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ORIGINAL PAPER

Patella in total knee arthroplasty: to resurface or not to—a cohort study of staged bilateral total knee arthroplasty

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Abstract The aim of this study was to assess medium term results of patellar resurfacing in total knee arthroplasty, specifically looking at anterior knee pain, patellofemoral function and need for reoperation. A prospective cohort study was conducted with patients undergoing staged bilateral knee arthroplasty with the patella being resurfaced only on one side. This was due to change in the clinical practice of the senior author. Sixty patients were reviewed clinically and radiologically on a regular basis. The surgery was either performed or supervised by the senior author in all cases. All patients received the cemented press-fit condylar© prosthesis. The Knee Society clinical rating system was used. Scores were recorded pre-operatively and post-operatively at three months, one year, two years and three yearly thereafter. The mean age of patients in the study group was 75 years (range: 62–89 years). There were 42 women and 18 men in the study. The mean duration of follow-up was 4.5 years (range: 2–12 years). There was no significant difference in the pre-operative scores in both groups. There were significantly better scores ($p<0.05$) on the resurfaced side as compared to the non-resurfaced side at final follow-up. No revision was carried out for patellofemoral complications on the resurfaced side. Four patients required revision in the form of patellar resurfacing on the non-resurfaced side for persistent anterior knee pain. Patellar resurfacing is recommended in total knee arthroplasty for better functional outcome with regards to anterior knee pain and patellofemoral function.

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Introduction

Osteoarthritis (OA) is a chronic disease process affecting synovial joints, particularly large weight-bearing joints. OA of the knee is a disabling condition. Total knee arthroplasty (TKA) has proven to be a very successful operation in relieving pain and improving function. Various prostheses have been used for TKA. However, the posterior cruciate-retaining prosthesis is still most widely used. Patellar resurfacing has been and still is a matter of debate in TKA. The early implants for TKA were not designed for patellar resurfacing. High rates of persistent anterior knee pain following early implants along with other complications such as dislocation, subluxation and maltracking were attributed to the patellofemoral joint. This led to the development of tricompartmental replacements that allowed patellar resurfacing [1, 2].

However, there seems to be lack of consensus regarding patellar resurfacing among orthopaedic surgeons. In general, orthopaedic surgeons performing TKA can be organised into three groups as to how they address the patella: non-resurfacers, universal resurfacers and selective resurfacers. The primary advantages of resurfacing the patella are that it pre-empts future concerns regarding symptomatic arthritis of the patellar articular surface and may provide lower rates of reoperation and anterior knee pain [3–6]. The primary advantages of non-resurfacing are that it avoids future

problems with the prosthetic patella such as loosening and fracture [3–6].

Some studies favour patellar resurfacing [7–9] due to lower incidence of anterior knee pain and better patellofemoral function. Other studies have shown worse results following patellar resurfacing [10, 11]. However, some studies have reported that resurfacing the patella has similar pain and function scores as compared to non-resurfaced patella in TKA [12–14]. In a published decision analysis, the revision rate following primary TKA for patellofemoral problems was 2.8% for resurfaced patella [8] as compared to 7.2% for non-resurfaced patella [8]. Hence, the authors favoured patellar resurfacing.

Thus, the decision regarding patellar resurfacing in TKA is still an unsolved problem.

Patients and methods

We reviewed the results of bilateral staged TKA in 65 patients (130 knees), performed consecutively as a part of prospective study. Five patients had died before the minimum 24 months follow-up, and hence were excluded from the study. The remaining 60 patients were reviewed clinically and radiologically on a regular basis. None of the patients were lost to follow-up. Ethics Committee approval was taken from the regional Ethics Committee. Consent was obtained from all patients prior to participation in the study.

Inclusion criteria consisted of all patients undergoing staged bilateral TKA under the care of the senior author and having patellar resurfacing only on one side. Patients with severe co-morbidities, symptomatic arthritis in hip or back or feet and previous hip arthroplasty were excluded from the study. A minimum follow-up of 24 months was an essential criterion for inclusion in the study. Patients were recruited from 1993 to 2005.

All procedures were carried out or supervised by the senior author (V.R.). A midline skin incision and medial parapatellar approach was used in all cases. All patients received a press-fit condylar (PFC)© prosthesis inserted with CMW 1 cement. Size-specific anatomical femoral and tibial components were used. The patella was resurfaced in all cases performed up to the year 1999, whereas the patella was not resurfaced in any case after year 2000. The change of practice was made by the senior author (V.R.) based on a review of the literature at the time as well as a review of practice of other colleagues within the trust. Selective resurfacing was not done in any case. A cemented all polyethylene three peg oval patellar button component was used in cases with patellar resurfacing. Cases in which the patella was not resurfaced were treated by patellaplasty consisting of osteophyte removal and patellar rim cautery to provide partial denervation. Patellofemoral tracking was assessed in all cases after trial component insertion as well as after implantation of definitive implants. Need for lateral release was assessed. One deep drain was used in all cases, and was removed at 24 hour post-operatively. No brace was used post-operatively and patients were encouraged to commence physiotherapy soon after the surgery.

Intra-operative details including tourniquet time, status of articular surface and blood loss were recorded in all cases. Complications (if any) during the immediate post-operative period or subsequent follow-up were noted and carefully documented.

Patients were followed up post-operatively at six weeks, three months, one year, two years and three yearly thereafter. All patients were assessed using the Knee Society clinical rating system.

Pre-operative and post-operative evaluation was performed by an independent examiner (K.P.), using the Knee Society clinical rating system [15] which consists of a 100-point scale for knee score and 100-point score for function score. The knee score has points for pain (50), range of motion (25) and stability (25). The function score has points for walking ability (50) and stair climbing ability (50).

In addition to this clinical evaluation and scoring, patients were asked to evaluate their subjective preference, their ability to climb stairs and presence or absence of anterior knee pain. If a patient had persistent knee pain, further details were collected including the location as well as severity.

Standard weight-bearing anteroposterior (AP) and lateral and skyline views were taken in all cases pre-operatively, immediately post-operatively and at three months, one year and three yearly thereafter. X-rays were evaluated for component loosening, wear and patellofemoral problems including fracture or loosening of resurfaced patella, subluxation and wear of non-resurfaced patella.

Statistical analysis

SPSS version 13.0 was used for statistical analysis. An unpaired *t* test was used to compare pre-operative and post-operative scores of two sides. An unpaired *t* test was also used to compare tourniquet time and blood loss between the two groups. The Mann-Whitney U test was used to assess non-parametric data including need for lateral release and preference for one knee over the other.

Results

The mean age of patients in the study group was 75 years (range: 57–93 years). There were 42 women and 18 men in

the study. The mean height was 166 cm (range: 150–182 cm), mean weight was 78 kg (range: 54–98 kg), mean duration of follow-up on the resurfaced side was 7.5 years (range: 5–12 years) and mean duration of follow-up on the non-resurfaced side was 4.5 years (range: 2–6 years).

The pre-operative diagnosis was primary OA in 45 patients, secondary OA in five patients and rheumatoid arthritis in ten patients. None of these patients had a previous high tibial osteotomy. The cruciate-retaining press-fit condylar (PFC)© prosthesis was used in all cases. Arthritic changes were noted on the patella at the time of surgery and graded according to the Outerbridge classification [16]. Results are summarised in Table 1.

Lateral release was required for three cases in patella retaining knees and required in one case in patellar resurfacing knees. No intra-operative complications were noted in any patient. There was no significant difference in the intra-operative factors between the two groups. Values are outlined in Table 2.

There was no significant difference in pre-operative knee scores between the two sides as shown in Table 3. The mean Knee Society knee score at final follow-up was 88 for the tricompartmental TKA group with a range of 70–94. The mean Knee Society knee score at final follow-up was 76 for the bicompartmental TKA group with a range of 60–86. The mean Knee Society function score at final follow-up was 80 (range: 70–92) in the tricompartmental TKA group and 68 (range: 55–86) in the bicompartmental TKA group. There were significantly better scores ($p<0.05$) on the resurfaced side as compared to the non-resurfaced side at final follow-up. The mean post-operative range of motion was 110° (range: 95–130°) for the tricompartmental TKA and 108° (range: 90–125°) for the bicompartmental TKA.

Persistent anterior knee pain was noted in six patients on the non-resurfaced side, whereas two patients reported such pain on the resurfaced side. Both patients with pain on the resurfaced side had minimal symptoms and did not need any surgery. Two of six patients with persistent pain on the non-resurfaced side did not have symptoms severe enough to justify further surgery. However, four patients underwent revision in the form of patellar resurfacing, of which three patients noted marked improvement, and one patient noted minimal improvement after the surgery. Two of these four patients underwent revision between six and 12 months and the remaining two patients between 12 and 18 months after the index operation. None of these six patients (painful non-resurfaced side) had symptoms or signs of instability or patellofemoral maltracking as a contributing factor to knee pain. This was evaluated both clinically and radiologically. One of these cases had grade 2 arthritis of the patella, four of these cases had grade 3 arthritis and one case had grade 4 arthritis. Four of these cases which were revised included three cases with grade 3 arthritis and one case with grade 4 arthritis.

Table 1 Grade of patellar arthritis at the time of surgery

	Knee arthroplasty with patellar resurfacing	Knee arthroplasty without patellar resurfacing
Grade 1	4	6
Grade 2	8	7
Grade 3	35	32
Grade 4	13	15

Table 2 Intra-operative parameters at the time of knee arthroplasty

	Knee arthroplasty with patellar resurfacing	Knee arthroplasty without patellar resurfacing	
Tourniquet time	76 min (60–90 min)	70 min (58–86 min)	$p>0.05$
Blood loss	80 ml (60–100 ml)	78 ml (62–90 ml)	$p>0.05$
Lateral release	1	3	$p>0.05$

Post-operative complications included urinary retention in two patients, which resolved with catheterisation followed by trial without catheterisation. Pseudo-obstruction was noted in one patient, which was treated non-operatively by a period of active monitoring and dietary restriction. Superficial redness around the wound was noted in two patients in the early post-operative period. These patients were successfully treated with a one week course of oral antibiotics with no evidence of infection during further follow-up.

With regards to subjective preference, all patients were asked if they felt one knee 'felt better' than the other: Ten patients expressed no preference, 41 patients preferred the knee with resurfaced patella and nine patients preferred the knee with non-resurfaced patella ($p<0.001$). Pre-operative and post-operative scores at final follow-up in both groups are mentioned in Table 3.

Radiological evaluation revealed a mean pre-operative mechanical axis of −2° (varus). Eight knees had valgus alignment >10°. Five knees with valgus alignment were in the non-resurfaced group, whereas three knees were in the resurfaced group. Post-operative patellar tracking was satisfactory in all cases as assessed in axial view. No intra-operative complications were noted related to patellar resurfacing. However, radiolucency at the bone-cement interface was noted in relation to the patellar button in two patients. This was monitored by regular follow-up radiographs, which did not show progressive loosening at the final follow-up. Moreover, both these patients were asymptomatic and hence no further operative intervention was required. None of the cases required

Table 3 Knee Society scores

	Pre-operative Knee Society knee score	Knee Society knee score at final follow-up	Pre-operative Knee Society function score	Knee Society function score at final follow-up
Knee replacement with patellar resurfacing	44	88	40	80
Knee replacement without patellar resurfacing	46	76	42	68
	$p>0.05$	$p<0.05$	$p>0.05$	$p<0.05$

revision knee arthroplasty for loosening of femoral or tibial components.

Discussion

TKA is one of the most commonly performed operations in adult reconstructive surgery. Three different approaches exist amongst orthopaedic surgeons with regards to patellar resurfacing: non-resurfacing, universal resurfacing and selective resurfacing.

Resurfacing is associated with good clinical outcome, but is associated with a small risk of patella fracture or need for patellar revision in the future [4–6]. Salvage for this problem includes further resurfacing or resection arthroplasty in cases with poor bone quality [18]. Non-resurfacing of the patella may prevent such complications, but is associated with a higher rate of anterior knee pain and subsequent operation [4–6]. The decision to resurface the patella is subjective. The current literature on patellar resurfacing in TKA has failed to show clear superiority of patellar resurfacing or not resurfacing [4–6]. As suggested by different authors, selective patellar resurfacing [14, 17] could increase the rate of satisfactory outcome, but selection criteria remain unclear and often subjective.

Barrack et al. [12] concluded that there was an approximately equal likelihood of developing anterior knee pain post-operatively regardless of whether patellar resurfacing is done, whereas Waters and Bentley [19], Wood et al. [20] and Badhe et al. [21] found that the resurfaced patella performed better. Reoperations for patellofemoral problems, anterior knee pain and pain during stair climbing occurred less frequently with the resurfaced patella [19–21].

The exact time line for the development of anterior knee pain following TKA is not known. However, Waters and Bentley [19] reported that anterior knee pain developed within 18 months in their series. Results from our study concur with this finding.

A recent decision analysis study reported an average incidence of anterior knee pain for the non-resurfaced patients of 26%, compared to an average incidence of 12% for the resurfaced patients [8]. The average reoperation rate for non-resurfaced patients was 7.2% compared to 2.8% for the resurfaced patients [8]. Results from our study show an incidence of anterior knee pain of 10% on the non-resurfaced side and 3.3% on the resurfaced side. Overall incidence of pain was lower in our study as compared to other studies, but was still higher on non-resurfaced knees as compared to resurfaced knees. Overall incidence of reoperation in our study was 6.7% in non-resurfaced knees as compared to 0% in resurfaced knees. Thus, results from our study are in keeping with the published evidence of reduced anterior knee pain and reoperation in patients with resurfaced patella.

Confounding variables such as surgeons with varying degrees of experience, variations due to different prosthetic designs on the femoral and the patellar side, different techniques regarding the retained patella, variable degree of arthritis of the patella, variable initial diagnosis and differences between different population groups add difficulties in the interpretation of the results of various studies. Our study decreases the effect of confounding variables, since the study included patients with staged bilateral TKA. The surgical technique of the senior author (V.R.) has remained the same over the years, thereby eliminating variable surgical technique and skills as a confounding variable. One limitation of the study is the difference in the duration of follow-up of the non-resurfaced side, which is less as compared to the resurfaced side. However, most studies have reported that anterior knee pain develops early following TKA within the first 18 months. Hence, the variable duration of follow-up should not affect the interpretation of the results [4–6, 18]. Another limitation of the study is recollection bias, since patients may have forgotten the tough times associated with the first knee and may have higher expectations from the second knee. Efforts were made to minimise this by collecting all the data as well as scores from the patients prospectively over the years.

Our results show advantages in resurfacing the patella during TKA to reduce the incidence of anterior knee pain and need for reoperation. Hence, we recommend resurfacing of the patella at the time of primary TKA.

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