

# Prospective Trial of Resurfaced Patella Versus Non-Resurfaced Patella in Simultaneous Bilateral Total Knee Replacement

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## ABSTRACT

**Introduction:** A prospective trial was carried out in simultaneous bilateral total knee replacement to compare the outcome of resurfaced versus non-surfaced patella.

**Methods:** Thirty-five patients between 1997 and 2002 had simultaneous bilateral total knee replacement with resurfaced patella on the left and non-resurfaced patella on the right knee using the same implant in both.

**Results:** There were 29 females and six males with a mean age of 65.3 years. Mean follow-up was 3.18 years. There was no significant difference between the resurfaced and non-resurfaced knees with respect to the overall Knee Society clinical score ( $p=0.093$  preoperative,  $0.310$  postoperative) or the pain ( $p=0.715$  preoperative,  $0.395$  postoperative) or function subscores ( $p=0.126$  preoperative,  $0.317$  postoperative). The postoperative range of motion was 109 and 110 degrees for the resurfaced patella and non-resurfaced patella respectively ( $p=0.894$ ). The post-operative knee scores between patients with or without pre-operative anterior knee pain ( $p=0.238$ ) and between those who were obese and non-obese ( $p=0.387$ ) were not significantly different. 82.9% of patients felt that the resurfaced knee and 80% felt that the non-resurfaced knee were much better than before. There was no major preference for either knee for climbing stairs and getting out of chair.

**Conclusion:** The functional and symptomatic outcome of total knee replacement with or without patella resurfacing is the same in the local population. Also, the present study demonstrated no evidence that the weight of the patient or the presence of preoperative anterior knee pain should be considered as factors in the decision to resurface the patella.

**Keywords:** total knee arthroplasty, patella, knee score, patella thickness, patella tracking

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## INTRODUCTION

Despite many studies comparing resurfaced and non-resurfaced patellae in total knee replacements, the results have been mixed and the topic on whether to resurface or retain the patella remains controversial<sup>(1-6)</sup>. Proponents for resurfacing the patella have suggested a reduction in anterior knee pain in resurfaced patellas<sup>(2,7-9)</sup>. However, resurfacing the patella has been associated with patellofemoral complications with reported incidences as high as 9%<sup>(10)</sup>. These complications include patellar fracture, dislocation, loosening, component fracture, patellar tendon avulsion, patella clunk syndrome and exposure of metal backing of the component causing synovitis<sup>(10-14)</sup>.

As a result of these complications, some authors have suggested selective patellar resurfacing to lower the complication rates. The indications are not universally agreed upon and include patient weight and height, preoperative anterior knee pain, the degree of patella chondromalacia and patellar tilt or deformity<sup>(1,2,6,15-17)</sup>. However, the outcome of the patellofemoral joint after total knee replacement may be more related to the component design and the surgical technique rather than whether the patella is resurfaced or not<sup>(1,18-21)</sup>.

Moreover, the average patellar thickness in Singapore is 21.9 mm in women and 24.0 mm in men. As such, there is a tendency to cut the residual bony patellar thickness to less than 12 mm so as not to exceed the original patellar thickness after resurfacing<sup>(22)</sup>. However, with a thinner residual bony patella, there is a theoretical increased risk of patellar fracture<sup>(23)</sup>. Thus in the local population with thinner patella, it is important to know if there is any difference in the outcome of resurfacing or retention of the patella.

We therefore carried out a prospective study to compare patella resurfacing or retention in simultaneous bilateral total knee replacements for osteoarthritis. The same surgeon performed the bilateral knee replacements, using the same prosthesis on both knees but resurfacing the left knee only. As such, the variables of demography, disease, surgical techniques and implant designs that influence the outcome in retrospective or less controlled comparative studies are eliminated.

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## METHODS

Thirty-five patients between 1997 and 2002 had simultaneous bilateral total knee replacement performed by a single surgeon at Singapore General Hospital for osteoarthritic knees. Patients who previously had a patella realignment operation or tibiofemoral realignment operation such as high tibial osteotomy were excluded.

All the patients had resurfaced patella on the left knee and non-resurfaced patella on the right knee. The non-resurfaced patella had patellaplasty which included only patellar rim cauterization to provide partial denervation and osteophyte removal to allow better seating of the patella on the trochlea of the femoral component. No surgery was performed on the articular cartilage or subchondral bone of the retained patella. The same implant was used in both knees. The surgical technique was similar in all cases using a medial parapatellar approach. Patellar tracking was checked at the end of the operation and no patient required any lateral release.

The patient's weight and height were also measured and a patient considered obese if the Body Mass Index (weight/height<sup>2</sup>) is more than 25. Data on range of motion, severity of symptoms, knee function and patient's response were obtained preoperatively and at three months, one, two and five years postoperation. The Knee Society Clinical Rating Scale was used to compare the knees pre- and postoperatively. The ability to climb stairs and rise from chair were specifically assessed as was the presence or absence of anterior knee pain as a means of identifying symptoms related to the patella. An independent assessor carried out the data collection and the patients were not informed of which knee had resurfaced or non-resurfaced patella.

The maximal width of the non-resurfaced and resurfaced patella on the lateral view of the postoperative knee radiograph was measured as the precut patella thickness and the residual patella thickness respectively. The measured anteroposterior dimensions of the femoral component on the same lateral knee radiograph divided by the actual measurements provided by the implant manufacturer was used to correct for X-ray magnification.

Statistical analysis was performed with the use of SPSS version 10.0. Categorical data were compared with the use of chi-square test. Nonparametric statistics were used for analysis of continuous variables when data were not normally distributed. Significance was defined as  $p < 0.05$ .

## RESULTS

### *Demographics*

There were 29 women and six men. The mean age was 65.3 years (range 52.6 to 80.1 years), mean height

153.4 cm (range 142 to 162 cm) and mean weight 64.6 kg (range 50.8 to 94.4 kg). All the patients had osteoarthritis. General anesthesia was used in 30 patients and spinal anesthesia in five. The average duration of operation was 110 minutes (range 70 to 130 minutes) and the average blood loss was 380 ml (range 30 to 1500 ml). The average hospital stay was 13 days (five to 25 days). Blood transfusion was required in 30 patients with an average of 779 ml (range 0 to 1,500 ml) transfused. Implants used were 15 Nexgen (Zimmer), 18 Miller-Galante II (Zimmer), 1 PFC (Johnson & Johnson), and 1 Genesis (Smith & Nephews). There was no lateral release performed. The mean height of patella was 22.0 mm in women and 23.5 mm in men. Fifteen of the resurfaced patella had a residual bony thickness of less than 12 mm and the rest more than 12 mm. The mean follow-up was 3.18 years (range two months to 6.23 years).

### *Complications*

There was one deep vein thrombosis which required anticoagulation, one urinary tract infection treated with antibiotics, and one acute gastric ulcer that was treated conservatively. There were no acute infections of the knees.

One of the non-resurfaced knee required a re-operation for a laterally subluxed patella as a result of a fall two months postoperation. Medialisation of the tibial tubercle with lateral release and medial plication of the patella retinaculum was performed.

There were no patella complications for the resurfaced knee and none required revisions. None of the non-resurfaced patellae required subsequent revision to resurfaced patellae for anterior knee pain. There were also no revisions for aseptic component loosening.

### *Clinical Knee Scores*

The average preoperative Knee Society clinical score was 95 points (median 100 points, range 20 to 167 points). The average preoperative score for pain was 50.5 points (median 50 points, range 10 to 87 points), and the average preoperative score for function was 44.7 points (median 45 points, range 5 to 95 points).

The average postoperative Knee Society clinical score at the time of final follow-up was 184 points (median 189 points, range 150 to 195 points). The average postoperative score for pain was 93 points (median 95 points, range 81 to 95 points), and the average postoperative score for function was 91 points (median 100 points, range 55 to 100 points).

Table I shows the functional outcome for resurfaced and non-resurfaced patellae.

The average Knee Society clinical score for the resurfaced knee was 96 points (median 100 points,

**Table I. Functional outcome between resurfaced and non-resurfaced knees.**

	Resurfaced	Non-resurfaced	p value
Preop total knee score	96	94	0.093
Postop total knee score	184	184	0.310
Postop function score	91	91	0.317
Postop pain score	93	93	0.395
Postop range of motion	109	110	0.894

**Table II. Outcome based on presence of preoperative anterior knee pain and obesity.**

	Postoperative knee score		
	Total	Function	Pain
Anterior knee pain			
Present	186	92	94
Absent	183	90	93
	p=0.238	p=0.334	p=0.280
Obese	182	89	96
Non-obese	189	96	93
	p=0.387	p=0.295	p=0.882

range 26 to 135 points) preoperatively and 184.4 points (median 188 points, range 150 to 195 points) postoperatively. The average score for pain was 50.2 points (median 50 points, range 10 to 72 points) preoperatively and 93 points (median 95 points, range 81 to 95 points) postoperatively. The average score for function was 46 points (median 45 points, range 5 to 95 points) preoperatively and 91.2 points (median 100 points, range 55 to 100 points) postoperatively.

The average Knee Society clinical score for the non-resurfaced knee was 94 points (median 100 points, range 20 to 167 points) preoperatively and 183.8 points (median 190 points, range 150 to 195 points) postoperatively. The average score for pain was 51 points (median 50 points, range 10 to 87 points) preoperatively and 93 points (median 95 points, range 83 to 95 points) postoperatively. The average score for function was 44 points (median 45 points, range 5 to 80 points) preoperatively and 91 points (median 100 points, range 55 to 100 points) postoperatively.

There was no significant difference between the resurfaced and non-resurfaced knees with respect to the overall Knee Society clinical score ( $p=0.093$  preoperative, 0.310 postoperative) or the pain ( $p=0.715$  preoperative, 0.395 postoperative) or function subscores ( $p=0.126$  preoperative, 0.317 postoperative).

Postoperatively, the mean improvement was 90 points (median 93 points, range 38 to 160 points) for the resurfaced knee and 89 points (median 90 points, range 28 to 170 points) for the non-resurfaced knee. The mean improvement in pain score was 43 points (median 45 points, range 8 to 85 points) for the

resurfaced knee and 42 points (median 45 points, range 8 to 85 points) for the non-resurfaced knee. The mean improvement in function score was 47 points (median 50 points, range 10 to 89 points) for the resurfaced knee and 47 points (median 50 points, range 10 to 95 points) for the non-resurfaced knee. There was no significant difference in the improvement of scores between the resurfaced and non-resurfaced knees ( $p=0.733$  total score, 0.474 pain score, 0.812 function score).

Table II shows the outcome for patients with or without preoperative anterior knee pain and for patients who are obese or non-obese.

Patients with preoperative anterior knee pain were not found to have significantly different postoperative Knee Society clinical scores (average 186 points, median 193 points, range 150 to 195 points) compared with those without preoperative anterior knee pain (average 183 points, median 186 points, range 150 to 195 points) ( $p=0.238$ ).

Patients who were considered obese (BMI more than 25) were not found to have significantly different postoperative Knee Society clinical scores (average 182 points, median 186 points, range 152 to 195 points) compared with who were not obese (average 189 points, median 188 points, range 185 to 195 points) ( $p=0.387$ ).

#### Range of motion

The average range of motion at the time of final follow-up was 109 degrees (median 110 degrees, range 85 to 135 degrees) for the resurfaced patella and was 110 degrees (median 110 degrees, range 85 to 135 degrees) for the non-resurfaced patella. There was no significant difference in the average postoperative range of motion between the resurfaced and non-resurfaced knees ( $p=0.894$ ).

#### Patient satisfaction

Table III shows the patient's response to resurfaced and non-resurfaced knees

At the time of last follow-up, the patient response for the resurfaced knee were 29 (82.9%) much better, 6 (17.1%) better. For the non-resurfaced knee, the response were 28 (80%) much better, 7 (20%) better. There was no significant difference between these results ( $p=0.759$ ).

When asked to compare their knees, 10 (28.6%) preferred the resurfaced side, 9 (25.7%) preferred the non-resurfaced side and 16 (45.7%) expressed no preference.

#### Patellofemoral function

At the time of last follow-up, 22 (62.9%) could climb stairs normally up and down, 7 (20%) climb stairs up normally but down with rails, 5 (14.3%) climb stairs up and down with rails and 1 (3.0%) was unable to climb stairs. For getting out of chair, 28 (80%)

**Table III. Patient's response.**

	Resurfaced no. (%)	Non-resurfaced no. (%)
Patient satisfaction		
much better	29 (82.9)	28 (80)
better	6 (17.1)	7 (20)
		p=0.759
Climbing stairs preference	11 (31.4)	10 (28.6)
Getting out of chair preference	9 (25.7)	9 (25.7)

**Table IV. Shows the location of pain for resurfaced and non-resurfaced knees.**

Site of pain	Resurfaced no. (%)		Non-resurfaced no. (%)	
	Preop	Postop	Preop	Postop
None	0 (0)	24 (68.6)	0 (0)	19 (54.3)
Medial	2 (5.7)	2 (5.7)	3 (8.6)	5 (14.3)
Lateral	1 (2.9)	0 (0)	1 (2.9)	2 (5.7)
Anterior	9 (25.7)	7 (20)	10 (28.6)	7 (20)
General	23 (65.7)	2 (5.7)	21 (60)	2 (5.7)

could get out of chair with ease without using arms and 7 (20%) could get out of chair using arms for support.

When asked to compare their knees for climbing stairs, 11 (31.4%) preferred the resurfaced side, 10 (28.6%) preferred the non-resurfaced side and 14 (20%) expressed no preference. For getting out of chair, 9 (25.7%) preferred the resurfaced side, 9 (25.7%) preferred the non-resurfaced side and 17 (48.6%) expressed no preference.

#### *Knee Pain*

Table IV shows the location of pain for resurfaced and non-resurfaced knees. Preoperatively, the patients were given analgesia but this was unable to control the pain satisfactorily thus requiring bilateral total knee replacement. Postoperatively at time of follow-up, 24 (68.6%) of the resurfaced knees and 19 (54.3%) of the non-resurfaced knees were pain-free and 11 (31.4%) of the resurfaced knees and 16 (45.7%) of the non-resurfaced knees only had mild occasional pain requiring analgesia very infrequently.

Fourteen knees developed postoperative anterior knee pain at a median time of 3.1 years (range 1.2 to 5.4 years). Of which, two developed anterior knee pain after five years of follow-up.

There was no significant difference in the prevalence of anterior knee pain between the knees with resurfaced and non-resurfaced patella preoperatively (p=0.788) and postoperatively (p=1.00). 19 out of 70 knees (27%) had anterior knee pain preoperatively and 14 (74%) of them had this symptom relieved by the operation.

Seven (20%) of resurfaced patella developed postoperative anterior knee pain of which 2 (6%)

were present preoperatively. Therefore 5 out of 7 (71%) resurfaced patella had new postoperative knee pain. For the non-resurfaced patella, 7 (20%) had postoperative anterior knee pain of which 3 (8.6%) was present preoperatively. Therefore 4 out of 7 (58%) non-resurfaced patella developed new anterior knee pain. The development of new postoperative anterior knee pain was not significantly different between the resurfaced and non-resurfaced patella knees (p=0.577).

The mean weight of patients with anterior knee pain was 69 kg (median 69, range 67.9 to 70 kg) compared with 64 kg (median 61, range 50.8 to 94.4 kg) for those without anterior knee pain. This was not significant (p=0.513).

## **DISCUSSION**

In this study, we found no significant differences between resurfaced and non-resurfaced patella with respect to the Knee Society pain (p=0.395), function (p=0.317) and total (p=0.262) scores. Patients did not express a clear preference for either side for climbing stairs and getting out of chair. There was also no significant difference in the improvement of scores between the resurfaced and non-resurfaced knees (p=0.733 for improvement in total score, 0.474 improvement in pain score, 0.812 improvement in function score). Other studies also found no significant differences between resurfaced and non-resurfaced patellae<sup>(1,5,6)</sup>.

Obesity and preoperative anterior knee pain are factors commonly considered to be indications for selective patella resurfacing<sup>(2,6,15-17)</sup>. However, our study found that most of the postoperative anterior knee pain were of new onset. The likelihood that anterior knee pain will develop postoperatively was about the same regardless of whether patellar resurfacing is performed. Neither obesity nor preoperative anterior knee pain predicted a lower postoperative knee score or postoperative anterior knee pain. Other studies also showed that the postoperative clinical scores, the postoperative development of anterior knee pain and the need for subsequent resurfacing were not predicted by the presence of preoperative anterior knee pain and obesity<sup>(1,9)</sup>. The prevalence of anterior knee pain in this study was consistent with the rates in previously reported studies<sup>(1,9,16,24)</sup>. Thus, resurfacing the patella does not guarantee a painless patellofemoral joint.

Patella complications have often raised concerns against routine patella resurfacing<sup>(10-14)</sup>. However, with refinements of prosthetic design and attention to technical details, recent studies have demonstrated no appreciable risk of complications compared with that associated with nonresurfacing<sup>(3,5,7)</sup>. In this study, the average patella thickness in Asian women was 22.0 mm and 23.5 in men. During the study

period, there were no complications related to patella resurfacing and none required revision. This suggests that a thinner residual patella bone of less than 12 mm may not predispose to increased risk of patella complications. This is in keeping with the results of another study<sup>(22)</sup>. In spite of this, given that the outcome of resurfaced versus non-resurfaced patella is the same, there may be an argument against resurfacing the patella routinely.

Several studies have shown that the design of the femoral component influences patellofemoral contact stresses and tracking in both resurfaced and non-resurfaced patellae and hence affect patellofemoral function and complications after total knee arthroplasty<sup>(19-21,25)</sup>. In our study, the implants used were: 15 Nexgen, 18 Miller-Galante II, 1 PFC, 1 Genesis. Having excluded the type of implant as a confounding factor by using the same type of implant for both knees in the same patient, we found no significant difference in the outcomes for the resurfaced and nonresurfaced knees.

The median time to develop postoperative anterior knee pain in this study is 3.1 years. One study found that anterior knee pain developed in two non-resurfaced knees at a median of sixty-three months<sup>(25)</sup>. However in our study, there were altogether 14 knees that developed postoperative anterior knee pain but only two developed it after five years of follow-up.

In this study, the range of follow-up is from two months to 6.23 years. Thus these results are preliminary and further follow-up is required to determine if there is any difference between knees with resurfaced and non-resurfaced patella in the long term, for example in 10 years' time. Also, in this study the side of knee with patella resurfacing is not randomised. Although this may introduce confounding factors, we feel that a comparison between knees with resurfaced and non-resurfaced patella can still be made and justifiable conclusions drawn.

The decision regarding whether to resurface the patella during a total knee arthroplasty remains problematic. As the results of resurfaced and non-resurfaced patella are similar, currently the decision to resurface the patella lies largely on surgeon preference. Retention of patella is a viable option, but patients must be willing to accept the risk that a reoperation might be necessary in order to resurface the patella. They also should know that such an operation is likely to decrease symptoms substantially. Conversely, patients who have resurfacing should understand that there is a risk of postoperative anterior knee pain for which there may not be an adequate solution. However, if resurfacing is chosen, this can be carried out even in thinner residual patella bone without increased risk of patella complications. Also more importantly, based on the present study, there is no evidence that the weight of the patient or the presence of preoperative anterior knee pain

should be considered as factors in deciding whether to resurface the patella.

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