

[Orthopaedic Surgery]

Open Patellar Tendon Debridement for Treatment of Recalcitrant Patellar Tendinopathy: Indications, Technique, and Clinical Outcomes After a 2-Year Minimum Follow-up

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Background: Patellar tendinopathy can be treated surgically for patients that have failed at least 1 year of nonoperative treatment who continue to have debilitating symptoms. Patellar tendinopathy can cause significant functional deficits, yet little has been reported about the operative treatment of patellar tendinopathy.

Hypothesis: A combined arthroscopic and open surgical technique for the treatment of recalcitrant patellar tendinopathy results in an improvement in function and pain at a minimum 2-year follow-up. The purpose of this study was to present the indications, combined surgical technique, rehabilitation protocol, and the 2-year minimum follow-up results of the operative treatment of recalcitrant patellar tendinopathy.

Study Design: Retrospective case series.

Methods: A retrospective review was performed of all patients who underwent a surgical primary patellar tendon debridement for recalcitrant patellar tendinopathy by a single surgeon between July 1999 and December 2005. Every patient failed at least 1 year of nonoperative treatment. Patients were excluded from the study if they had previous open knee surgery. Validated patient-reported outcome scores were used to assess function and pain levels pre- and postoperatively (Lysholm, International Knee Documentation Committee, Tegner activity, and visual analog pain score).

Results: Thirty-four consecutive patients (37 consecutive cases) with mean follow-up 3.8 ± 1.6 years (range, 2-7.6 years) underwent the procedure with no complications. The mean age at surgery was 29 years (range, 14-51 years). Postoperatively, the visual analog score decreased by an mean of 6 points (range, 1 to -10, $P < 0.001$), and patients were able to return to their preinjury Tegner activity level. When asked if they were satisfied by the overall outcome of their surgery, 28 patients (82%) were completely or mostly satisfied with their surgical outcome on a particular knee; 6 (18%) were somewhat satisfied; and 2 (6%) were dissatisfied. Twenty-seven patients (79%) said they would have the surgery again.

Conclusion: The combined arthroscopic and open surgical technique described for chronic recalcitrant patellar tendinopathy successfully reduces knee pain and allows return to preinjury level of activity.

Keywords: patellar tendinopathy; microfracture; fenestration; clinical outcomes

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Ethical Board Review Statement: All human studies have been approved by the appropriate ethics committee and therefore have been performed in accordance with the ethical standards in the 1964 Declaration of Helsinki. All persons gave their informed consent before their inclusion in the study. All studies were carried out in accordance with relevant regulations of the US Health Insurance Portability and Accountability Act.

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WHAT IS KNOWN ABOUT THE SUBJECT

Surgical intervention for patellar tendinopathy is an effective treatment for patients that have failed at least 1 year of nonoperative treatment who continue to have debilitating symptoms.

ADDS TO EXISTING KNOWLEDGE

A combined arthroscopic and open surgical technique for the treatment of recalcitrant patellar tendinopathy results in an improvement in function and pain at a minimum 2-year follow-up. To the authors' knowledge, this study is unique in that it is the largest reported cohort of patients with patellar tendinopathy after a single surgical technique.

Patellar tendinopathy ("jumper's knee") presents as well-localized activity-related anterior knee pain. Those who engage in activities that repetitively load the patellar tendon (eg, jumping athletes) are at greatest risk. Patients complain of anterior knee pain exacerbated by sports activity, climbing/descending stairs, and/or prolonged knee flexion ("movie-theater sign"). Usually, pain onset is insidious, but some can associate symptom onset with a period of increased frequency, intensity, or duration of sports activity. Most localize pain to the inferior patella, and the most consistent physical examination finding is localized tenderness at the inferior pole of the patella. Pain can also be elicited at the inferior pole of the patella during a resisted straight-leg raise. A decline squat test loads the patellar tendon, reproducing the pain.^{2,12,18}

When Taunton et al examined running injuries, patellar tendinopathy was the fifth-most-common diagnosis, affecting 96 of 2002 patients (4.8% overall; 57% male, 43% female).¹⁵ Radiographic results are usually normal but may identify associated bony abnormalities (eg, severe Osgood-Schlatter or Sinding-Larsen-Johansson syndrome) or intratendinous calcification. Magnetic resonance imaging of patellar tendinopathy may show a thickened tendon with increased signal on T2-weighted images and a longer nonarticular patellar surface (ie, a longer lower patellar pole) as compared with controls.⁹ The use of imaging is questionable, since asymptomatic athletes can have patellar changes on both ultrasound and magnetic resonance imaging while symptomatic patients can present with normal imaging.^{8,12}

Nonoperative management typically includes relative rest, nonsteroidal anti-inflammatory drugs, corticosteroid injections (controversial) or iontophoresis, icing, extracorporeal shockwave therapy, platelet-rich plasma injections, and physical rehabilitation protocols. Surgery is usually considered only after a year of conservative management. There are a number of surgical techniques advocated, including open tenotomy with excision of macroscopic necrotic tissue, arthroscopic patellar tenotomy, drilling/resection of the inferior pole of the patella, resection of the tibial attachment with realignment and quadriceps bone-tendon graft, open or percutaneous longitudinal tenotomy, and percutaneous needling.¹²

PATIENTS AND METHODS

A retrospective review was performed of all patients who had a patellar tendon debridement performed by a single surgeon between July 1999 and December 2005. Patients were contacted by mail and in some cases by telephone after a minimum of 2 years. Patients were excluded from the study if they had previous open knee surgery. Clinically, patellar tendinopathy was diagnosed on the basis of (1) anterior knee pain exacerbated by activity and often by prolonged sitting, (2) localized pain at the inferior pole of the patella, and (3) tenderness to palpation at the inferior patellar pole. All patients were strongly encouraged to engage in a structured physical therapy rehabilitation protocol before considering surgery. Patients underwent patellar tendon debridement if they had symptoms for at least 1 year despite nonoperative treatment.

Thirty-four patients (37 knees) met the inclusion criteria and were contacted for final follow-up.

Statistical Analysis

Age, sex, and subjective outcome scores were analyzed to determine the mean and standard deviation of each set of data points. Preoperative and postoperative data were compared using a 2-tailed paired *t* test.

Patellar Tendinopathy Nonoperative Physical Therapy Protocol

Nonoperative treatment to manage pain and inflammation included ultrasound or iontophoresis and activity modification. The program includes stretching and strengthening of the quadriceps, hamstrings, iliotibial band, gastrocnemius, and hip musculature. Therapists made footwear/orthotic recommendations based on individual needs. For those who continued to have pain and functional impairment despite 1 year of aggressive nonoperative management, operative management was offered.

Surgical Technique

An inferolateral arthroscopic portal was established and systematic examination of the joint conducted, with all pathologic findings noted and recorded. If intra-articular pathology was discovered (eg, synovitis, adhesions, chondral flaps, or meniscal tears), it was addressed via instrumentation (eg, motorized shaver and arthroscopic punches) through an inferomedial portal. Via the inferomedial portal, a bipolar cautery device was used to perform a lysis of adhesions in the suprapatellar pouch and anterior interval of the tibia. The arthroscopic instruments were removed.

An Esmarch bandage was then used to exsanguinate the limb, and the thigh tourniquet was inflated to 280 mmHg. A midline longitudinal incision was made from the inferior pole of the patella distally for a distance of approximately 3 to 4 cm (the prepatellar bursa and any other fibrous tissue overlying the proximal tendon are excised sharply). The medial and lateral borders of the

Table 1. Rehabilitation protocol

Phase	Goals	Activities
Phase 1: 0-2 weeks	Wound healing	Quadriceps setting
		Heel slides
	Straight leg extension	
	Activation of quadriceps muscles	Sitting knee flexion
		Hip abduction
		Standing toe raises
Phase 2: 2-6 weeks		Ankle pumps
	Walk normally	Discontinue brace
	Full range of motion	Stationary bicycle
	Full muscle strength	Straight leg lift
		Short arc lift
Phase 3: 6-12 weeks		Standing hamstring curl
	Full range of motion	Walking/stairs
	Muscle strength	Swimming
		Wall slides
		Squat to chair
		Step-up-down exercise
		One-legged toe raises
Phase 4: 12 weeks		Hamstring, quadriceps, and calf stretches
	Run progression	Chair squat wall slide
		Advanced single-leg strengthening progression
		Hamstring curl
	Single-leg strengthening	

tendon were palpated, and a midline incision was made into the tendon itself at the level of the inferior pole. The thickened areas of tendinosis were sharply excised. Fenestrations were then performed throughout the remainder of the tendon to encourage a healing response. A surgical awl (Linvatec, Largo, Florida) was placed through the superior extent of the tendon incision to perform a microfracture of the inferior pole of the patella to stimulate new blood supply into the tendon itself. At least 3 microfracture sites were created on the nonarticular inferior patella.

The patient was weightbearing as tolerated with a brace locked in extension. Passive motion was permitted as tolerated. All patients followed the postoperative rehabilitation protocol (Table 1).

RESULTS

There were 37 consecutive patellar tendon debridements (34 patients) performed by a single surgeon from July 1999 to December 2005 with no complications (Table 2). The mean follow-up was 3.8 ± 1.6 years (range, 2-7.6 years). The mean age at surgery was 29 years (range, 14-51 years), with 22 males and 12 females. The mean age at symptom onset was 24 ± 10 years (range, 12-49 years). Seven patients (21%) were using narcotics, and 31 patients (91%) were using nonsteroidal anti-inflammatory drugs preoperatively for knee pain. Clinical and functional outcomes of patients that underwent an open patellar tendon debridement for recalcitrant tendinopathy are in Table 3.

Table 2. Patient demographics^a

Age at surgery (range), y	29 (14-51)
Sex, n	
Male	22
Female	12
Time from surgery to follow-up (range), y	3.8 (2-7.6)

^aN = 37 knees (n = 34 patients).

The Outerbridge classification system was used to grade the articular cartilage surfaces postoperatively. Patients with grade 3 changes had similar results to those with normal surfaces. One had mild patellofemoral osteoarthritis; 1 had minimal enthesopathy of the inferior pole of the patella; 1 had ossification at the patellar tendon attachments; and 4 had mild to moderate medial joint space narrowing.

During the diagnostic arthroscopy, 2 knees had lateral meniscal tears, and 2 knees had medial meniscal tears treated with a partial meniscectomy. Eleven knees (30%) had grade 3 cartilage changes on the patellar articular surface. Fifteen (41%) had complete or partially imperforate suprapatellar plica with adhesions in the suprapatellar pouch. Thirty-four knees (92%) had an infrapatellar plica with adhesions of the anterior interval. Five (14%) knees had a medial shelf plica.

At latest follow-up, 2 patients had returned to the operating room for further surgery on their operative knee. One patient had a painful, audible pop when flexing her knee. At 7 months postoperatively, she had an arthroscopic lysis of adhesions in the suprapatellar pouch and anterior interval. At 2.2 years postoperatively from her index surgery, she had a visual analog score of 8 (1 point higher than preoperatively), a 6-point decrease in Tegner activity score, a poor Lysholm grade, and an International Knee Documentation Committee score of 41. She was dissatisfied and would not have had surgery again.

At approximately 10 months postoperatively, another patient continued to have pain and decreased function. He went back for an arthroscopic lysis of adhesions in the suprapatellar pouch and anterior interval release. He was noted to have grade 2 change of the central trochlea. An open patellar tendon debridement was repeated. An inflamed bursa at the inferior pole was excised. The tendon was markedly thickened with a large central area of tendinosis that was excised. At 3.1 years postoperatively, he had a visual analog score of 5 (2 points lower than preoperatively), a 2-point decrease in Tegner activity score, a good Lysholm grade, and an International Knee Documentation Committee score of 57. He was somewhat satisfied with the results but would not have had the original surgery again.

Table 3. Clinical and functional outcomes of patients that underwent an open patellar tendon debridement for recalcitrant tendinopathy

Outcome Measure	Results
Visual analog scale	
Preoperative	7 ± 2 (range, 3-10)
Postoperative	2 ± 2 (range, 0-8)
Tegner	
Preoperative	6 ± 2 (range, 0-10)
Postoperative	6 ± 2 (range, 2-10)
International Knee Documentation Committee (postoperative)	80 ± 14 (range, 41-100)
Lysholm	
Good to excellent	28
Fair	6
Poor	1
Patient satisfaction, n (%)	
Completely/mostly satisfied	28 (82)
Somewhat satisfied	6 (18)
Dissatisfied	2 (6)

DISCUSSION

Although most patients with patellar tendinopathy will improve with nonoperative treatment, there is a subset of patients who do not respond. Patients with chronic patellar tendinopathy can be difficult to manage and are frequently frustrated by their inability to return to sports.

There are various open and arthroscopic techniques to surgically treat patellar tendinopathy. In 2000, Coleman et al reviewed 20 papers and 2 abstracts (1966-1999) on patellar tendinopathy surgery.³ The most widely reported procedure was open patellar tenotomy. Adjunct procedures included scarification ("bony curettage") or multiple drilling of the inferior pole of the patella, removal of bony outgrowths from the inferior tip of the patella, extensor mechanism realignment, and multiple longitudinal tenotomies. There was an 80% success rate for end-stage patellar tendinopathy irrespective of the surgical technique used.^{2,4,5,13,16} In 2007, another review

found a mean success rate of 87% (range, 50%-96%) with a mean percentage return to sport at 71% (range, 16%-91%). Higher success rates occurred without patellar bony work, paratenon closure, or postoperative immobilization.⁷

There is a high correlation of intra-articular knee pathology with chronic patellar tendinopathy.⁶ Open techniques have traditionally been the mainstay of operative management. Arthroscopy (alone or with open techniques) has recently been incorporated in the surgical treatment of patellar tendinopathy.^{1,3,10,11,14,17} Ten of these 36 cases (28%) had extensive synovitis.⁶ The 2 reviews found average success rates of 80% and 87%.^{4,7} The success rates of all-arthroscopic procedures range from 87% to 100%.^{3,10,11,17} The present success rates were 82% (the patient would have repeated the surgery) and 94% (were satisfied with the procedure).

The major weakness of this study is that it is a retrospective case series. Survey data were collected at the latest follow-up.

CONCLUSION

The combined surgical technique for patellar debridement provided overall excellent and good results. Patients who had a combined arthroscopic and open patellar tendon debridement for chronic patellar tendinopathy had pain relief, and the majority of the patients were able to return to their preinjury activity level after following the rehabilitation protocol.

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