

# Medium term results of Avon patellofemoral joint replacement

Praveen K Sarda, Anup Shetty, Shanmuga S Maheswaran

## ABSTRACT

**Background:** Ten to fifteen percent of knee arthritis is reported to be isolated patellofemoral arthritis. Total knee arthroplasty is not recommended for isolated patella femoral arthritis particularly in young patients. We present the retrospective review of 45 consecutive patellofemoral replacements performed in 41 such patients, between June 2002 and January 2007.

**Materials and Methods:** All patients were operated by single surgeon (SM) or under his supervision. All forty five patients had minimum three year followup and had the data collected prospectively. No patient was lost to followup. This data was later collated by review of notes, radiographs, and a clinical followup. The patients were assessed using knee function score and Melbourne patellofemoral score.

**Results:** The average followup was 4.5 years. The preoperative average Melbourne (Bartlett) score was 10 (range 5–21). Preoperative knee functional score averaged 57 (range 23–95). The average range of movement was 116° (range 100°–140°). Postoperatively, the average Melbourne knee score improved to 25 (range 11–30), while the knee function score was 85 (range 28 – 100). The difference was statistically significant ( $P < 0.05$ ). Eighty-five percent rated the result as good or excellent, while 12% rated it as fair. Five percent thought the result was poor. The most common complaint was clicking at 40° of flexion ( $n=7$ ). Six patients underwent arthroscopic lateral release, which improved the symptoms in four patients. Two knees were revised one due to progression of tibiofemoral arthritis and the other due to persistent clicking, yielding a survival rate of 95.6% at an average five year followup.

**Conclusion:** The Avon patellofemoral joint replacement provides predictably good results and excellent survivorship in the medium term, for isolated patellofemoral arthritis. However, progression of tibiofemoral arthritis remains unpredictable and therefore patient selection is crucial to ensure success. Clicking remains a potential problem and can compromise the postoperative results in upto 15% of the cases.

**Key words:** Anterior knee pain, arthritis, arthroplasty, patellofemoral maltracking, replacement

## INTRODUCTION

It is estimated that nearly 10% to 15% of patients suffering from knee arthritis have isolated patellofemoral joint arthritis.<sup>1</sup> Such patients typically belong to the younger age group, and are therefore unsuitable for traditional Total Knee Arthroplasty (TKA). The most common

complaint is anterior knee pain, made worse while getting up or down the stairs or walking on inclines. In the past these patients have been treated in a variety of ways, including anti-inflammatory medications, physiotherapy, steroid injections, osteotomy, patellectomy, arthroscopic debridement, and so on. TKA has so far remained the gold standard for the treatment of knee arthritis. However, it involves sacrificing the normal tibiofemoral cartilage and cruciate ligaments, which leads to decreased proprioception, reduced movements, and a need for the traditional revision knee replacement later on. Moreover, a TKA is not recommended in younger patients, who are often the ones afflicted with isolated patellofemoral arthritis.

The first case of patellofemoral joint replacement (PFJR) was reported by Mckeever,<sup>2</sup> which was basically a metal shell screwed onto the patella. Since then various designs have been reported and tried with variable success rates, as reported by Agletti,<sup>3</sup> and Blazina *et al.*<sup>4</sup> In recent years the most commonly used prostheses have been Lubinus<sup>5</sup> and Avon.<sup>6</sup> There have been reported problems with the

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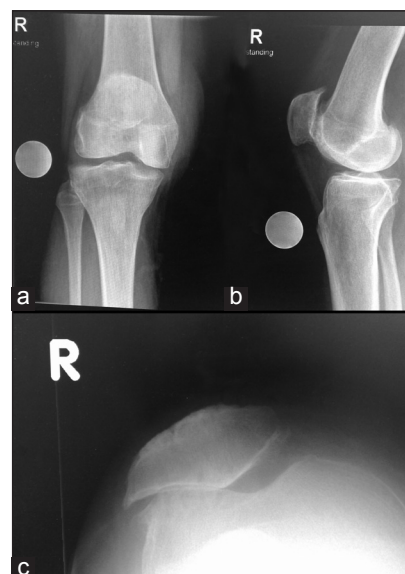
design of the Lubinus implant (Waldemar Link, Hamburg, Germany) as reported by Broad *et al.*, which has led to poor satisfaction rates and its decreased use over the years.<sup>7,8</sup> Ackroyd *et al.* have reported 95.8% survivorship at five-year follow-ups, with low complication rates,<sup>9</sup> when using the Avon design (Stryker corp, UK,) pioneered at the Avon Orthopedic Center, Southmead, Bristol, UK, and this remains a popular prosthesis in the current era. However, there is still a paucity of literature regarding the results of this implant from independent centers. We present a retrospective analysis of medium term results of consecutive patellofemoral replacement using Avon design.

## MATERIALS AND METHODS

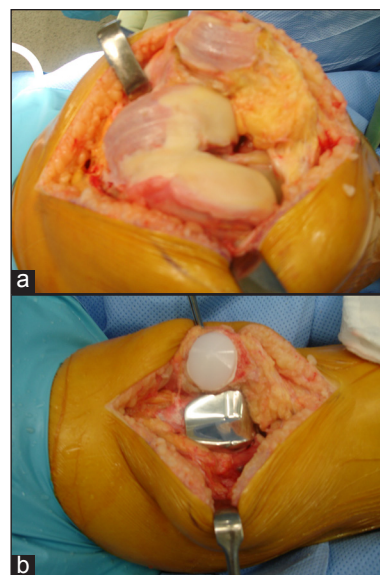
45 consecutive patellofemoral replacements were performed by the senior author (SM) in 41 patients between June 2002 and January 2007. Patients with a minimum three-year followup were included in the study. Forty patients (44 knees) were available for review, while one patient died three years after the operation following unrelated causes. The patients were selected on fulfilling strict criteria, as described by Ackroyd *et al.*<sup>6</sup> They all had grade III or IV patellofemoral arthritis confirmed by X-ray using Ahlback's classification,<sup>10</sup> or by arthroscopy, using the Outerbridge<sup>11</sup> classification. Grade I / II arthritis in other compartments was accepted only if it was clinically validated to be inconsequential symptomatically. Anybody with a flexion deformity of more than five degrees or less than 100° flexion was deemed unfit for this procedure. Varus / valgus malalignment of more than four degrees was not accepted as recommended by Ackroyd *et al.*<sup>9</sup> The physical findings were the main criteria for patient selection rather than the age, which varied from 43 to 88 in our series. All the patients had standard preoperative X-rays AP (standing), lateral, and the Merchant's patellofemoral view<sup>12</sup> [Figure 1]. Some patients with suspected tibiofemoral osteoarthritis (OA) had further imaging in the form of Rosenberg<sup>13</sup> view (with knee in 45° flexion posterior anterior view).

The operative technique was used as described originally by Ackroyd *et al.*<sup>14</sup> The tibiofemoral joint was inspected intraoperatively, to ensure there was no cartilage defect more than 1 cm in size [Figure 2a]. If the knee was converted to TKR due to intraoperative assessment of cartilage defect that joint was excluded from analysis.

The trochlear cut with the jig frequently needed some freehand refashioning with dental burrs to ensure proper seating of the component. The patella was measured with callipers, and the resection jig was set appropriately to leave at least a 12 mm thickness. The thickness of the



**Figure 1:** Preoperative anteroposterior (a) and lateral (b) skyline (c) Merchant's view of right knee showing lateral tilting and severe patellofemoral arthritis



**Figure 2:** Intraoperative picture (a) of the same patient showing an eburnated patella and trochlea. Intraoperative photograph (b) following patellofemoral joint replacement

button was chosen to reconstruct the original width, or to restore the width to about 22 mm in females and 25 mm in males. Care was taken not to overstuff the anterior compartment. Particular attention was paid to the tracking and any clicking on trial reduction. The components were implanted using fast setting cement [Figure 2b] and tracking was again checked carefully. All patients had check X-ray on the second postoperative day as per the standard protocol. [Figure 3].

All the patients had preoperative Melbourne<sup>15</sup> and Knee Function scores,<sup>16</sup> and these were checked at three months, six months, one year, and then at yearly intervals. All the

postoperative X-rays were reviewed to assess the alignment and progression of the tibiofemoral arthritis. Data with regard to any further intervention was obtained from the hospital records. All the patients were sent a satisfaction questionnaire. The results were defined by using revision to total knee replacement as the endpoint. No patient was lost to followup. They were all assessed clinically and radiologically till the last followup. The outcome was assessed using the knee function score and the Melbourne patellofemoral score.

## RESULTS

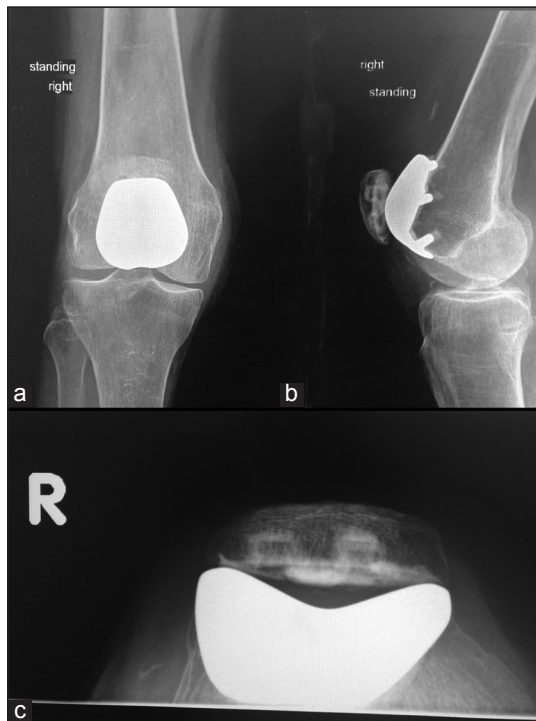
Forty-four knees were evaluated in 40 patients, with average followup of 4.5 years (range 3-8 years). 77% (n=31) of the patients were females, who outnumbered the males by 3:1. The average age was 61.7 years (range 43 – 84 years). Four patients had operations on both the knees at different times. All the patients had radiologically proven patellofemoral arthritis, with 26 / 44 knees (59%) having early (grade I) tibiofemoral arthritis in one or both compartments while rest had normal tibiofemoral joint on radiographs.

Average preoperative Melbourne knee score was 10, (range 5 – 21) improved to 25 (range 11 – 30) postoperatively. The preoperative average Knee functional score was 57, (range 23 – 95), while it was 85 (range 28 – 100) postoperatively. The average range of motion (ROM) was 116°, (range

100°–140°) [Table 1]. Postoperatively the average ROM had improved to 125°, (range 100°–140°). Twelve patients had undergone previous surgeries, mostly arthroscopic procedures, at varying intervals prior to this surgery, but this did not seem to have a statistical influence on the outcome ( $P=.362$ ). Six knees needed lateral release, to improve tracking intraoperatively. There were no cases of deep infection.

The patients were asked to fill the satisfaction questionnaire and grade the result as excellent, good, fair or poor. Eighty-five percent (n=34) rated the result as good or excellent, while 12% (n=3) rated them as fair. Five percent (n=2) thought the result was poor and the knee felt worse than before.

The most common complaint postoperatively was clicking at various degrees of flexion (n=7), most often around 40° of flexion [Table 2]. Two of these patients had a nodule at the insertion of the quadriceps tendon, which was arthroscopically resected, as previously reported by the same author.<sup>17</sup> All but one of the seven knees needed arthroscopic lateral release (including the two with nodules). Three knees had persistent anterior knee pain, despite satisfactory clinical and radiological findings. Two knees were revised, and one patient needed revision to Total Knee Replacement at 18 months, due to the dramatic progression of lateral compartment arthritis, while another was revised after three years due to persistent pain and clicking, which persisted despite lateral release.



**Figure 3:** Postoperative anteroposterior radiograph (a) lateral radiograph (b) and postoperative skyline view (c) of the same patient shows well placed prosthesis

**Table 1: Comparison of pre and postoperative scores**

	Preoperative value	Postoperative value
Average Melbourne knee score	10	25
Average knee function score	57	85
Average range of motion	116°	125°

ROM: Range of motion

**Table 2: Complications reported on followup**

Complications	Treatment	Further op
Click, at 1yr	Tubigrip, PT	A&LR
Clicking 30°	Operative	A&LR
Painful click	Operative	A&LR, Revised later
Patella clunk	Operative	Arthroscopy + LR 10m, resection of fibrous nodule
Anterior knee pain + synovitis	LHC	No
Undiagnosed knee pain	PT	No
Undiagnosed knee pain	Aspiration, LHC	No
Increased pain, swelling	Operative	Revised to TKR
Click	PT	A&LR
Click at 40° flexion	PT	No
Clicking	Operative	A&LR

PT = Physiotherapy; A&LR = Arthroscopy and lateral release; LHC = Local hydrocortisone



## DISCUSSION

Isolated patellofemoral arthritis is a known cause of anterior knee pain, but has been neglected in the past. Radiological prevalence of isolated patellofemoral arthritis in females over fifty-five years has been documented at 13.6%, while the same in men over 60 is 11 to 15.4%.<sup>1,18</sup> In patients over fifty-five years of age, with symptomatic osteoarthritis, the prevalence of isolated patellofemoral disease ranged from 5 to 8%.<sup>18,19</sup>

Patellofemoral joint replacement has always been a controversial subject, particularly in elderly patients, where a more predictable result could be obtained with TKA.<sup>19-21</sup> However, with better implants and techniques, the indications have been expanded to older age groups and also in early arthritis in the tibiofemoral compartment, as reported by various authors.<sup>14,22,23</sup> Blazina and Lubinus prosthesis were popular in the 1990s, but the long-term results were not encouraging. Ackroyd *et al.*<sup>8,9,24</sup> reported a survival rate of 65% at a mean of 7.5 years and patient satisfaction rates of only 45% using the Lubinus prosthesis. They subsequently stopped using this prosthesis, due to a high rate of revision and unsatisfactory results. The Avon prosthesis is the only patellofemoral prosthesis with more than 1000 cases having five-year or longer follow-up, according to the National Joint Registry Report 2010 (UK).<sup>25</sup> However, most of the long-term results have been published by the designers,<sup>5,9</sup> with good short-term results being reported by other centers only recently.<sup>24,26</sup> We present a large series with a longer followup.

This study has the drawback of being retrospective in nature, like most similar studies. However, it benefits from being a consecutive series performed by a single surgeon at an independent center, with no loss to followup and all complications being presented. The main weakness is lack of a validated patient satisfaction questionnaire and missing preoperative data in 20% of the patients. The scores have been obtained prospectively as part of our routine clinical practice and are usually obtained by a trained specialist nurse. We present a table below of our results compared with various other published studies [Table 3].

Progression of arthritis in other compartments has been a well-recognized problem after patellofemoral replacements, as published by Nicol *et al.*<sup>27</sup> It has been our experience that while patients tolerate concomitant medial compartment arthritis reasonably well, the lateral compartment arthritis progresses much more quickly after surgery and is poorly tolerated after patellofemoral joint replacement. Of the 26 knees in our study with early tibiofemoral arthritis, 19 had isolated medial compartment arthritis, one had isolated lateral compartment arthritis, while five had combined medial and lateral compartment arthritis [Table 4]. At the last followup, progression / development of new tibiofemoral arthritis was noted on radiographs in seven knees, and five (11%) were clinically symptomatic. This was similar to the rates of progression quoted in other articles.<sup>24</sup> Of the six knees with evidence of early lateral compartment arthritis, two progressed to grade IV arthritis at an average of two years, and one had already been revised on account of this. We therefore recommend surgeons to avoid performing this operation in the presence or even early stages of lateral compartment arthritis.

Twelve (22%) patients in our series had previous operations on the same knee, which was similar to that reported in other series.<sup>9,24,26</sup> Out of these, six knees had previous lateral release performed, while others had chondrectomy earlier for patellar cartilage degeneration. Earlier designs like Blazina and Lubinus had a higher failure rate due to maltracking and wear.<sup>8</sup> Avon prosthesis benefited from a broad trochlear, which could be rotated or translated as needed. In our series, the rate of clicking and maltracking was about 15%, which could result in persistent pain or clicking. This had not been reported elsewhere in literature, but Odumanye *et al.* admitted to coming across this phenomenon in their practice, recently.<sup>24</sup> Interestingly, only one of the seven patients suffering from clicking had previous arthroscopic release and the rest did not have any prior surgery. The clinical relevance of this observation was uncertain, as the tracking was checked and confirmed to be satisfactory in all the knees before closure.

Three patients had pain in the anterolateral aspect of the knee despite the excellent radiological appearance of the

**Table 3: Results of various published studies**

Author(s)	Implant	Number of knees	Minimum follow-up (years)	Mean Melbourne score	Mean AKS (functional)	Self-reported patient satisfaction	Survival (%)
Ackroyd <i>et al.</i> <sup>[6]</sup>	Avon	124	2			-	96.7
Ackroyd <i>et al.</i> <sup>[9]</sup>	Avon	109	5	25	-	-	95.8
Starks <i>et al.</i> <sup>[26]</sup>	Avon	37	2	28	85	-	-
Leadbetter <i>et al.</i>	Avon	25	2	-	-	-	-
Odumanye <i>et al.</i> <sup>[24]</sup>	Avon	50	5.3	-	-	-	100
Our results	Avon	44	3	25	85	85%	95.4

**Table 4: Progression of tibiofemoral arthritis**

Additional preop X-ray diagnosis	Last FU X-ray appearance	FU (months)
(gr I) MCA & LCA	gr IV LCA	52
MCA (gr II)	gr III MCA	44
(gr II) MCA	Same	49
(gr I) MCA+LCA	Same	36
(gr I) MCA	gr II MCA	56
(gr I) MCA	gr II MCA	44
(Igr I) MCA	Same	48
(gr I) MCA	Same	36
(gr I) MCA	gr II MCA	67
(gr I) MCA	Same	36
(gr I) MCA	Same	36
(gr I) MCA	Same	37
(gr I) MCA	Same	36
(gr I) LCA	gr IV LCA	39 (Revised to TKA)
(gr I) MCA	Same	43
(gr I) MCA	Same	38
(gr I) MCA	Same	38
(gr I) MCA	Same	60
(gr I) MCA+LCA	Same	66
(gr I) MCA+LCA	Same	61
(gr I) MCA+LCA	Same	36
(gr I) MCA	Same	52
(gr II) MCA	Same	42
(gr I) MCA	Same	36
(gr II) MCA	Same	49

gr = grade; MCA = Medial compartment arthritis; LCA = Lateral compartment arthritis; preop = Preoperative; FU = followup

prosthesis and good tracking. The authors observed that the flanges of the trochlea in the Avon prosthesis were quite prominent, more so on the lateral side, where the quadriceps bulk was less than on the medial side. In thin patients, this could be easily palpated through the skin. We found that the prosthetic trochlea was usually thicker than the bone resected and this could probably contribute to both the pain and clicking. If the thickness of the prosthesis could be reduced while maintaining the biomechanical properties, we believe this particular problem could be resolved to a great extent.

Average Melbourne knee score in our series increased from 10 to 25 and the knee functional score increased from 57 to 85 at the last followup. We assessed the scoring preoperatively at, three months, six months, and one year, followed by subsequent scoring on each followup. We found that the score continued to increase up to a year, and plateaued after that. The difference in scores was statistically significant, ( $P < .05$ ). Two knees needed revision, one of them on account of progression of lateral compartment arthritis, giving a survival rate of 95.5% at an average of 4.5 years followup. The revision was quite straightforward, similar to a primary total knee replacement, without any complications, and the patients remained satisfied with the outcome.

## CONCLUSION

The Avon patellofemoral joint replacement provides predictably good results and excellent survivorship in the medium term, for isolated patellofemoral arthritis. However, progression of tibiofemoral arthritis remains unpredictable and therefore patient selection is crucial to ensure success. Clicking remains a potential problem and can compromise the postoperative result in up to 15% of the cases.

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