BioPoly® RS Knee Case Report

Treatment of a focal osteochondral defect at the knee with a cemented BioPoly® RS implant

Craig G. Tinning, BSc (Med Sci), MBChB, MRCS(Ed) – Department of Orthopedic and Trauma Surgery, Ninewells Hospital, Dundee, UK

Martin Logan, BSc(Hons), MBChB, MRCS(Glas, Eng), MD, FRCS (Tr&Orth) – Harley Street Knee Clinic, 78 Harley Street, London, UK

INTRODUCTION

The management of focal, full-thickness osteochondral defects in middle-aged knees remains problematic. The challenge is to preserve healthy bone, cartilage and soft tissues in an active population for whom the revision rate with conventional knee arthroplasty is high [1]. We report a case in which a large, traumatic osteochondral defect was treated by implantation of a novel focal resurfacing device, the BioPoly® RS Knee System (BioPoly® LLC, Fort Wayne, IN). The BioPoly® RS implant is designed for replacement of focal chondral and osteochondral defects of the femoral condyles. The bearing material is a microcomposite of ultra-high molecular weight polyethylene (UHMWPE) and cross-linked hyaluronan attached to a titanium alloy (Ti-6Al-4V) stem. No previously published reports describe post-operative outcome following implantation of the BioPoly® RS implant.

CASE PRESENTATION

A 46-year-old man presented to hospital with a painful, locked right knee and difficulty weight-bearing following a game of squash where he lunged forward and heard a ‘crack’ in his knee. The knee had previously been asymptomatic. Clinical examination revealed a knee mechanically locked at 20 degrees with a tense effusion and medial joint pain preventing full weight-bearing. Pre-operative Modified Cincinnati knee score [2] was 32.

MRI revealed a 20mm (long) x 12mm (wide) x 8mm (deep) unstable osteochondral lesion from an old osteochondritis dissecans lesion at the medial femoral condyle (Fig. 1-A, B). At arthroscopy, the lesion was non-viable and was removed. The base and edges of the lesion were curetted back to stable and viable tissue. The medial meniscus and tibial plateau were noted to be well preserved.

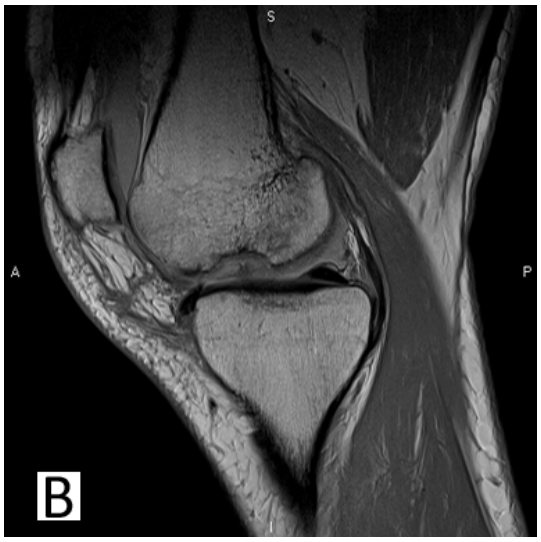

Fig. 1. A, B. Pre-operative MRI images of patient's right knee showing a deep osteochondral lesion at the medial femoral condyle: (A) coronal and (B) sagittal

DISCUSSION

Arthroscopic debridement and removal of a symptomatic loose osteochondral fragment in the knee is the least complex surgical option but long term clinical results have been poor and more aggressive strategies are recommended [3]. Wright et al reported good or excellent results in only 35% of knees with a mean follow-up of 8.9 years following fragment excision [3].

Microfracture recruits mesenchymal stem cells from bone marrow into the lesion by perforation of the subchondral plate. Although some authors have reported good to excellent long-term results, outcomes have been less promising in older patients and the treatment of larger lesions. Asik et al reported the outcomes of 90 patients (average age 34.5 years) with focal full-thickness articular cartilage lesions treated with microfracture [4]. They observed poorer functional results in patients older than 35 years and when the size of the lesion treated was >2cm2.

Autologous chondrocyte implantation (ACI) is a cell-based technique involving arthroscopic harvest, in-vitro cell culture and subsequent implantation of cultured chondrocytes into cartilage deficient areas. Although early reports were promising, age (>41 years) has a strong negative influence on functional outcome following ACI at the knee [5]. Further limitations include the need for 2 operations, one for tissue harvest and a second for cell implantation.

Osteochondral autograft transplantation (mosaicplasty) involves the harvesting of osteochondral plugs from non-weight-bearing peripheral areas of the knee and implantation into the osteochondral defect by press-fit. Hangody and Fules reported a large series of 831 mosaicplasties performed for Outerbridge grade III or IV osteochondral defects [6]. Good to excellent results were found in 92% of femoral lesions treated. Lesions included in Hangody's study were smaller than described in our case report, covering an average area of 1cm2. To our knowledge, the majority of outcome studies reporting the results of mosaicplasty have included patients younger than we describe in this report. The efficacy of mosaicplasty in patients older than 40 years with large osteochondral defects has yet to be established in long term outcome trials.

Osteochondral allograft transplantation involves the transplantation of cadaveric graft, including hyaline cartilage and subchondral bone, into an osteochondral defect. The allograft bone provides structural support and is gradually replaced by creeping substitution. Advantages include a single stage procedure and no donor site morbidity. In a prospective cohort study including 60 patients with traumatic osteochondral defects at the knee, Gross et al reported 95% fresh femoral allograft survival at 5 years and 85% survival at 10 years [7]. However, functional results were not as impressive with only 61% of patients achieving a good or excellent score at mean 10 years follow-up. The average patient age was 27 years, significantly younger than the patient described in our report. Further disadvantages of allograft techniques include limited availability of cadaveric grafts and the potential for immunological rejection and disease transmission.

The procedures outlined above were designed primarily to avoid prosthetic joint arthroplasty in young, active patients. The National Joint Registry for England and Wales reported the seven-year revision rate for those aged under 60 years with a cemented knee replacement as 7.5% compared with 2.6% in patients aged 70 years or over [1]. Reports of focal femoral condyle resurfacing using implants with a cobalt-chrome articular surface have been promising with 62% excellent and 24% very good or good patient rated outcomes at mean follow-up of 5.3 years [8]. Nonetheless, with potential for damage to opposing articular surfaces, there are no long-term studies that evaluate a focal resurfacing implant with a metal articulating surface.

The BioPoly® RS knee system is a focal femoral condyle resurfacing implant with an articulating surface combining UHMWPE and cross-linked hyaluronan. The osteochondral lesion is reamed out and replaced with an appropriately sized BioPoly RS implant which fills the cavity left by tissue removal. This material may articulate more favorably with native tissues than all-metal devices.

In active middle-aged patients, the results of biological techniques and conventional arthroplasty are less satisfactory. Although a single case report cannot prove the value of such a device, we suggest that the BioPoly® RS knee system may be a safe and reliable treatment for large osteochondral defects in appropriately selected patients.

Following a structured rehabilitation program to regain full range of motion and given persistent knee pain the decision was made to insert a novel focal resurfacing implant to the medial femoral condyle defect. Six weeks following the injury a 20x12mm metal backed BioPoly® RS implant was cemented in place through a medial arthrotomy and the patient was allowed full weight-bearing the next day. He was discharged from hospital after 72 hours. There were no peri-operative complications. At review 5 months post-operation the knee was pain free with a full range of motion. At 12 months, clinical progress remains excellent with a pain-free knee, range of motion from 0-130 degrees and a Modified Cincinnati knee score of 95. The patient has returned to recreational cycling and continues to avoid impact sports as per the senior author's instructions. Plain radiographs at 12 months show the BioPoly® RS implant position to remain satisfactory with no evidence of loosening and congruent articular surfaces (Fig. 2-A, B).

Fig. 2. A, B. Weight-bearing radiographs showing position of the cemented BioPoly® RS prosthesis in the medial femoral condyle at 12 months post-operation: (A) anteroposterior and (B) lateral

REFERENCES

1. NJR 8th Annual Report 2011. National Joint Registry. http://www.njrcentre.org.uk.

2. Noyes FR, Barber SD, Mooar LA. A rationale for assessing sports activity levels and limitations in knee disorders. CORR 1989; (246):238-49.

3. Wright RW, Mclean M, Matava MJ, Shively RA. Osteochondritis dissecans of the knee: long term results of excision of the fragment. CORR 2004; (424):239-43.

4. Asik M, Ciftci F, Sen C, Erdil M, Atalar A. The microfracture technique for the treatment of full-thickness articular cartilage lesions of the knee: midterm results. Arthroscopy 2008; 24(11): 1214-20.

5. Krishnan SP, Skinner JA, Bartlett W et al. Who is the ideal candidate for autologous chondrocyte implantation? J Bone Joint Surg [Br] 2006; 88(1):61-4.

6. Hangody L, Fules P. Autologous osteochondral mosaicplasty for the treatment of full-thickness defects of weight-bearing joints: ten years of experimental and clinical experience. J Bone Joint Surg [Am] 2003; 85-A Suppl 2:25-32.

7. Gross AE, Shasha N, Aubin P. Long-term followup of the use of fresh osteochondral allografts for posttraumatic knee defects. CORR 2005; (435):79-87.

8. Becher C, Kalbe C, Thermann H et al. Minimum 5-year results of focal articular prosthetic resurfacing for the treatment of full-thickness articular cartilage defects in the knee. Arch Orthop Trauma Surg 2011; 131(8):1135-43.