Mobile-bearing, congruent patellofemoral prosthesis: short-term results

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ABSTRACT

Purpose. To report the short-term outcome of the low contact stress (LCS) patellofemoral prosthesis in 51 knees.

Methods. 12 men and 37 women aged 23 to 79 (mean, 53.4) years underwent 51 consecutive LCS patellofemoral replacements. All patients had symptomatic isolated arthritis in the patellofemoral joint with well-preserved tibiofemoral compartments. All knees were evaluated pre- and post-operatively. The new Oxford scoring system was used. Anteroposterior, lateral, and skyline weight-bearing radiographs were reviewed.

Results. The mean follow-up period was 4.2 years; no patient was lost to follow-up. The mean new Oxford Knee score was 13.9 preoperatively and improved by 13.7 at 3 months (p<0.001) and by further 7.1 at 12 months (p<0.001). Any change after 12 months was not significant (p=0.73). 18 of the knees developed patellar maltracking and resulted in subluxation and lateral tilt of the patella with severe polyethylene wear.

10 (20%) of the knees were revised; 8 with patellar maltracking were revised to total knee arthroplasty (n=3) or patellofemoral arthroplasty with a different implant (n=5), whereas 2 with disease progression were revised to total knee arthroplasty. The estimated survival rate of the prosthesis was 73% at 4.5 years and 48% at 5.5 years.

Conclusion. The revision rate for the LCS patellofemoral prosthesis was high (20%).

Key words: patellofemoral joint; prosthesis failure; reoperation

INTRODUCTION

For isolated patellofemoral arthritis, conservative treatments include rest, activity modification, physiotherapy, and analgesic medications, whereas surgical options include chondroplasty, soft-tissue reconstruction, realignment or unloading osteotomy, biological articular restoration, and prosthetic resurfacing. Patellofemoral arthroplasty has been an effective treatment for patellofemoral arthritis.
Nonetheless, implant design features may have significant impact on the clinical outcome. Some trochlear designs have shown relatively high rates of patellar maltracking, catching, and subluxation.\textsuperscript{2–7} We report the short-term outcome of the low contact stress (LCS) patellofemoral prosthesis (Fig. 1), which is the second-generation inlay design.\textsuperscript{8}

**MATERIALS AND METHODS**

Between May 2003 and November 2008, 12 men and 37 women aged 23 to 79 (mean, 53) years underwent 51 consecutive LCS patellofemoral replacements. All patients had symptomatic isolated arthritis in the patellofemoral joint with well-preserved tibiofemoral compartments. Patients with a history of infection, inflammatory arthritis, patella baja, and reflex sympathetic dystrophy were excluded.

All arthroplasties were performed by a single senior surgeon through an upper medial parapatellar approach using recommended surgical techniques. In cases of trochlear dysplasia, one of the anterior flanges was left proud of the cortical surface in order to cater for the flatness of the native bony trochlea. Patellar and femoral osteophytes were resected. Tracking of the patella was meticulously assessed with trial components. If there was any tendency of lift off, a staged selective soft-tissue release was performed. All trochlear components were cemented, whereas 33 patellar implants were un-cemented and 18 were cemented. Postoperatively, full-weight bearing equivalent to that after total knee arthroplasty was allowed.

Anteroposterior, lateral, and skyline weight-bearing radiographs were reviewed. All knees were prospectively evaluated pre- and post-operatively (3 months, one year, and annually thereafter), using the new Oxford scoring system.\textsuperscript{9} Oxford scores were analysed using a repeated measures regression model, whereas the survival rate was evaluated using the Kaplan-Meier survival curve.

**RESULTS**

The mean follow-up period was 4.2 years; no patient was lost to follow-up. The mean new Oxford Knee score was 13.9 preoperatively and improved by 13.7 at 3 months (p<0.001) and by further 7.1 at 12 months (p<0.001). Any change after 12 months was not significant (p=0.73).

18 of the knees developed patellar maltracking and presented with clunking and snapping of the rotating platform against the trochlear implant and native bone. This resulted in subluxation and lateral tilt of the patella with severe polyethylene wear (Fig. 2). The skyline radiographs show patellar tilt and asymmetry in the patellofemoral joint line (Fig. 3). Eight such patients underwent arthroscopy, which confirmed abnormal patellar tracking in all 8 knees and severe localised polyethylene wear in 5. Open lateral release and medial plication was performed in 2 knees with severe patellar maltracking but without severe polyethylene wear. Both knees remained

![Figure 1](image1.png) The LCS mobile bearing patellofemoral prosthesis.

![Figure 2](image2.png) Intra-operative photograph showing polyethylene wear.
symptomatic and later were subjected to revision with a different patellofemoral implant. In total, 10 knees were revised: 8 knees with patellar maltracking were revised to total knee arthroplasty (n=3) or patellofemoral arthroplasty with different implants (n=5), whereas 2 knees with disease progression were revised to total knee arthroplasty.

Among the 10 knees subjected to revision arthroplasty, the mean new Oxford knee score improved significantly from 14.5 to 24.8 at 3 months and to 32 at one year. There was no infection or mechanical loosening of implants. The estimated survival rate of the prosthesis was 73% (95% confidence interval [CI], 52–85) at 4.5 years and 48% (95% CI, 19–73) at 5.5 years (Fig. 4).

**DISCUSSION**

Patellofemoral arthroplasty is an alternative to total knee arthroplasty in patients with isolated patellofemoral arthritis. Since the first pure resurfacing of the patella in 1949,10 multiple patellofemoral implant designs have been introduced. Inferior results secondary to patellar maltracking are attributed to poor patient selection, component malposition, soft-tissue imbalance, and improper surgical technique.2–7 The role of particular design features of the trochlear components has been emphasised.2,3,7,11–12 Improved trochlear designs have provided better results.2,3 First-generation implants (Lubinus and Richards Mod I and II) showed a high degree of variation in clinical results (45% to 88% good-to-excellent results at the short- and mid-term). There was a comparatively high rate of revision surgeries secondary to mechanical problems. A deep-constraining groove in the Richards Mod I and II implants seemed to predispose to patellar maltracking, with a revision rate of 27%.2,3,11,14 The Lubinus patellofemoral implant was also associated with a high revision rate of 28%.5

With the use of the second-generation Lubinus prosthesis, the rate of fair-to-poor results (patellofemoral dysfunction, subluxation, catching, and substantial pain) was reduced to <4% from 17% encountered with the first-generation design.3 Design features of the trochlear component (sagittal radius of curvature, proximal extension of the trochlear flange, thickness of trochlear component, mediolateral breadth and constraint of the trochlear groove) that could have an impact on patella tracking were improved.2,3

The LCS patellofemoral implant is a second-generation, modified implant of the Richards/Blazina trochlear design. A slight modification of the trochlea is a patellofemoral sulcus angle of 140°, compared to 135° in the Richards trochlear component. The deep sulcus angle of the trochlea could be detrimental to long-term outcome.7 A major modification of the LCS prosthesis is the patellar component, which is a modular implant based on the patella used in total knee arthroplasty. This implant has had an excellent track record.15,16 The original implant was modified by elongating the superior-inferior dimension of the polyethylene, so that it could remain in contact with
the metal trochlea farther into flexion. The edges were rounded and contoured to prevent gouging the cartilage as it transits the edges of metal cartilage interface. The congruent polyethylene bearing can in theory rotate over the metal base plate by 35° in both directions (Fig. 4).

In our series, the high failure rate secondary to patellar maltracking was related to following design features. (1) The sagittal curvature of the trochlear component is obtuse, making it difficult to implant flush with the articular cartilage. If implanted in a slightly flexed position it stands proud proximally, where it can cause patellar snapping as the patella moves over the edge. (2) In knees with a high-sitting kneecap, the trochlear component does not extend proximally enough to prevent the patella from articulating with the anterior femoral cortex. As the knee bends, the kneecap may catch on the implant edge. (3) The congruent mobile patella is supposed to move in a constrained deep trochlear groove to predictably re-align patellar tracking. However, with any muscular imbalance, this concept does not work, particularly in the initial stages of flexion. (4) A deep sulcus of the trochlear design can lead to high levels of combined (Von Mises) stresses leading to failure of the polyethylene. This caused abnormal localised wear leading to failure in 9.8% of our cases. (5) Metal-backed mobile bearing patellar implants have shown excellent results in total knee arthroplasty, with a complication rate of 1.6% and survivorship of 97% at 19 years. The results of metal-backed mobile bearing patellae in the isolated patellofemoral arthroplasty are by no means as promising. The inlay design of the isolated trochlea cannot compensate for patellofemoral maltracking when compared to the onlay design of the femoral component in total knee arthroplasty. (6) Implantation of the trochlea has been technically demanding because the implant should be positioned in an anatomically favoured orientation. In trochlear dysplasia, this appeared to be a rather unpredictable because anatomic landmarks are missing. Freehand preparation of the distal femur could attribute to inaccurate trochlear alignment. (7) Arthroscopic investigation of the implant function turned out to be most instructive in determining the reason for malfunction in knees with mechanical symptoms. Rotational freedom of the patella could lead to locking in the trochlear groove or on host bone, resulting in mechanical symptoms and localised polyethylene wear. The patellar component engaged centrally within the trochlea at 20° to 30° of flexion and tracked normally until rotation occurred. This indicated that retinacular tightness/laxity or imbalance was not a significant feature.

In our series, knees that underwent arthroscopy did not have any pathology in the tibiofemoral compartments. Two (4%) of the knees with progressive arthritis in tibiofemoral compartments warranted revision to total knee arthroplasty. The rates of progressive arthritis in other studies were 6.5%,8.3%,18 and 5.5%.19 Facet pathology in our patients were not collected.

Despite the high failure rate relating to this implant, patellofemoral arthroplasty is indicated in patients with isolated patellofemoral arthritis or symptomatic trochlear dysplasia. This study highlighted the difficulty in predicting the outcome of a particular implant design, even when it is based on a successful predecessor. Implant evaluation and strict follow-up is important to minimise unfavourable outcomes. It remains to be seen whether more predictable implantation techniques and simpler trochlear surface profiles will lead to better clinical results.

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REFERENCES