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CASE REPORT

Osteochondral fracture of the knee treated with bioabsorbable implants in two adolescents

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We present two patients, respectively 14 and 18 years old, who sustained an osteochondral fracture of the weight-bearing part of the lateral femoral condyle, which was treated operatively with biodegradable self-reinforced polylactide rods. The first patient was operated 60 days after the injury, the second one on the third day. The clinical and functional results were good in both cases one year postoperatively. MRI showed a good bony union of the osteochondral fragments.

Keywords : knee injury ; osteochondral fracture, bioabsorbable implant.

INTRODUCTION

Metal pins, screws, bones, pegs as well as cyanoacrylate and bioabsorbable implants are generally used in the fixation of osteochondral fragments (*5,7,9,13-17*). Metal implants generally have to be removed in a second operation, particularly those used in weight-bearing bones and joints. Good results have been achieved in osteochondritis dissecans of the knee fixed with biodegradable self-reinforced polyglycolide (SR-PGA) and polylactide (SR-PLLA) rods (*5,15*).

We report two cases in adolescents with intra-articular osteochondral fractures of the weight-bearing part of the distal femur treated with SR-PLLA rods.

CASE REPORTS

Case 1

An 18-year-old boy climbed in May 2004 into a large empty waste container, which tipped over and hit his right knee. He was seen the next day in the emergency room with a painful and swollen knee. The radiographic evaluation showed an intra-articular fragment in the intercondylar region of the femur (fig 1). The knee joint was clinically stable.

An arthroscopy was performed the following day. There was a large osteochondral lesion in the posterolateral part of the weight-bearing region of the lateral femoral condyle, and the loose fragment was situated close to the anterior cruciate ligament. After an anterolateral arthrotomy the fragment (size : 20 mm × 50 mm) was fixed to the bed of the

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Fig. 1. — Case 1 : AP radiograph of the knee with displacement of the osteochondral fragment (arrow) from the lateral condyle of the femur.

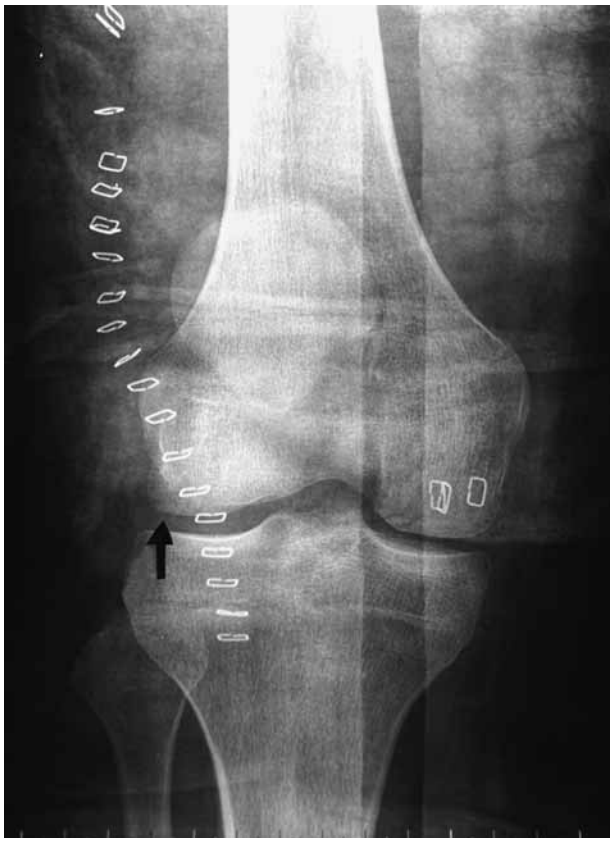

Fig. 2. — Case 1 : Postoperative AP radiograph of the knee. The arrow shows the fixed fragment.

lesion. The defect extended from the central line of the lateral condyle into the posterior part of the articular surface. Fixation was performed with five absorbable SR-PLLA-rods (2 mm in diameter and 30 mm in length, Biofix®, Bioscience Ltd, Tampere, Finland).

After surgery the knee was immobilised in an above-the-knee cast at 30° of flexion for two weeks and then in another leg plaster cast for two more weeks. After removal of the cast the patient started passive and active range-of-motion exercises.

Partial weight-bearing was allowed after four weeks, and full weight-bearing six weeks postoperatively. Postoperative radiographic examination one day after the surgery showed an excellent reposition of the fragment (fig 2).

The patient was re-examined clinically 7 weeks postoperatively and after 12 weeks by MR imaging (T1- and T2-weighted images). MRI showed the fragment to be in exact position, and there was evidence of healing in the lesion. However, the articular cartilage of the lesion was slightly thinner than in the surrounding area. The presence of absorbable rods was noted (fig 3).

The clinical findings were normal 14 weeks after operation (normal range of motion, no effusion, and good quadriceps function). However, the patient complained of occasional pain during activities. His BMI was 27.

After 14.5 months postoperatively a second MR imaging (T1- and T2-weighted images) was performed. The fragment was healed, the presence of

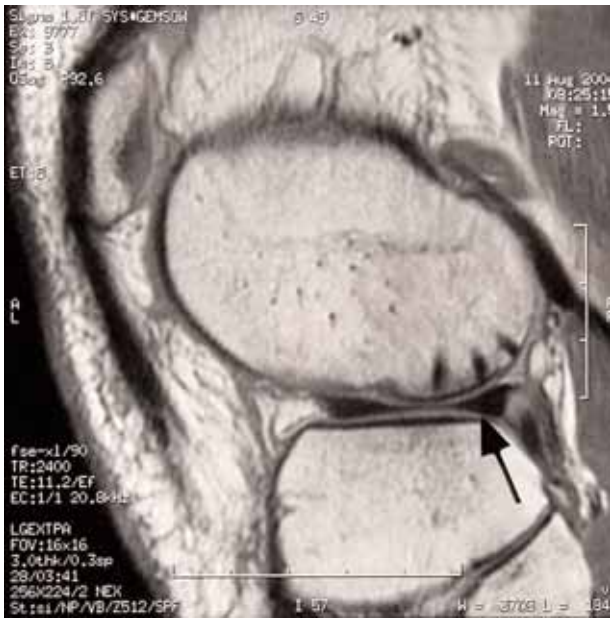

Fig. 3. — Case 1 : Bone union of the fragment (arrow) three months after the operation. Sagittal T1-weighted images reveal some oedema in the earlier fracture region. There is no sign of a significant lesion of the articular surface. The image shows three absorbable rods.

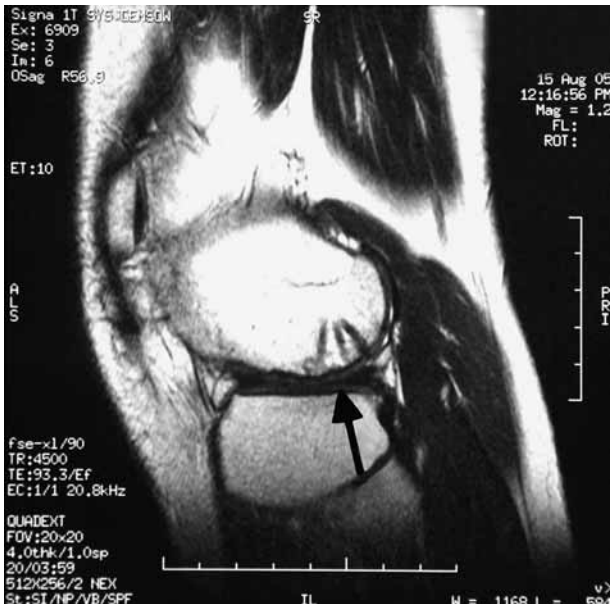

Fig. 4. — Case 1 : Bone union of the fragment (arrow) 14.5 months after the operation. Three rods are still visible in sagittal T1- and T2-weighted images. The cartilage is thinner than in the figure 3 with local osteoarthritis changes.

the absorbable rods was noted, and the cartilage was even slightly thinner than in the first MRI, with local osteoarthritic changes. However, the size of the cartilage and osteoarthritic changes were only less than 10 mm in diameter (fig 4).

The patient was re-examined clinically after 15.5 months postoperatively. The clinical findings were normal (ROM, no effusion, good quadriceps function). He complained occasionally of some discomfort during activities but no pain. The last clinical re-examination was performed 28 months postoperatively. The clinical findings were normal, and he considered the knee was as good as before the injury. His IKDC Subjective Knee Score was 69 (*4*). The decreased score was mainly due to his natural inactivity in sports.

Case 2

A 14-year-old boy was seen with a painful and swollen knee joint in June 2005 after jumping on a trampoline and incurring a valgus injury of the knee. The clinical and radiographic findings showed a small intra-articular osteochondral fragment associated with a patella dislocation. The radiographs did not indicate the location of the fracture. The patella view was normal. The primary treatment was conservative.

Because the knee joint did not achieve the normal range of extension the patient underwent a MR imaging (T1- and T2-weighted images), which showed a rupture of the medial retinaculum, the patella located on the lateral femoral condyle, a fracture in the lateral epicondyle of the tibia, a chondral fracture in the lateral part of the patella and an intra-articular fragment in the anterior part of the joint.

Sixty days after the injury an arthroscopic examination was performed. There was a lesion in the weight-bearing part of the lateral femoral condyle, and an osteochondral fragment was located in the lateral part of the joint. There was no chondral

lesion on the patella. After an anterolateral arthrotomy the loose osteochondral fragment (size : 15 mm × 20 mm) was fixed in the defect of the lateral femoral condyle with 4 SR-PLLA rods (3 rods measuring 1.5 mm in diameter and 30 mm in length and one rod measuring 2 mm in diameter and 20 mm in length, Inion OTPS™ Inion Ltd, Tampere, Finland).

During the operation two small chondral fragments situated between the lateral femoral condyle and the lateral synovium of the joint were removed. The patella was quite stable and no special treatment for the patella was performed. The postoperative plaster cast treatment was the same as in the first patient. Partial weight-bearing started after 4 weeks postoperatively and full weight-bearing 2 weeks later.

Four months postoperatively an MR imaging (T1- and T2- weighted images) showed healing of the osteochondral fragment (fig 5). The last MR imaging 13 months after surgery showed a good bone union of the osteochondral fragment. The chondral thickness was a little thinner than the surrounding cartilage but there were no degenerative changes (fig 6). The clinical outcome was excellent. The patient had a good ROM and no pain on his final follow-up. His IKDC score was 85. His BMI was 20.5.

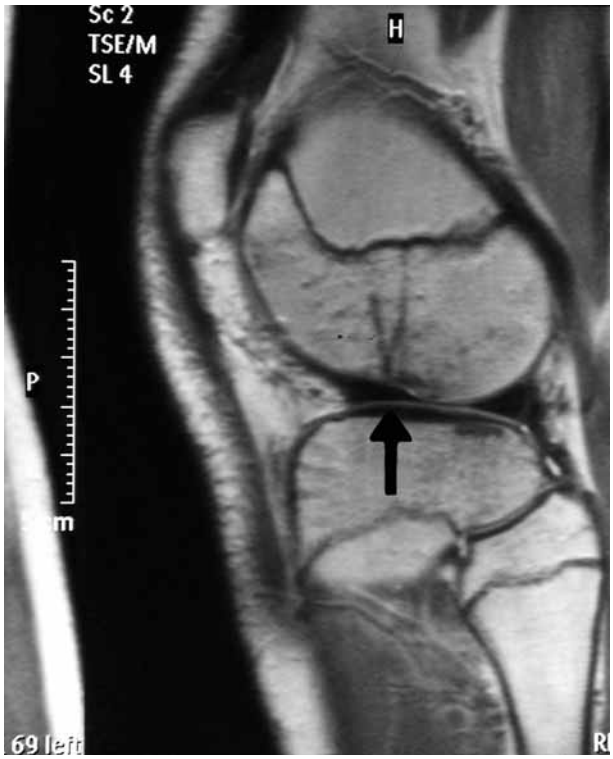

Fig. 5. — Case 2 : Sagittal T1- and T2- weighted images from the knee at four months postoperatively show bone union of the fixed fragment (arrow). The absorbable rods are visible. The images demonstrate oedema in the lateral condyle of the femur.

DISCUSSION

Clinical experience and experimental studies suggest that the success of chondral repair in osteochondral injuries depends to some extent on the severity of the injury as measured by the volume of the tissue or surface area of cartilage injured and on the age of the patient (*2,3*). Fractures heal more rapidly in children than in adults.

Recently, many new techniques have been developed to address osteochondral lesions, indicating that no single procedure is universally accepted. The goal in treating osteochondral fractures is to produce a smooth gliding articular surface of hyaline or hyaline-like cartilage.

Smillie (*13*) was the first author to publish the results of reposition and internal fixation of osteochondral fragments in the knee.

Bioabsorbable self-reinforced fracture fixation implants were introduced into clinical work in 1984 (*16*). At first they were made of SR-PGA, followed by SR-PLLA in 1988. When implanted *in vivo* these will loose their shear-strength in five to six weeks and 24 to 36 weeks, respectively (*6*). The implant will then slowly bioabsorb by hydrolysis and enzymatic reactions. In a recent study of 2,114 patients treated with bioabsorbable osteosynthesis devices the infection rate was 0.7% for pure PLLA implants (*12*).

We used totally bioabsorbable rods for fixation in both patients. The first author (PL) has used SR-PGA and SR-PLLA devices from the 1990s in many patients (children and adults) with intra-articular fractures, and the experience has been good. Healing of the bone was also achieved in this study.

Fig. 6. — Case 2 : Sagittal T1- and T2-weighted images 13 months postoperatively shows bony union of the fragment (arrow). The rods are still visible. The images show no oedema and no osteoarthritic changes of the cartilage surface.

In the second patient there was a delay in the operative treatment. The primary diagnosis was patella dislocation, and the radiographs showed an intra-articular fragment. However, the radiograph did not show the origin of the fragment. Because the patella was radiographically normal, the treatment choice was conservative. An early MR imaging would have led to the right diagnosis. In this case the osteochondral lesion was in the weight-bearing part of the lateral femoral condyle. Osteochondral fractures of the lateral femoral condyle are uncommon injuries, and they can occur with patella dislocation (*8*). This possibility should be kept in mind. On the other hand, Sanders *et al* have shown that, after transient lateral dislocation of the patella, osteochondral lesions of the lateral femoral condyle are common MRI findings (*11*).

Our follow-up results were clinically good as were the functional results.

We used the International Knee Documentation Committee Subjective Knee Form (IKDC), because it is a reliable and valid measure of symptoms, function, and sports activity in patients with a variety of knee conditions, including ligament and meniscal injuries, articular cartilage lesions, osteoarthritis, and patellofemoral pain (*4*). The mean score according to the normative data (United States) for men aged 18 to 24 years was 89 ± 18, and 82 (SD : 22 ; range : 2 to 100) for the entire sample (5,246 knees) (*1*).

We started with early weight-bearing and active rehabilitation. According to a recent paper it may be better to delay the return to full weight-bearing when the subchondral or osteochondral injury is large or severe to prevent further collapse of subchondral bone and degenerative changes (*10*). Long-term prospective studies are necessary to determine whether or not delayed weight-bearing can prevent or lessen posttraumatic osteoarthritis.

CONCLUSIONS

Traumatic osteochondral fractures in the knee in adolescents and adults present in many cases a difficult challenge. The correct diagnosis may be difficult without MRI. If the lesion is located in the weight-bearing articular surface, operative treatment with open reduction and internal fixation or arthroscopic fixation is necessary. We recommend re-fixation of the fragment with bioabsorbable implants. We also recommend the postoperative use of MRI controls in order to assess the final recovery of the articular cartilage. Posttraumatic cartilage abnormalities cannot be detected on plain radiographs. Correct diagnosis of a posttraumatic osteochondral lesion does affect the later prognosis of the joint.

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