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ORIGINAL ARTICLE

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Repair of partial patellar ligament avulsion during total knee arthroplasty using the Statak device

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Abstract The Statak is a suture anchor device used for attaching soft tissue to bone. This is a report on six knees in which this device was used to repair partial avulsion of the patellar ligament during total knee arthroplasty (TKA). The six patients were all women. The average age of the patients was 69 years. The diagnosis was osteoarthritis in three patients, rheumatoid arthritis in two, and steroid arthropathy in one. Three of the operations were revision arthroplasties. In all six cases, approximately half of the patellar ligaments were accidentally detached from the tibial tubercles during surgery, and were repaired using the Statak devices. The average length of follow-up was 3 years. The Knee Society knee score improved from an average of 15 points preoperatively to 87 points at the latest follow-up. The average total range of motion measured 104° before surgery and 108° at the latest follow-up. Three of the six knees operated on had no extensor lag. The suture anchor simplifies the secure fixation of the ligament to bone. The procedure can be performed easily and quickly. In our opinion, the Statak device has proven itself to be effective for the repair of partial patellar ligament avulsion during TKA.

Key words Avulsion · Patellar ligament · Suture anchor · Total knee arthroplasty (TKA)

Introduction

Rupture of a patellar ligament during total knee arthroplasty (TKA) is rare.[1–3] However, excessive tension on the patellar ligament during exposure can avulse the ligament partially or totally from the tibial tubercle. Careful surgical techniques are important to avoid this serious complication.

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The Statak (Zimmer, Warsaw, IN, USA) is a suture anchor device used for attaching soft tissue to bone.[4–9] Suture anchors were initially developed and promoted for use in shoulder repairs, but they have a large number of other potential applications.[6] This article reports our experiences of using this device for the repair of partial avulsion of the patellar ligaments during TKA. To our knowledge, no reports have advocated the use of the Statak device to treat partial patellar ligament avulsion during TKA.

Materials and methods

Six patients who had partial avulsion of the patellar ligament during TKA were treated at our hospital between January 1996 and December 1999. During this interval, 171 primary and revision TKAs were performed. The relative frequency of partial avulsion of the patellar ligament requiring repair at that time was 3.5% (6 out of 171 knees).

The six patients were all women. The average age of the patients was 69.0 years (range 60–78 years). The diagnosis was osteoarthritis in three patients, rheumatoid arthritis in two, and steroid arthropathy in one (Table 1).

A standard medial parapatellar approach was employed for exposure in all knees. Lateral retinacular release was necessary in four knees. All prostheses were fixed with cement except for the femoral component in case 2. Three of the operations were revision arthroplasties. Aseptic component loosening was the reason for all the revision operations. The patellae in this study were resurfaced in three primary TKAs and revised in two revision TKAs. Approximately half of the patellar ligament was detached accidentally from the medial aspect of the tibial tubercle at the time of surgery, and repaired using a Statak device to prevent continued propagation of the avulsion after surgery. The anchor was inserted into the aspect perpendicular to the bone surface according to the manufacturer's instructions. One horizontal mattress suture with preattached no. 2 braided polyester was used to repair the ligament. A screw-and-washer fixation was added to the repair in the first of

the six knees (case 1). Postoperatively, all patients wore a knee brace all day except during range-of-motion exercises using a continuous passive motion machine for 3 weeks. Cast immobilization was not used for any of these knees. Partial weight-bearing was permitted 2–4 weeks after the operation. The average length of follow-up was 35.8 months (range 24–53 months).

Results

The knees were evaluated according to the Knee Society clinical rating system[10] (Table 1). The average knee score was 15.3 points preoperatively, and 86.7 points at the latest follow-up. The function score improved from an average of 32.5 points preoperatively to 62.5 points at the latest follow-up. The average total range of motion measured 104° before surgery and 108° at the latest follow-up. Three of the six knees which were operated on had no extensor lag. A lag was defined as an inability to actively bring the knee to the same extension as was achieved passively. Quadriceps strength was graded by manual muscle testing before and after surgery. Five of the six patients had achieved excellent quadriceps strength at the final follow-up. There were no infections or other postoperative complications. Patella position was evaluated according to the method of Insall and Salvati.[11] Lateral radiographs showed normal patellar height before and after surgery. Differences of more than 0.08 in length of tendon/length of patella (LT/LP) ratio were not found before and after surgery in any of the knees. There was no evidence of component loosening at the latest radiographic evaluation.

Case report

Case 4 was a 72-year-old woman who was referred to our clinic because of severe pain in her left knee. The patient had received weekly intraarticular steroid injections for the past 8 years at another hospital. At the time of referral, a radiographic examination revealed severe varus deformity and an obvious bone defect (Fig. 1). She was unable to walk owing to knee instability. The knee score was three points and the function score was zero. TKA was performed in February 1998 using a Total Condylar III Knee (Johnson and Johnson, Raynham, MA, USA) combined with autogeneic bone grafting. Approximately half of the patellar ligament was detached from the tibial tubercle owing to fragility at the insertion caused by numerous steroid injections. The ligament was repaired using a Statak 5.2 anchor device. Secure fixation of the ligament to bone was confirmed after the repair. The patient wore a knee brace for 3 weeks, and partial weight bearing was permitted 4 weeks

Table 1. Patient data

	Case					
	1	2	3	4	5	6
Sex	Female	Female	Female	Female	Female	Female
Age at surgery (years)	68	60	70	72	68	78
Side	Left	Left	Right	Left	Right	Left
Diagnosis	OA	OA	OA	SA	RA	RA
TKA	Revision	Primary	Primary	Primary	Revision	Revision
Prosthesis	Kinematic rotating hinge	PFC PCR	PFCΣPCR	TC III	Deltafit PCR	PFCΣPCS
Size of the Statak model (mm)	5.0	5.0	3.5	5.2	5.2	5.2
Additional fixation	Screw and washer	–	–	–	–	–
Follow-up (months)	53	24	42	36	36	24
Knee score (points)						
Preop.	0	6	9	3	50	24
Postop.	74	80	94	100	87	85
Function score (points)						
Preop.	20	40	5	0	75	55
Postop.	55	80	70	65	60	45
Range of motion (°)						
Preop.	90	55	120	140	125	95
Postop.	120	60	105	125	135	100
Extensor lag (°)						
Preop.	30	20	25	15	5	10
Postop.	10	5	0	0	0	5
Quadriceps strength by MMT						
Preop.	3	4	4−	4	5	4
Postop.	4−	5	5	5	5	5

OA, osteoarthritis; SA, steroid arthropathy; RA, rheumatoid arthritis; TKA, total knee arthroplasty; PFC, Press-Fit Condylar; PCR, posterior cruciate retaining; TC, Total Condylar; PCS, posterior cruciate substituting; MMT, manual muscle testing

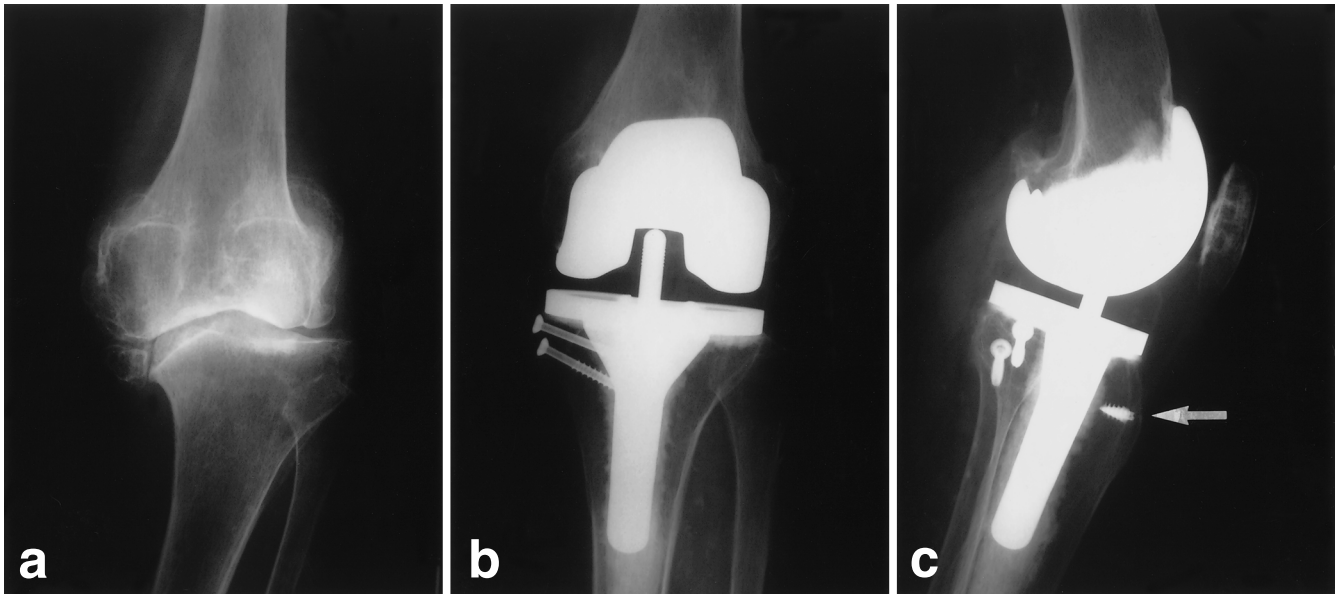

Fig. 1. **a** Anteroposterior radiograph of the knee of a patient (case 4), showing severe varus deformity and an obvious bone defect. **b**, **c** Anteroposterior and lateral radiographs of the knee 3 years after the operation, showing normal patellar height and no evidence of component loosening. The anchor of the Statak device can be seen in the tibial tubercle in the lateral radiograph (*arrow*). The medial tibial bone defect was reconstructed with an autograft of resected femoral bone fixed to tibial bone using two screws

postoperatively. Three years after the operation, the patient could walk with a cane. She had a passive range of motion from 0 to 125°. There was no extensor lag, and quadriceps strength was excellent. The knee score was 100 points and the function score was 65 points. Recent radiographs showed normal patellar height and no evidence of component loosening. The anchor of the Statak device can be seen in the tibial tubercle in the lateral radiograph (Fig. 1).

Discussion

Rupture of the patellar ligament has been reported to occur in 0.17%–1.4% of patients after TKA.[1] It is an infrequent but disabling complication associated with TKA. Several methods of treatment of this difficult problem have been described in the literature.[1–3,12] Operative techniques have included direct suture of the ligament,[3] staple fixation,[3] and reconstruction grafts.[2,3,10,12] However, it is best prevented by careful surgical techniques; extensive dissection of the tibial attachment of the patellar ligament should be avoided.[3]

Acute patellar tendon avulsion at the time of surgery is less common, but can occur more commonly in patients with rheumatoid arthritis and in more complicated TKAs, especially in knees with limited motion.[2] Complete rupture of the ligament did not occur in any of our cases, but six of the ligaments were approximately half detached accidentally from the tibial tubercles during surgery. Two of the six patients suffered from rheumatoid arthritis. Five of the six knees were complicated TKAs, three of which were revision arthroplasties, one was a markedly unstable knee due to steroid arthropathy, and one knee had a total range of motion of 55°.

The Statak device consists of a suture anchor with an attached suture assembled to a driver. The suture anchor is a self-drilling, self-tapping, threading device manufactured from titanium alloy. The suture is nonabsorbable polyester.[8] These devices, as well as being used in shoulder surgery, are also used for primary repair of rupture of the lateral collateral ligament of the ankle,[8] rupture of the patellar ligament,[9] and intraoperative disruption of the medial collateral ligament during TKA.[13] However, to our knowledge, no report exists on the repair of partial avulsion of the patellar ligament during TKA using the Statak device.

Several experimental studies on the failure strength of the Statak device have been reported.[4–7] Carpenter et al.[6] examined the pull-out strength of five suture anchors. These devices were tested to failure in human cadaveric proximal tibiae. In loadings perpendicular to the bone surface, the Statak was the strongest with a mean load at failure of 90.2 N. The results of this study indicate that a patellar ligament detached from the tibial tubercle can be securely fixed with the Statak device. Estimating the effectiveness of this device in preventing complete rupture of the patellar ligament after TKA is very difficult. This is because our study is not prospective or randomized. However, no cases of patellar ligament rupture after TKA have been seen at this hospital since this procedure started in 1996.

The Statak device simplifies the problem of obtaining secure fixation of the ligament to bone, and its small size allows it to be buried in the bone. The procedure can be performed easily and quickly. No extraction is necessary. However, a small metal anchor is actually left in the bone. This is made of titanium alloy, and the high cost is a problem.

We repaired partial avulsion of the patellar ligaments during TKA using the Statak device in six knees. The clinical results were considered to be successful at an average follow-up of 3 years. In our opinion, the Statak device has proved to be effective for this repair.

References

1. Cadambi A, Engh GA. Use of a semitendinosus tendon autogenous graft for rupture of the patellar ligament after total knee arthroplasty: a report of seven cases. J Bone Joint Surg 1992;74-A:974–9.
2. Emerson RH, Head WC, Malinin TI. Extensor mechanism reconstruction with an allograft after total knee arthroplasty. Clin Orthop 1994;303:79–85.
3. Rand JA, Morrey BF, Bryan RS. Patellar tendon rupture after total knee arthroplasty. Clin Orthop 1989;244:233–8.
4. Barber FA, Cawley P, Prudich JF. Suture anchor failure strength: an in vivo study. Arthroscopy 1993;9:647–52.
5. Barber FA, Herbest MA, Click JN. The ultimate strength of suture anchors. Arthroscopy 1995;11:21–8.
6. Carpenter JE, Fish DN, Huston LJ, Goldstein SA. Pull-out strength of five suture anchors. Arthroscopy 1993;9:109–13.
7. Craft DV, Moseley JB, Cawley PW, Noble PC. Fixation strength of rotator cuff repairs with suture anchors and the transosseous suture technique. J Shoulder Elbow Surg 1996;5:32–40.
8. Loder BG, Wertheimer SJ. Primary repair of lateral collateral ligaments of the ankle utilizing the mini-Statak device. J Foot Ankle Surg 1994;33:120–3.
9. Wada M, Tomonaga K, Taniguchi Y, Uematsu N, Okumura M, Egawa T. A case of rupture of the patellar ligament with Statak (in Japanese). Seikeigekatosaigaigeka 1993;42:1382–5.
10. Insall JN, Dorr LD, Scott RD, Scott WN. Rationale of the Knee Society clinical rating system. Clin Orthop 1989;248:13–4.
11. Insall J, Salvati E. Patella position in the normal knee joint. Radiology 1971;101:101–4.
12 Gustillo RB, Thompson R. Quadriceps and patellar tendon ruptures following total knee arthroplasty. In: Rand JA, Dorr LD, editors. Total arthroplasty of the knee. Rockville: Aspen; 1987. p. 41–7.
13. Leopold MSS, McStay C, Klafeta K, Jacobs JJ, Berger RA, Rosenberg AG. Primary repair of intraoperative disruption of the medial collateral ligament during total knee arthroplasty. J Bone Joint Surg 2001;83-A:86–91.