Case Report

Donor-Site Morbidity After Osteochondral Autograft Transfer Procedures

Robert F. LaPrade, M.D., Ph.D., and Jesse C. Botker, M.D.

Abstract: We report on 2 patients who had donor-site morbidity after an autogenous osteochondral grafting was performed. Both patients had fibrocartilage hypertrophy at the donor sites that contributed to knee pain and occasional locking; the second patient also had a lack of fibrocartilaginous regrowth with symptomatic residual osteocartilaginous defects. Additional arthroscopic surgery was required in both cases to trim the fibrocartilage. In addition, for the second case, a fresh osteoarticular allograft was used to transfer osteocartilaginous plugs back into the original knee donor sites due to continued knee pain. When performing an osteochondral autograft transfer, the benefits provided at the recipient site must be weighed against the possible donor-site morbidity that may result. **Key Words:** Donor-site morbidity—Osteochondral autograft—OATS—Mosaicplasty—Osteochondral allograft.

Symptomatic focal articular cartilage defects are difficult to treat and are often disabling. Osteochondral autogenous transfers are relatively new techniques[1-4] that transfer an osteochondral plug from areas of decreased weight bearing on the outer aspects of the trochlear groove, or along the intercondylar notch, to areas of symptomatic focal, full-thickness articular cartilage lesions. Donor sites are left to heal and are reported to fill in with bone and dense fibrous tissue.[5] Donor-site morbidity is an obvious concern as the smooth hyaline articular cartilage in these areas is eventually replaced with fibrocartilage. However, to our knowledge, there have been no reports in the literature describing complications seen at these donor sites. We present 2 cases of osteochondral autogenous grafting that required additional surgery for problems related to donor-site pain and dysfunction.

From the Sports Medicine and Shoulder Divisions, Department of Orthopaedic Surgery, University of Minnesota, Minneapolis, Minnesota, U.S.A.

Address correspondence and reprint requests to Robert F. LaPrade, M.D., Ph.D., Department of Orthopaedic Surgery, University of Minnesota, 2450 Riverside Ave, R200, Minneapolis, MN 55454, U.S.A. E-mail: lapra001@umn.edu

0749-8063/04/2007-4217$30.00/0

doi:10.1016/j.arthro.2004.06.022

CASE REPORTS

Case 1

An 18-year-old white female student presented with a dislodged left talar dome osteochondritis dissecans lesion that had caused her considerable ankle pain for more than 10 years. After obtaining a magnetic resonance imaging arthrogram of her ankle, the decision was made to proceed with an osteochondral graft transfer (mosaicplasty) harvested from the superior aspect of the lateral trochlear groove of the left knee to her left ankle. The patient noted that she had no previous left knee problems.

A 3-cm arthrotomy was performed just distolateral to the vastus lateralis attachment on the patella to harvest the donor plugs. The superior aspect of the lateral trochlear groove was exposed and six 3.5-mm diameter osteochondral plugs were obtained with a depth of 15 mm. The plugs were placed into the prepared recipient sites at the talar dome and the incision was closed, leaving the donor sites to heal on

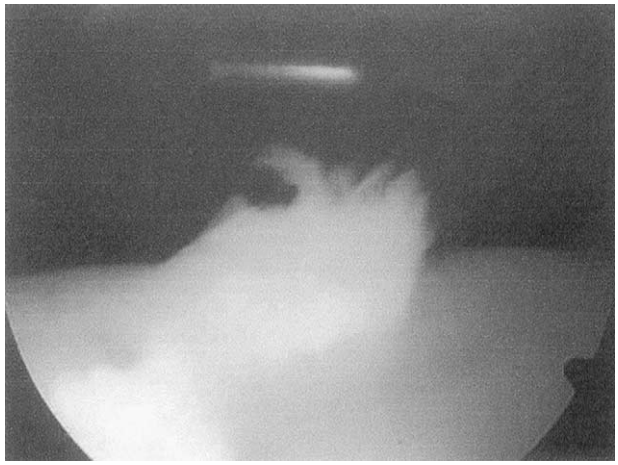

FIGURE 1. Hypertrophic fibrocartilage scar tissue seen at the superior aspect of the lateral trochlear groove at an autogenous 3.5-mm osteochondral donor site (arthroscopic view, left knee).

their own. Postoperatively, the patient was placed on a strict, non–weight-bearing protocol for 6 weeks with the use of continuous passive motion during this period for 10 hours per day. After the 6-week period, the patient was advanced to minimal weight bearing with the use of crutches for an additional 3 weeks and then weaned off crutches once she no longer had a limp.

On subsequent visits to the clinic, the patient complained of left knee pain that was worse than the pain in her left ankle. Physical examination revealed a mild knee effusion with a knee range of motion of 0° to 130°. There was no pain with patella tracking or attempted lateral subluxation, but she did have crepitation with translation of the patella over the lateral aspect of the trochlear groove in the area of her donor sites. The patient was encouraged to continue quadriceps strengthening on a home exercise program.

After 11 months of continued pain and swelling of her left knee, a magnetic resonance imaging scan was obtained, which was unremarkable. The decision was made to proceed with a diagnostic arthroscopy of the left knee to examine the donor grafting areas, because of her pain and persistent crepitation on physical examination. The articular cartilage surface of her patella, medial and lateral femoral condyles, as well as the medial and lateral tibial condyles were normal. The lateral aspect of the superior trochlear groove from which the grafts were taken had a large hypertrophic scar mound over 2 donor sites (Fig 1). A shaver was used to debride the area of hypertrophic fibrocartilage scar tissue to a flush stable rim. The patient was placed on crutches postoperatively for a 2-week period and then underwent rehabilitation. At the latest follow-up 2 years after arthroscopy, the patient had a full range of motion and no pain in her left knee with normal activity. Physical examination no longer revealed crepitation over her previous donor areas.

Case 2

A 35-year-old white male truck driver originally injured his right knee after jumping out the back of his truck in March 1999. The original extent of his injury included an anterior cruciate ligament (ACL) tear, a small posterior-horn medial meniscus tear, and a large chondral defect of the medial femoral condyle. At a different institution, the patient received a partial medial meniscectomy and a debridement of the ACL stump. Postoperatively, he continued to have pain and instability. He was taken back to surgery in June 1999 and an osteochondral transfer procedure was performed for the right medial femoral condyle with five 10-mm plugs from the medial and lateral aspects of the trochlea. After the second surgery the patient's knee remained symptomatic.

The patient first presented to our clinic in January 2000. The patient had a right knee varus deformity with stance and on long-leg alignment radiographs. The weight-bearing axis was through the midpoint of the medial compartment. The patient's range of motion was 0° to 130° and his knee exhibited no varus or valgus instability. He had a 2+ Lachman and pivot shift, as well as pain, but no crepitation, over his medial femoral condyle. We recommended proceed-

FIGURE 2. Original donor area of a 10-mm autogenous osteochondral donor site with exposed bone and no fibrocartilaginous filling seen at the distal aspect of the medial femoral trochlear groove (arthroscopic view, right knee).

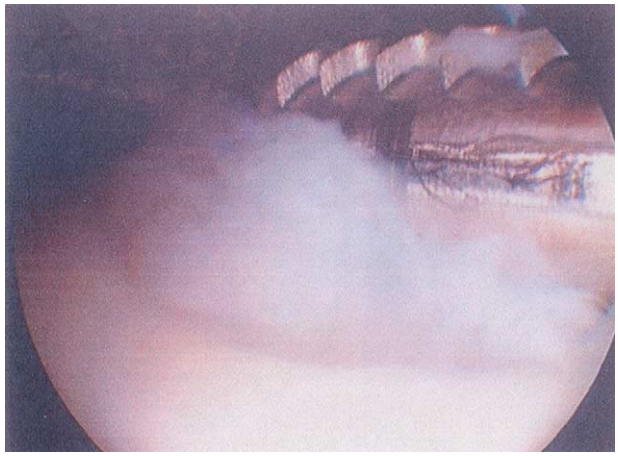

Figure 3. Hypertrophic scar tissue found at the superolateral trochlear groove from a 10-mm autogenous osteochondral donor site (arthroscopic view, right knee).

ing with an opening wedge proximal tibial osteotomy to first correct the patient's genu varum, while also performing arthroscopy to evaluate the status of his medial compartment osteochondral grafting.

Arthroscopic findings of his right knee included evidence of the previous osteochondral transfer procedure grafts on the medial femoral condyle. On probing, this area had 5 intact and firm articular cartilage grafts that measured approximately 1 cm in diameter and appeared to be well incorporated. Next, 4 of the 5 donor sites of the osteochondral transfer procedure were seen to have abnormal fibrocartilaginous filling. The first area was on the distal aspect of the medial femoral trochlear groove, which was an area of exposed bone with no fibrocartilage filling in the defect (Fig 2). The next area was on the superior aspect of the lateral trochlear groove, which had significant fibrocartilage hypertrophy. Several large flaps of fibrocartilage extended from this area. The final donor sites were distal to this. These 2 sites had incompletely filled fibrocartilage bases, which were stable on probing. After examination of the donor site areas was complete, the hypertrophied cartilage at the superolateral trochlear groove was debrided tangentially with an arthroscopic shaver until a stable base was reached while preserving the remaining rim of articular cartilage (Fig 3). The articular cartilage of the patella was noted to be normal. The patient was placed on a non–weight-bearing protocol with the use of crutches for 8 weeks until the proximal tibial osteotomy had sufficiently healed. He received daily continuous passive motion treatments for a minimum of 10 hours per day.

On subsequent follow-up visits, the patient continued to experience pain and catching that had localized to the anterior and lateral aspect of his knee with stair walking, squatting, and walking uphill. There was no further pain over the medial compartment of his knee. It was believed that the catching and pain were caused by the cartilage lesions present at the donor sites. Physical examination revealed pain with translation of the patella in the trochlear groove and a feeling like the patella was falling into a pothole defect. This was found to reproduce the patient's pain. It was decided at this time to bring the patient back to surgery to reconstruct his ACL (to provide stability of his knee) as well as fill in his symptomatic donor sites with fresh

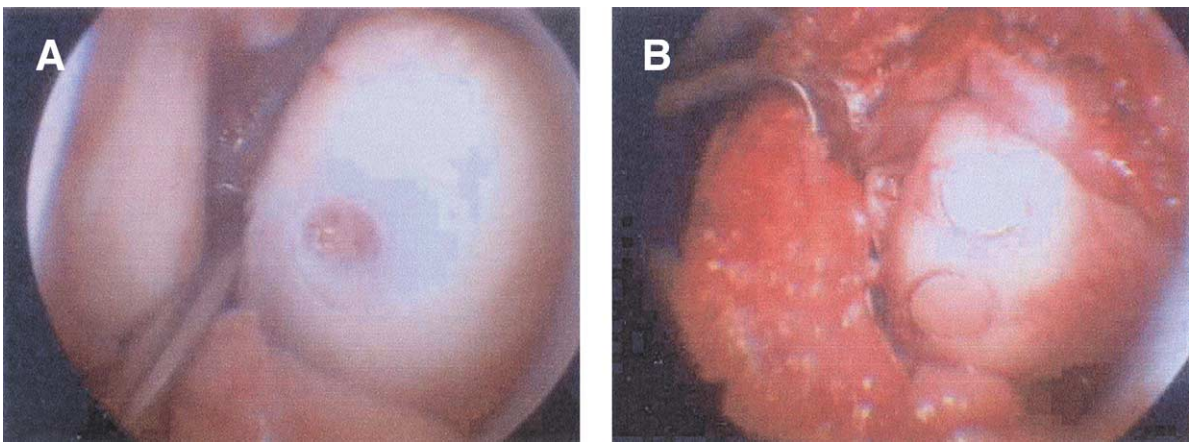

Figure 4. (A) One 10-mm autogenous osteochondral donor-site lesion at the superolateral trochlear groove before grafting (at arthrotomy, right knee). (B) Two previous autogenous osteochondral donor sites at the superolateral trochlear groove after grafting with 10-mm fresh osteoarticular allograft plugs (at arthrotomy, right knee with an increase in knee flexion to show proximal grafts).

osteoarticular allografts, once his osteotomy had healed 6 months postoperatively.

The examination under anesthesia revealed retropatellar crepitation with translation of the patella in the trochlear groove and 2+ Lachman and pivot shift tests. An uncomplicated endoscopic ACL reconstruction was performed using a central third patellar tendon autograft after hardware removal. A medial parapatellar arthrotomy was then performed and the 4 abnormal donor sites were identified (Fig 4A). Four 10-mm diameter plugs with 15-mm depths were obtained from the fresh donor osteochondral allograft and inserted flush into the recipient sites (Fig 4B). After smooth tracking of the patella was noted with both flexion and extension of the knee, and also medial and lateral translation of the patella, the incision was closed. The patient was non–weight-bearing for 6 weeks and was placed into a continuous passive motion machine for 10 hours per day. After the 6-week period, the patient was rehabilitated based on his ACL reconstruction.

At the last follow-up 2 years after his ACL reconstruction and donor-site osteochondral allografting, the patient had returned to work driving a dump truck with no sequelae and he had marked improvement in his knee compared with his preoperative status. Physical examination revealed a range of motion of 3° to 135° with 1+ Lachman and a stable end point. Translation of his patella over the donor sites revealed no crepitation or irritation. Radiographs showed good bony incorporation of the fresh allograft recipient sites.

DISCUSSION

Osteochondral autograft transfer procedures involve taking small-sized cylindrical grafts ranging from 2.7 to 10 mm in diameter (OATS—Arthrex, Naples, FL; Mosaicplasty—Smith & Nephew Endoscopy, Andover, MA; COR—Mitek, Norwood, MA) from areas of decreased weight bearing of the knee and transferring them to prepared recipient defect sites. The grafts are press-fit into slightly larger recipient sites and inserted to the level of the native articular cartilage.[4,6-9] The donor sites are left to heal on their own and have shown the ability to fill in with cancellous bone and fibrocartilage.[5]

It has been reported that these osteochondral donor sites have minimal to no weight bearing and thus would have little influence on a patient's function once they have healed.[4] However, a study by Simonian et al.,[10] found that the recommended harvest sites at the lateral femoral condyle and intercondylar notch showed significant contact pressures, which could potentially lead to degenerative changes, and associated pain and swelling over time at these donor sites.

Discussion of donor-site morbidity after an osteochondral autogenous transfer procedure is virtually nonexistent in the literature. The only mention is a case report discussing loose bodies found in the joint space. The authors reported that the bone core taken from the osteochondral defect that they had inserted into the donor site had dislodged postoperatively from the donor site.[6] An experimental animal study looked at the effects of delayed and incomplete spontaneous healing seen in untreated osteochondral defects and found that defects that extended to 9 mm prevented spontaneous healing in horses.[11] To our knowledge, there has been no mention in the literature of complications with fibrocartilage overgrowth as seen in our 2 patients.

Autogenous osteochondral transfer procedures appear to be clinically effective treatments for full-thickness articular cartilage lesions.[1,7,8,12] However, as we have reported, donor-site morbidity from these procedures does occur and can cause patient morbidity. A careful assessment of the location, size, and number of donor plugs for autogenous osteochondral transfers must be made, along with close follow-up of these donor sites postoperatively, to both minimize the chance of donor-size morbidity and also to recognize and treat it once it occurs.

REFERENCES

1. Horas U, Pelinkovic D, Herr G, Aigner T, Schnettler R. Autologous chondrocyte implantation and osteochondral cylinder transplantation in cartilage repair of the knee joint. *J Bone Joint Surg Am* 2003;85:185-192.
2. Bobic V. Arthroscopic osteochondral autograft transplantation in anterior cruciate ligament reconstruction: Preliminary clinical study. *Knee Surg Sports Traumatol Arthrosc* 1996;3:262-264.
3. Hangody L, Kish G, Karpati Z, Udvarhelyi I, Szigeti I, Bely M. Mosaicplasty for the treatment of articular cartilage defects: Application in clinical practice. *Orthopedics* 1998;21:751-756.
4. Matsusue Y, Yamamuro T, Hama H. Arthroscopic multiple osteochondral transplantation to the chondral defect in the knee associated with anterior cruciate ligament disruption. *Arthroscopy* 1993;9:318-321.
5. Ahmad CS, Guiney WB, Drinkwater CJ. Evaluation of donor site intrinsic healing response in autologous osteochondral grafting of the knee. *Arthroscopy* 2002;18:95-98.
6. Kim SJ, Shin SJ. Loose bodies after arthroscopic osteochondral autograft in osteochondritis dissecans of the knee. *Arthroscopy* 2000;16:E16.
7. Hangody L, Fules P. Autologous osteochondral mosaicplasty for the treatment of full-thickness defects of weight-bearing joint: Ten years of experimental and clinical experience. *J Bone Joint Surg Am* 2003;85:25-32.

8. Hangody L, Kish G, Karpati Z, Szerb I, Udvarhelyi I. Arthroscopic autogenous osteochondral mosaicplasty for the treatment of femoral condylar articular defects. *Knee Surg Sports Traumatol Arthrosc* 1997;5:262-267.
9. Outerbridge HK, Outerbridge AR, Outerbridge RE. The use of a lateral patellar autologous graft for the repair of a large osteochondral defect in the knee. *J Bone Joint Surg Am* 1995; 77:65-72.
10. Simonian PT, Sussmann PS, Wickiewicz TL, Paletta GA, Warren RF. Contact pressures at osteochondral donor sites in the knee. *Am J Sports Med* 1998;26:491-494.
11. Convery FR, Akeson WH, Keown GH. The repair of large osteochondral defects: An experimental study in horses. *Clin Orthop* 1972;82:253-262.
12. LaPrade RF, Swiontkowski MF. New horizons in the treatment of osteoarthritis of the knee. *JAMA* 1999;281:876-878.