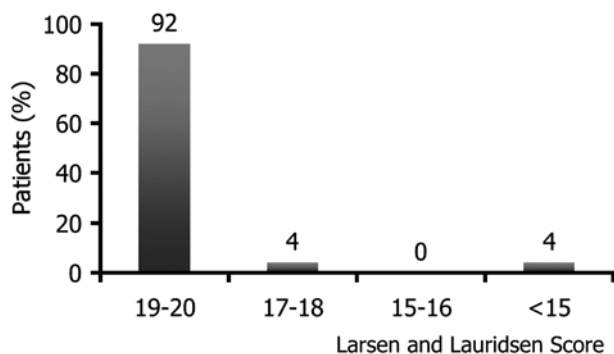
Fig. 2. — Clinical results according to the Larsen and Lauridsen scoring system.

compare the values of preoperative and postoperative congruence angles the data was analysed using the Student's t-test for paired variables. The level of significance was set to $p \leq 0.05$.

RESULTS

All patients regained full range of motion (ROM) two months after the surgical procedure, except one patient with superficial wound infection by *Pseudomonas aeruginosa* treated with local wound care and intravenous antibiotics. He achieved 120° of flexion, and had a poor final result. One patient required removal of the staple because of discomfort. There were no postoperative recurrent dislocations or symptoms of instability.

According to the Larsen and Lauridsen score, 27 knees (90%) had an excellent result ; two knees had good result (7%) and one fair result (fig 2).

The mean postoperative congruence angle improved from 25° + 15° to 12° + 8° (fig 3). In two cases the patellofemoral congruence angle improved from 60° to 30° and permanent subluxation of the patella was resolved, with an activity level increased from a preoperative fair to a postoperative good.

DISCUSSION

The medial structures of the retinaculum contribute to the stabilisation of the patella in this order : The MPFL is responsible for 53% of the medial stability, the patellomeniscal ligament for

22%, the patellotibial ligament for 11% and the medial retinaculum for 5% (*14, 19*). In the absence of major structural deformities therefore, the recreation of a medial tension band would logically stabilise the patella and prevent further dislocation. In the present study it is demonstrated that no recurrent dislocation occurred after the reconstruction of the MPFL.

The MPFL is a thin fascial band 10 to 30 mm wide (mean : 19) and 45 to 64 mm long (mean : 53) linking the superior border of the patella to the adductor tubercle (*37*). Although initially the femoral insertion of this ligament was described in the same adductor tubercle (*14, 21, 26*), later it was proven that the insertion is superior and posterior to the medial epicondyle and just distal to the adductor tubercle (*30, 31*). The technique described in the present study recreates the exact anatomic linkage of the normal ligament.

Between 15% and 25% of patellar dislocations recur after patellar realignment (*3*). Excessive passive laxity is the essential element in instability of the patellofemoral joint, and the role of extensor alignment and muscle forces is not clear (*15*). Proximal realignment, in casu medial plicature and lateral advance of the vastus medialis obliquus will not stabilise the patella in case of a condylar dysplasia or high riding patella, and in case of a femoral desinsertion or diffuse fraying of the MPFL (*10, 15, 32, 36*). To safeguard normal passive motion it is better to repair or reconstruct the torn ligamentous structures only in a unstable joint. Some authors (*15*) prefer awaiting primary healing of the MPFL. As this ligament is extrasynovial, unless a full-thickness capsular injury occurs, the MPFL tear may heal spontaneously. In chronic lesions, the MPFL is absent or very weakened and a semitendinosus plasty to limit the external displacement of the patella is to be preferred. A few techniques have been published using the semitendinosus tendon and medial patellar retinaculum plicature in children (*17, 28*). In the classic tenodesis (Galeazzi's technique) the semitendinosus is transfered to the inferior pole of the patella. This procedure provides a medial tether and effectively alters the net vector of the patellar tendon towards the medial side. However, this procedure does not
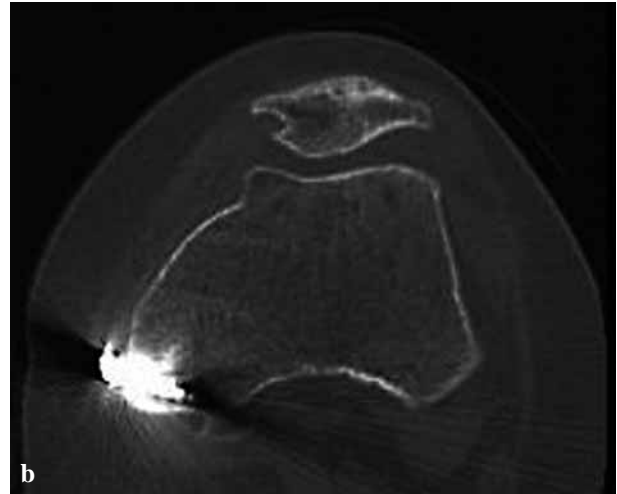
Fig. 3. — **a**) Preoperative axial CT-scan. Subluxation and abnormal congruence angle ; **b**) Postoperaticve CT-scan. Semitendinosus plasty and normal congruence angle.

restore the normal tracking of the patella (*5*).

The main advantage of our technique is the isometrical placement of the graft, avoiding knee flexion limitation or patella maltracking. In one study with human specimens it is shown that tracking of the patella was not completely restored after reconstruction of the MPFL alone (*34*). Tracking was markedly improved, especially in the early flexion where dislocation is thought most likely to occur, but the patella tended to be overconstrained in extension and underconstrained in flexion, probably because of non-isometric placement of the plasty.

Some authors have reported that distal realignment is unnecessary when proximal realignment is performed, while others suggest that failure to medialise the tibial tubercle adequately when the Q-angle is high has been correlated with unsatisfactory results (*9, 12, 14, 16, 22, 36*). We carry out a distal realignment in cases with a Q-angle over 25°, although this procedure only reduces the lateral force but does not decrease patellofemoral pressure (*20*). We perform a lateral release only if lateral tilt is present, to avoid iatrogenic medial patellar instability (*8*).

It is of interest that, although the outcome after medial patellofemoral ligament plasty was satisfactory and no recurrent dislocations were observed,

the congruence angle was not completely restored in many cases. Excessive tension applied to the plasty to restore the congruence would also cause an unacceptable flexion limitation as observed intra-operatively in the early cases of our series.

The technique of MPFL plasty is a simple and effective procedure for chronic patellar dislocation and is also indicated in cases of severe femoral dysplasia and marked laxity. It makes it possible to achieve a durable patellar stabilisation although it does not improve the patellofemoral congruence angle to normal values. Long-term studies are required to find out if this stabilisation is sufficient to prevent early osteoarthritis.

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