Singapore Med J 1998; Vol 39(7):303-305

Isolated Metal-Backed Patellar Component Revision Following Total Knee Arthroplasty

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ABSTRACT

Background: Twenty-two consecutive revisions for failed metal-backed patellar components following total knee arthroplasty in 17 patients were retrospectively reviewed. All had similar total condylar knee prosthesis inserted with retention of the posterior cruciate ligament and resurfacing of the patella with a metal-backed component. There were 3 male and 14 female patients.

Results: The mean time to failure of the patellar component was 60 months (range 26 to 93 months). The majority of patients presented with metallic crepitus (86.4%) and knee pain (72.7%). At surgery, full thickness polyethylene wear exposing the metal-backing was present in 81.8% with surface damage of the femoral components present in 40.9%. All 22 cases underwent successful isolated patellar component revision with all polyethylene patellar components.

Conclusion: Resurfacing of the patella in total knee arthroplasty with metal-backed patellar components carries a significant risk of early failure and the use of these components is no longer practised at our institution.

Keywords: metal-backed patellar component revision

INTRODUCTION

Improvement in prosthetic designs, materials development and surgical techniques have resulted in significantly better results of total knee arthroplasty. The procedure is now both very successful and reproducible. Survivorship to revision is now in excess of 90% at 15 years following surgery. However, problems with the extensor mechanism, including the patellar component, occur in up to 10% of total knee arthroplasties and account for up to 50% of cases undergoing revision following primary total knee arthroplasty. Metal-backing of the patellar component was introduced in order to provide a more even stress distribution on the patella as well as to provide the option for cementless fixation[1]. Despite this, several early failures of metal-backed patellar components have been reported[2-4]. The purpose of this study was to review our experience with the use of metal-backed patellar components in primary total knee arthroplasty.

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MATERIALS AND METHODS

Twenty-two consecutive isolated revisions of failed metal-backed patellar components following total knee arthroplasty were performed in 17 patients between July 1992 and February 1996 at our institution. There were 3 male and 14 female patients with an average age at the index arthroplasty of 67 years (range 58 to 79 years). The mean body weight was 60.7 kg (range 47 to 81 kg). The primary diagnosis was osteoarthritis in 21 knees and rheumatoid arthritis in 1 knee. All patients were evaluated clinically pre- and post-arthroplasty utilising the Knee Society Clinical Rating System[5]. This system combines the evaluation of the knee joint together with the patient's functional status in its scoring. Post-operative evaluation was performed in the third month following the index arthroplasty. Standard anterior-posterior standing radiographs of the involved knee joint together with lateral radiographs were taken pre- and post-arthroplasty. All primary total knee arthroplasties were performed using the Miller-Galante total condylar prosthesis with retention of the posterior cruciate ligament. Patellar resurfacing was performed in all cases with the Miller-Galante cementless metal-backed patellar component. Knee Society Scores were also evaluated pre and third month post-patellar revision. The presence of signs and symptoms such as grating, crepitus, pain, frequent falls and locking were also assessed clinically. Standard anterior-posterior and lateral radiographs were obtained pre- and post-patellar revision. Radiographic analysis was performed to access for the presence of radiolucent lines and radiographic loosening.

At surgery, the knee was exposed in the standard fashion with a midline incision and medial parapatellar arthrotomy. A thorough debridement and synovectomy were performed. The patellar components were removed with an oscillating saw and osteotomes. Intra-operative findings were noted and revision was performed using an all-polyethylene cemented patellar component in all cases. A lateral retinacular release was performed in 8 knees to improve patellar tracking. Five knees showed evidence of polyethylene wear of the tibial insert and all had exchange of the tibial insert at the time of surgery. Five patients had bilateral patellar revisions, 4 of which were simultaneous and 1 of which was performed in a staged fashion.

RESULTS

Knees scores prior to patellar revision averaged 47.5 (range 12 to 82) and 84.3 (range 58 to 95) respectively.

The average interval between index arthroplasty and patellar revision was 60 months (range 26 to 93 months). The commonest presenting symptoms were of grating sensation in the knee and pain which were present in 19 (86.4%) and 16 (72.7%) knees respectively. Other symptoms reported included frequent falls and locking in 2 knees each (Table I). None of the knees revealed any radiographic loosening of the tibial or femoral components. Subluxation of the patella was present in 5 knees and complete dislocation was evident in 2 knees accounting for the 2 cases presenting with locking. No evidence of radiographic loosening of the patellar components was present in the remaining knees.

Intraoperative findings included complete polyethylene wear of the patellar component exposing the metal backing. This was present in 18 knees (Table II). At surgery, there was evidence of metal-to-metal contact and accompanying metallic synovitis. In 9 of these knees, evidence of scratching on the femoral component was present although this was superficial in nature and none of the well-fixed femoral components was revised. Four other knees showed evidence of partial polyethylene wear. Other intraoperative findings included fracture of the metal peg in 1 knee and subluxation or dislocation of the patella in 7 knees.

Table I – Symptoms of metal-backed patellae failure

Symptoms	No. of knees	%
Grating sensation & sound	19	86.4
Pain	16	72.7
Frequent falls	2	9.1
Locking	2	9.1

Table II – Intra-operative findings

	No.
Polyethylene wear exposing underlying metal back with metallic synovitis	18
Polyethylene wear only (not exposing metal back)	4
Fracture of fixation pegs	1
Subluxed patellar component	5
Dislocated patellar component	2
Groove/scratching on femoral component	9

Knees scores prior to patellar revision averaged 75.4 (range 30 to 88). Following patellar revision, the average knee score was 84.1 (range 50 to 95). The mean flexion arc averaged 92° & 99.3° pre- and post-revision respectively. All patients reported significant improvement in pain following revision as well as absence of grating and crepitus in the knee. The problem of locking which was present in 2 patients (2 knees) was also resolved following patellar revision. Deep infection occurred in 1 knee at 2 weeks post-revision. Multiple cultures grew methicillin-resistent *Staphylococcus aureus* and treatment with intravenous antibiotics and resection arthroplasty were performed. The infection was completely resolved and this patient subsequently underwent re-implantation with a constrained condylar total knee arthroplasty. No evidence of infection was present at the latest follow-up 9 months post-reimplantation. No other significant complications occurred in this series of patients.

Final follow-up averaged 18.7 months (range 6 to 48 months). By the final follow-up, 7 knees (39%) had mild pain. The remaining knees did not have any significant discomfort. All patients acquired independent ambulatory status.

DISCUSSION

The improvement in the results of total knee arthroplasty in recent years has been well recognised. The durability and predictability of the procedure is also well-established. Early total knee prostheses did not provide for resurfacing of the patello-femoral joint. Anterior knee pain in as many as 50% of patients has been reported without patellar resurfacing[6]. This led to design modifications that allowed for resurfacing of the patella. The addition of patellar resurfacing has reduced the incidence of pain and improved functional results but an additional set of complications has emerged. These include patello-femoral instability, fracture, loosening, component failure, patellar clunk syndrome and tendon rupture. At present, patello-femoral complications account for up to 50% of revisions total knee arthroplasties[7,8].

Although component failure of polyethylene patellar designs has been reported, this has primarily been a problem of metal-backed designs. The development of metal-backing of patellar components was aimed at decreasing patellar surface strains and supporting the underlying polyethylene, thereby lessening deformation as well as allowing for cementless patellar fixation[9]. Despite this, failure of metal-backed patellar components have included polyethylene wear and fracture, polyethylene-metal plate dissociation, peg-plate dissociation and metal plate fracture[10].

Peak contact stresses at the patello-femoral joint vary from 1 to 7 times body weight during normal activities including stair climbing. Thus, patellar polyethylene wear is not unexpected as these contact pressures have been found to substantially exceed the yield strength of polyethylene[11]. Furthermore, the addition of metal-backing to the patellar component reduces the thickness of the polyethylene and this predisposes to accelerated polyethylene wear rates. In addition to this, less wear is required before catastrophic failure occurs as the polyethylene wears through the metal-backing. There is also significant deformation of the polyethylene during loading and, as this deformation extends to the rim, polyethylene-plate dissociation may occur.

Failure at the plate peg junction can occur as a result of high sheer forces experienced at this location together with the situation where bone ingrowth occurs at the peg and not on the plate.

Numerous factors have been related to patellar component failure. These include excessive body

weight, enhanced post-operative knee flexion of more than 115°, increased activity level as well as male gender. Other factors include patellar malalignment, increased patellar component composite thickness, use of oversized femoral components, flexion of the femoral component and joint line malposition. All these above factors result in increased loading on the patellar component and predispose to early failure[2,3,10].

Several reports of early metal-backed patellar failures have more recently emerged. Most reports revealed failures as early as 2 years following primary total knee arthroplasty. These results differ somewhat from this particular series in which the average time to failure was 5 years. There are 2 possible reasons for these. Firstly, the particular patient profile in this local population is possibly less active and of smaller build. This may result in slightly more prolonged patellar function before failure occurs. Secondly, the time to failure reflects the time from arthroplasty to the time of revision and may not necessarily reflect the actual time at which symptoms occurred from failure of the polyethylene. The primary mechanism of failure in our series appears consistent with that previously reported. The classical clinical presentation of crepitus, pain, effusion and synovitis were also well-documented in this series. The intra-operative findings of exposed metal-backing, metallosis and synovitis with metallic pigmentation of the soft tissues were also well-documented in this series. One interesting finding was the incidence of patellar subluxation that occurred in this group. This may be a predisposing factor to the early failure in metal-backed patellar components as a result of higher contact stresses due to malalignment and maltracking in this particular cohort of patients.

The recommended treatments of failed patellar components include complete component removal (100% in our series), a thorough synovectomy to remove particulate debris (100% in our series), tibial polyethylene insert replacements (5 knees in our series), and femoral component revision if metal abrasion is significant (none in our series). Correction of patellar maltracking (8 knees in our series) and femoral-tibial component malpositioning should be performed as they contribute to patellar component failure due to increased loading. Options for revision of the patellar component include cementation of an all polyethylene primary or biconvex patellar component depending on the availability of remaining bone stock, patelloplasty or patellectomy. The latter 2 options are reserved for cases where a patellar component cannot be fixed securely to the remaining bone.

Isolated revision of a failed patellar component, while seemingly minor when compared to a revision total knee arthroplasty in which all components are revised, has been associated with a significant complication rate. In a review of 36 isolated patellar component revisions by Berry and Rand[12], 83% achieved good or excellent results. However, complications occurred in 34% which included 5 patellar fractures, patellar instability in 3, 2 peroneal nerve palsies and infection and extensor lag in 1 case each.

The problem of patellar component failure remains a significant one and surgical treatment can result in a complication rate similar to that of formal revision total knee arthroplasty. The potential for complications must be recognised when considering surgical treatment for patellar component failure in total knee arthroplasty.

CONCLUSION

Patellar resurfacing in total knee arthroplasty can produce more predictable pain relief. Surgical technique is extremely important particularly in achieving normal patellar tracking and alignment in order to reduce contact stresses and loading thereby reducing the risk of polyethylene wear. The use of metal-backed patellar components has predisposed to accelerated polyethylene wear and a higher incidence of early failures of patellar components. While the issue of patellar resurfacing still remains controversial, the use of metal-backed patellar components does appear to increase the incidence of early patellar component failure when compared to a non metal-backed component. Our results did not reveal new findings with regard to this and parallels that of others previously reported[2-4]. As such, the use of metal-backed patellar components is no longer practised at our institution.

REFERENCES

1. Goldstein SA, Coale E, Wiess AP et al . Patellar surface strain. J Orthop Res 1986; 4:372.
2. Bayley JC, Scott RD, Edward FC, et al. Failure of the metal backed patellar component after total knee arthroplasty.
3. Bayley JC, Scott RD. Further observation on metal backed patellar component failure. Clin Orthop 1988; 236:82.
4. Rosenberg AG, Andriacchi TP, et al. Patellar component failure in cementless total knee arthroplasty. Clin Orthop 1988; 236:106.
5. Install JN, Dorr LD. Rationate of the Knee Society Clinical Rating System. Clin Orthop 1989; 248:13.
6. Abraham W, Buchanan JR, Daubert H, et al. Should the patella be resurfaced in total knee arthroplasty? Efficacy of patellar resurfacing. Clin Orthop 1988; 236:128.
7. Ranawat CS. The patello-femoral joint in total knee condylar knee arthroplasty: pros and cons based on five to ten year follow-up observation. Clin Orthop 1986; 205:93.
8. Brick GW, Scott RD. The patello-femoral instability in total knee arthroplasty. Clin Orthop 1988; 231:163.
9. Laskin RS, Bucknell A. The use of metal-backed patellar prosthesis in total knee arthroplasty. Clin Orthop 1990; 260:52.
10. Stulberg SD, Stulberg BN, Hamati Y, Tsao A. Failure Mechanism of metal-backed patellar component. Clin Orthop 1988; 236:88.
11. Hsu HP, Walker PS. Wear and deformation of patellar components in total knee arthroplasty. Clin Orthop 1989; 246:260.
12. Berry DJ, Rand JA. Isolated patellar component revision of total knee arthroplasty. Clin Orthop 1993; 286:110.