Arthroscopic inspection after the surgical treatment of patella fractures

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Abstract After the treatment of patella fractures the only way to evaluate healing at the articular surface before implant removal is through arthroscopy. The purpose of this study was to examine the healing potential of the cartilage. Arthroscopy was performed in 18 patients at the time of implant removal. The mean age of the patients was 42.1 years. The time elapsed from the index surgery to the arthroscopy and implant removal surgery was 12.9 months. During the arthroscopy, we inspected articular step-off, cartilage loss, and joint surface irregularities. Cartilage irregularities were observed in 13 of the 18 patients. Five patients had well-healed cartilage at the patellar surface. Although none of the patients had displacement at final follow-up X-rays, step-off was detected in two patients during arthroscopy. Our observation showed that cartilage lesions did not correlate with clinical and radiological evaluation. Despite good knee scores, we observed surface irregularities, chondral lesions, and fibrillation in most of the cases implicating subsequent patellofemoral arthritis.

Résumé La seule façon d'évaluer la cicatrisation de la surface articulaire après traitement de la fracture de la rotule est l'arthroscopie. Le propos de cette étude est d'examiner le potentiel de cicatrisation du cartilage. une arthroscopie a été réalisée chez 18 patients après fracture de la rotule au moment de l'ablation de matériel. L'âge moyen de ces patients était de 42,1 ans. Le temps écoulé entre la chirurgie et l'arthroscopie au moment de l'ablation de matériel a été

de 12,9 mois. Durant l'arthroscopie, le cartilage a été analysé surtout en terme d'irrégularités et de pertes de substances. des irrégularités cartilagineuses ont été observées chez 13 patients sur 18. 5 patients sur 18 ont un cartilage qui a parfaitement cicatrisé en surface. Cependant, aucun de ces patients n'avait de déplacement. A la fin du suivi radiologique, une marche d'escalier a été observée chez 2 patients sur les 18 ayant bénéficié de l'arthroscopie. nos observations permettent de montrer que la lésion cartilagineuse n'est pas corrélée à la symptomatologie clinique et radiologique. Cependant, des patients ayant un bon score au genou, peuvent présenter des irrégularités de surface cartilagineuse avec lésions chondrales de fibrillation dans la plupart des cas et peuvent à terme évoluer vers une athrose fémoro-patellaire.

Introduction

Patellar fractures constitute approximately 1% of all skeletal injuries [11]. Displacement of patella fragments and articular incongruence are the main indications for surgical treatment of these fractures. Tension-band wiring using AO principles has been the gold standard, although several other techniques involving combinations of K-wires, screws, and cerclage wiring have been reported [5, 7, 8].

The goal of operative fixation is to achieve an anatomical reduction of the articular surface and, through a stable fixation, allow the knee early motion. It is generally accepted that displaced fractures without significant comminution should be treated with anatomical reduction and stable internal fixation [5, 7, 8].

Patella fractures should be treated well to obtain normal knee function [5, 7, 8, 11]. Articular incongruity is the leading cause of post-traumatic arthritis of the patellofemoral

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joint [7]. Although an anatomical reduction is achieved during surgery, articular step-off, displacement, and cartilage loss can be commonly seen [7]. Such cartilage problems are the most important cause of patellofemoral joint arthritis after patella fractures and are not uncommon [7].

Functional and radiological results have been used to evaluate the success of the patella fracture management. The only way to evaluate healing at the articular surface after the treatment of patella fractures and before implant removal is via arthroscopic inspection. We performed arthroscopy at the time of hardware removal. The purpose of this study was to examine the healing potential of the cartilage in patella fractures.

Material and methods

Between June 2002 and April 2006, we treated 26 cases of patella fractures. Arthroscopy was performed in 18 patients at the time of implant removal. All patients provided written informed consent for this study. The format was recommended by our institution's review board for the use of human subjects. Twelve patients were male and six were female. The mean age of the patients was 42.1 years (range, 17–54). The left knees of ten patients and right knees of eight patients were treated.

The mechanism of injury was a fall on a flexed knee in 15 cases, car accident in two cases, and a small-caliber

Fig. 1 Lateral radiography of a patient with transverse patella fracture

handgun injury in 1 case (Table 1). One of the fractures was vertical (medial facet), five were transverse, and 12 of them were comminuted (Fig. 1). In index operation, all patients were treated by the tension-band wiring technique using AO principles (Fig. 2).

Controlled passive range of motion (CPM) and full weight bearing with an immobiliser type brace was allowed on the day following surgery. The initial range of motion was between 0° and 40° flexion on a CPM device. The flexion angle was increased 20–30° weekly, with the objective of

Table 1 Demographic of patients

Patient no.	Age	Gender	Affected side	Aetiology	Fracture type	Follow-up time (months)	Lysholm score
1	54	M	R	Fall	Vertical (Medial facet)	16	86
2	44	F	R	Fall	Comminuted	14	85
3	43	F	L	Fall	Comminuted	12	82
4	31	F	R	Car accident	Transverse	13	88
5	50	M	L	Fall	Comminuted	14	86
6	53	M	L	Fall	Comminuted	12	84
7	17	M	R	Car accident	Transverse	12	88
8	50	F	R	Fall	Comminuted	12	86
9	35	M	R	Gunshot injury	Comminuted	14	90
10	51	M	L	Fall	Comminuted	16	84
11	44	M	R	Fall	Comminuted	12	86
12	54	F	L	Fall	Comminuted	12	88
13	35	M	R	Fall	Transverse	13	90
14	34	M	R	Fall	Comminuted	12	86
15	50	F	R	Fall	Comminuted	12	90
16	36	M	R	Fall	Transverse	12	86
17	27	M	L	Fall	Comminuted	12	86
18	50	F	L	Fall	Transverse	12	82
Average	42.11111					12.88889	86.27778
Max	54					12	90
Min	17					16	82

Fig. 2 Anterior–posterior and lateral radiography of a patient who was treated by tension-band wiring technique using AO principles

full 90° flexion at 4 weeks. Active knee extension was allowed but quadriceps exercises against resistance were delayed to 6 to 8 weeks.

The time elapsed from index surgery to arthroscopy and implant removal surgery was 12.9 months (range, 12–16 months). On physical examination, patients revealed no knee instabilities. Neither non-union nor mal-union were observed in any of the cases. There were also no meniscus signs except in one patient. Medial McMurray was found positive on physical examination of a patient who suffered from medial knee pain. Arthroscopic meniscectomy was performed after the diagnosis of medial meniscus tear and implants were also removed at the same time. No knee joints

showed limitation of movement. Evaluation of patients was performed by Lysholm functional knee scores [6].

Arthroscopy was performed by using 4 mm, 30° scopes. Antero-lateral and anteromedial portals were used to examine the tibio-femoral joint including the trochlear groove. Supero-medial portals were used in every patient to examine the patello-femoral joint and especially the patellar joint surface. Superior-lateral portals were mostly used when there was a need for chondroplasty. Those two portals gave adequate vision for the evaluation of the patellofemoral joint. During arthroscopy, we inspected articular step-off, cartilage loss, and joint surface irregularities. Chondral lesions were classified according to the Outer-

Table 2 Surgical results

Patient no.	Age	Articular step-off at fracture site	Joint surface irregularity at fracture site	Cartilage lesion at trochlea
1	54	Not applicable (N/A)	Grade 3 lesion with fibrillation	Grade 3 lesion
2	44	N/A	Grade 2 lesion	Grade 2 lesion
3	43	N/A	Grade 3 lesion with fibrillation	Grade 1 lesion
4	31	N/A	N/A	N/A
5	50	N/A	Grade 3 lesion with fibrillation	Grade 3 lesion
6	53	N/A	Grade 3 lesion with fibrillation	Grade 1 lesion
7	17	N/A	N/A	N/A
8	50	N/A	Grade 2 lesion	N/A
9	35	Yes—2 mm	Grade 3 lesion with fibrillation	Grade 3 lesion
10	51	N/A	Grade 3 lesion with fibrillation	N/A
11	44	N/A	Grade 3 lesion with fibrillation	N/A
12	54	N/A	Grade 3 lesion with fibrillation	N/A
13	35	N/A	N/A	N/A
14	34	Yes—1 mm	Grade 3 lesion with fibrillation	Grade 3 lesion
15	50	N/A	Grade 2 lesion	Grade 1 lesion
16	36	N/A	N/A	N/A
17	27	N/A	N/A	N/A
18	50	N/A	Grade 3 lesion with fibrillation	N/A

Fig. 3 Arthroscopic view of patient who had well-healed cartilage at the patellar surface after the treatment of transverse patella fracture

bridge classification and the pathologies detected were treated by chondroplasty.

Results

At the time of hardware removal, the average knee Lysholm score was 86.3 (min. 82; max. 90). Surgical results of the arthroscopy are given in Table 2. Five patients (27.7%) had well-healed cartilage at the patellar surface (Fig. 3). Cartilage irregularities were observed in 13 patients (73.3%). Twelve had comminuted fractures. Three patients had grade 2 chondral lesions on the fracture line (Fig. 4a). The remaining ten patients had grade 3 chondral lesions with fibrillation (Fig. 4b). In eight knees (44.4%), there

Fig. 5 Arthroscopic view of a patient who had grade 3 chondral lesions and fibrillation on the trochlea facing the fracture side

were chondral lesions on trochlea facing the fracture side (Fig. 5; Table 1).

Although none of the patients had displacement at final follow-up X-rays, step-off was detected in two patients during arthroscopy. The first patient was a 34-year-old male with had a 1-mm step-off who had a comminuted patella fracture because of a sudden fall. At the proximal side of the fracture line on the joint surface was a grade 3 chondral lesion, and at the distal side a grade 2 chondral lesion was found. Fracture lines were filled with fibrous cartilage. The second patient who had a 2-mm step-off was a 35-year-old man who had a comminuted patella fracture because of a

Fig. 4 a Arthroscopic view of a patient who had grade 2 chondral lesions around the fracture line at the patellar surface after the treatment of a comminuted patella fracture. **b** Arthroscopic view of a

patient who had grade 3 chondral lesions with fibrillation around the fracture line at the patellar surface after the treatment of a comminuted patella fracture

Fig. 6 Arthroscopic view of a 35-year-old male patient who had 2-mm step-off. At the proximal and distal sides of the fracture line on the joint surface, grade 3 chondral lesions were found. Fracture lines were filled with fibrous cartilage

gunshot injury. At the higher and lower sides of the fracture line on the joint surface grade 3 chondral lesions were found. There was also significant cartilage fibrillation around the fracture lines and grade 3 chondral lesions on the trochlea facing the fracture side (Fig. 6). Chondroplasty was performed in all patients who had cartilage lesions and fibrillation.

Discussion

The goal in treating patellar fractures is to restore the continuity of the extensor mechanism and to anatomically reduce the joint surface [8, 11]. The aims of the treatment of these intra-articular fractures are anatomical reduction, stable osteosynthesis, and early mobilisation for prevention of the progression of secondary osteoarthritis [5, 7, 8, 11]. Failure to restore the contour of the articular surface results in post-traumatic arthritis [5]. Today, surgery is the first choice in the treatment of patella fractures [8, 11].

Various techniques of internal fixation have been recommended, including cerclage wiring, tension-band wiring with or without transfixing screws, external fixation, and percutaneous suture fixation [1, 2, 8, 9]. There is universal agreement that early joint motion after the treatment of patellar fractures requires a stable internal fixation either by arthroscopy-assisted or open surgery [1, 2, 10].

Patella fractures should be treated well to obtain normal knee function. Articular incongruity is the leading cause of post-traumatic arthritis of the patellofemoral joint [4, 5, 7, 8, 11]. Although an anatomical reduction is achieved, cartilage loss can commonly be seen [3]. Such cartilage problems are the most important cause of patellofemoral joint arthritis after patella fractures [5, 7, 11].

At inspection arthroscopy at the time of implant removal, cartilage lesions of various degrees was a common finding around the fracture side (seen in 13 patients [73.3%], 12 of which were comminuted fractures). We also observed cartilage fibrillation in most of the comminuted fractures (10/12) and concluded that they were formed as a part of regenerated fibrocartilage. In eight knees (44.4%), there were chondral lesions on the trochlea facing the fracture side. Those surface irregularities might create chondral lesions on the trochlea opposite the chondral lesion. On the other hand, they might have already existed before the patella fracture. Those cartilage lesions and fibrillation on the patellar surface did not cause prominent patellofemoral complaints in our patients at the end of follow-up. At the time of the arthroscopy, the average knee Lysholm score was found to be 86.3 (min. 82; max. 90).

In two patients, we saw step-off at the joint surface of the patella. The first patient had a 2-mm step-off because of a gunshot injury, and the second patient had a 1-mm step-off because of a sudden fall; both had comminuted patella fractures. Although we were not able to see either implant failure or fracture malalignment in the follow up X-rays, we observed step-off at inspection arthroscopy. Sometimes it is difficult to maintain the stability and joint surface regularity in comminuted fractures. This might be the reason why we see step-off in those cases. As was mentioned previously in literature, up to 2-mm step-off does not become a problem and can heal with fibrocartilage tissue. Consequently, those two patients had mild complaints at their patellofemoral joint.

If anatomical reduction of the articular surface is achieved, healing of hyaline cartilage occurs with a small amount of fibrous tissue. In five of our patients we were unable to find any surface irregularities around the fracture side. This might be because of lack of micro displacement and step-offs. All those patients had transverse fractures. Although none of the patients had displacement at final follow-up X-rays, step-off was detected at arthroscopic inspection. We can conclude that if there is a step-off on X-rays during the follow-up period, we might see more degenerated joint surface and fibrillation. We think that there is a good correlation from the step-off in X-rays and the degree of step-off in the arthroscopic surgery review. If we have a perfect X-ray we might know what to expect from prognosis.

Considerable information can be achieved by arthroscopy performed at the time of implant removal surgery in patella fractures. Until now, patella fractures have been evaluated clinically and radiologically. However, we were not able to obtain adequate information from the joint surfaces. By arthroscopy, we were able to see the lesions directly. Our observation showed that healing of the fracture line and cartilage did not correlate with clinical and radiological evaluation. Although those patients had

good knee scores, we observed surface irregularities, chondral lesions, and fibrillation in most of the cases.

Although we did not have enough cases or sufficient follow-up, we can say that surface irregularities can lead to patellofemoral joint arthritis. In our opinion and clinical impression, performing arthroscopy at the time of implant removal facilitates prediction of the clinical outcome of the patients. Those patients who had cartilage irregularities had mild or moderate complaints at their patellofemoral joints. Removal of the implants and performing chondroplasty at the same session diminishes the patellofemoral complaints of the patients and reduces the chance of arthritis formation. For that reason we favour arthroscopic chondroplasty at the time of implant removal to lessen the chance of cartilage degeneration.

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