

Posterior Stabilized Total Knee Arthroplasty without Patellar Resurfacing

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ABSTRACT

Introduction: Total Knee arthroplasty remains the most commonly performed surgical procedure for the management of knee osteoarthritis when conservative management fails. Apart from pain relief, improved range of motion and improvement in lifestyle of the patient are major advantages. Long term follow-up of total knee arthroplasty has shown up to 97% survival rates at 15 and 20 years (Buechel 2002, Callaghan et al. 2005). With newer implants providing longer survivorship, it is crucial to study long term functional outcome in patients to have a better understanding of the variables responsible for providing good outcome. We conducted the study to evaluate the functional outcome following Posterior Stabilized Total Knee Arthroplasty without patellar resurfacing at 2-year follow-up.

Material and Methods: We have prospectively studied functional outcome for 2 years in terms of Knee Society Scoring System in 114 patients undergoing total knee arthroplasty without patellar resurfacing for knee osteoarthritis in the Department of Orthopedic Surgery Unit 1 between June 2020 and January 2022. Following approval of the Ethical committee, 114 patients presenting with advance stage of knee osteoarthritis after failed conservative management, underwent Total Knee arthroplasty without patellar resurfacing. Knee Society Scoring was calculated pre-operatively and post-operatively at 6 weeks, 6, 12 and 24 months. Difference between means Knee Society Score at each follow-up was assessed by paired sample T-test. For statistical significance P-value of ≤ 0.05 was selected.

Results: The study consisted of 114 patients of which 2 died and 2 were lost to follow up and were thus excluded. There were 64 (56.1%) males and 46 (40.4%) female patients with mean age of 58.14 ± 9.50 years ranging from 30 to 77 years. In total, 56 (49.1%) were operated on the right and 54 (47.4%) operated on the left. Mean operative time for the surgery was 79.2 ± 14.0 minutes, mean Knee score and Knee functional score was 38.6 ± 13.92 and 43.0 ± 18.2 respectively. The mean Knee score and Knee Functional score at was 51.4 ± 19.6 and 56.5 ± 14.5 at post-operative 6 weeks, 81.6 ± 6.6 and 82.6 ± 7.2 at 6 months, 88.6 ± 3.8 and 89.1 ± 3.5 at 12 months, 89.7 ± 3.6 and 90.1 ± 2.9 at 24 months. A total of 4 (3.5%) patients developed post-operative complications which were managed accordingly. There was significant improvement in the knee score and the functional score pre-operatively when measured at 24 months post-operatively with p value < 0.05 .

Conclusion: Our study concludes that significantly good results can be obtained in Posterior Stabilized Total Knee without Patellar Resurfacing at two years follow-up in terms of Functional outcome using the Knee Society Scoring System.

Keywords: Knee Society Score, Patellar re-surfacing, Total Knee Arthroplasty

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INTRODUCTION

Total Knee arthroplasty remains the most commonly performed surgical procedure for the management of knee osteoarthritis when conservative management fails. Apart from pain relief, improved range of motion and improvement in lifestyle of the patient are major benefits. Long term follow-up of total knee arthroplasty has shown up to 97% survival rates of

the implants at 15 and 20 years (Buechel 2002, Callaghan et al. 2005). But when it comes to whether to Resurface the patella during knee arthroplasty or not, controversy arises. Management of patellofemoral arthritis during total knee arthroplasty includes three strategies namely patellar resurfacing, patellar non-resurfacing and selective resurfacing^{2,3}, but no consensus has been reached until now regarding the best management⁴. Proponents of the

patellar resurfacing claim this technique to have decreased rate of re-operation, improved knee function and decreased post-operative anterior knee pain⁵, whereas the advocates of patellar non-resurfacing argue that this technique has decreased surgical time, lesser intra-operative complications and results similar to patellar resurfacing⁶. The previous published data, including high quality Randomized control trial and meta-analysis has been trying to solve this ongoing debate only to conclude conflicting results in terms of Knee Society Scores and Anterior knee pain^{7,8}. There have been many suggested causes of anterior knee pain such as chondropathy secondary to patellar maltracking, patellofemoral compartment degeneration and pain arising from peripatellar retinaculum, infrapatellar fat pad and the synovium. But the most commonly accepted opinion among scholars regarding the origin of post Total Knee Arthroplasty is of patellofemoral etiology despite no clear consensus in terms of etiology and treatment. On the other hand, joint cartilage is usually aneural, so the lesions on the surface are not thought to be the cause of anterior knee pain. Regarding the innervation of the anterior knee, substance-P nociceptive afferent nerve fibers were found in the peripatellar soft tissue³⁰. So theoretically denervating these fibers using the electrocautery may have a role in desensitizing the anterior knee. Using the electrocautery along with patelloplasty and removal of osteophytes has been in practice for the anterior knee pain when operating for total knee arthroplasty³¹⁻³³.

The Knee Society Score was proposed by the American Knee Society in 1989 (Knee Society score, Insall et al. 1989) and includes two-part assessment of the patient, the Knee Score and the Functional Score. The Knee Score assesses mainly the pain, stability and range of motion along with deductions for flexion contractures, extension lag and malalignment. The Second part evaluates the walkable distance and the ability to climb stairs as the main parameters and deducts points if a walking aid is used. A score between 80 to 100 is labelled as Excellent, 70 to 79 as Good, 60 to 69 as fair and below 60 as poor.

Considering the contrasting results in management of patellofemoral arthritis, we conducted this prospective study at our institute to assess the functional outcome in terms of Knee Society Score at 2-year follow-up, in patients undergoing Posterior Stabilized Total Knee arthroplasty without patellar resurfacing.

PATIENTS AND METHODS

This was a prospective study including patients undergoing Posterior Stabilized total knee arthroplasty without patellar resurfacing for knee osteoarthritis in a tertiary care hospital, between June 2020 and January 2022. A sample size of 114 patients were selected using appropriate statistical method for sample calculation. Following approval of the Ethical committee, 114 patients presenting with advance stage of knee osteoarthritis after failed conservative management were admitted and consent for study was taken. Detailed History including comorbidities was taken, and then detailed physical examination to check for active and passive range of motion, any joint contractures and any ligamentous pathology, and then radiographs were taken. Patients presenting with history of inflammatory arthritis, previous osteotomy or patellofemoral procedure, Varus or valgus deformity of more than 25° and those having bone deficiency on pre-operative radiographs were excluded from the study. Pre-operative demographic details and knee society score was calculated for each patient and documented. Following relevant blood tests and anesthesia fitness, the patients underwent Cemented Posterior Stabilized SIGMA® Total Knee System (DePuy Synthes, Johnson & Johnson, USA) without patellar resurfacing. A longitudinal mid-line skin incision was made, the standard median, Para patellar approach was used. Distal femoral, proximal tibial cuts were made according to preoperative planning in order to place the relevant components perpendicular to lower extremity mechanical axis. Bone cuts were made to ensure minimum bone resection. Lateral soft tissue was released in a stepwise manner. The size of the components was then determined. Soft tissue balancing was assessed, released and repeated if it was deemed necessary followed by placement of the selected articular insert. After trial components proved to be well balanced in uncompromised range of motion, the definitive implant components were cemented and implanted after thorough preparation of the ends. The patellar articular surface was assessed and classified pre-operatively based on the criteria laid down by Outerbridge⁹. Patellar osteophytes were removed if present followed by circumferential electrocautery to denervate the patella. Patellar tracking was assessed at the end of operation.

Post-operatively each patient was given a rehabilitative plan and was mobilized on 1st post-operative day under the supervision of a physiotherapist. After discharge from the hospital,

the patients were called for follow up at 2 weeks, 6 weeks, 6, 12 and 24 months. Stitches were removed at first follow-up. At each follow-up, clinical and radiological assessment was done, as well as calculation of the functional outcome using the Knee Society Score. Coronal and sagittal knee alignment before and after surgery, patellar altitude and the position of joint line were assessed using the radiographs. All the information was collected in Performa and assessed with a statistical software with the help of a statistician. Continuous variables were presented as mean and categorical variables were expressed as frequencies and percentages Difference between mean Knee Society Score at each follow-up was assessed by paired sample T-test. For statistical significance P-value of ≤ 0.05 was selected as significant.

RESULTS

The study consisted of 114 patients of which 2 died and 2 were lost to follow up and were thus excluded. There were 35 (30.7%) males and 75 (65.8%) female patients with mean age of 58.78 ± 8.31 years ranging from 45 to 77 years. Mean weight of subjects was 84.9 ± 8.8 kg. the demographic detail of the subjects is shown in table 1. In total, 56 (49.1%) were operated on the right and 54 (47.4%) operated on the left.

Mean operative time for the surgery was 79.2 ± 14.0 minutes. Intra-operative patellar articular surface as classified by Outerbridge is shown in Table 2. Forty-four (38.6%) had cartilage with softening and swelling, 59 (51.8%) had partial thickness defect with fissures on the surface, 7 (6.1%) Fissuring to the level of subchondral bone.

A total of 29 (25.4%) patients had comorbidities in the form of Diabetes mellitus, Hypertension, Ischemic Heart disease, Rheumatoid Disease or Obesity, with two or more existing at the same time in some patients, details of which are shown in Table 3. Post-operatively, a total of 6 (5.5%) subjects developed complications, with one patient having superficial wound infection which resolved without any surgical intervention. Another patient developed deep infection at 3 weeks which warranted thorough washing and retention of the implant with saline and antiseptic solution along with Culture specific antibiotics for 6 weeks. Four (3.6%) subjects developed anterior knee pain at 6 months, which gradually resolved with extended physiotherapy program. Two (1.8%) patients died due to cause unrelated to the study and 2 (1.8%) did not show up for follow-up, hence were excluded from the study.

Pre-operatively 55 (50%) of the subjects had Active Range of Motion (AROM) between $0-60^\circ$, 42 (38.1%) between $0-90^\circ$ and 13 (11.8%) subjects between $0-110^\circ$. At 6 weeks post-operatively all 110 (100%) subjects had AROM between $0-110^\circ$, and at 6 months post-operatively 40 (36.4%) had AROM of $0-90^\circ$ and 70 (63.6%) had AROM of $0-110^\circ$. At 12 months follow-up 41 (37.3%) subjects had AROM of $0-110^\circ$ and 69 (62.7%) had AROM of $0-120^\circ$. At 24 months follow-up all 110 (100%) subjects had AROM of $0-120^\circ$. Table 5 shows the AROM Pre-operatively and at different follow-ups.

Pre-operatively, mean Knee score and Knee functional score was 38.6 ± 13.92 and 43.0 ± 18.2 respectively. The mean Knee score and Knee Functional score pre-operatively and at follow-up is shown in Table 6. The mean Knee score and Knee Functional score at was 51.4 ± 19.6 and 56.5 ± 14.5 at post-operative 6 weeks, 81.6 ± 6.6 and 82.6 ± 7.2 at 6 months, 88.6 ± 3.8 and 89.1 ± 3.5 at 12 months, 89.7 ± 3.6 and 90.1 ± 2.9 at 24 months. There was significant improvement in the knee score and the functional score pre-operatively when measured at 24 months post-operatively with *p value* of < 0.05 . The greatest improvement between mean Knee Score and Functional Score was seen between 6 weeks and 6 months at 37% and 31%. There was not much difference between the means in-between 12 and 24 months as illustrated in Figure 1.

Table 1. Demographic details of Subjects

Total Subjects (n)	110
Mean age in years	58.78 ± 8.31
Gender (M: F)	35:75
Side (R: L)	56:54
Mean weight in Kg	84.9 ± 8.8

Table 2. Outerbridge Classification of Articular Surface of Patella

Grade	N (%)
0	0
1	44 (38.6)
2	59 (51.8)
3	7 (6.1)
4	0 (0)

Table 3. Comorbidities in subjects

Comorbidity	N (%)
Diabetes Mellitus	4 (3.6)
Hypertension	8 (7.3)
Rheumatoid	2 (1.8)
Obesity	6 (5.5)
Multiple	9 (8.2)

Table 4. Post-operative Complication in subjects

Post-op complication	N (%)
Wound infection	2 (1.8)
Anterior knee pain	4 (3.6)
Total	6 (5.5)

Table 5. Active Range of Motion Pre- and Post-operatively

	Pre-op	6 weeks	6 months	12 months	24 months
0-60°	55 (50%)	-	-	-	-
0-90°	42 (38.1%)	110 (100%)	40 (36.4%)	-	-
0-110°	13 (11.8%)	-	70 (63.6%)	41 (37.3%)	-
0-120°	-	-	-	69 (62.7%)	110 (100%)

Table 6. Functional Outcome in terms of Knee Society Score, Pre-op up to 2-year follow-up

Score	Knee Score and Functional Score					Paired Sample T - test pre-op and at 2 years
	Pre-op	6 weeks	6 months	12 months	24 months	
Mean	38.6, 43.0	51.4, 56.5	81.3, 82.3	87.3, 88.8	89.1, 89.7	t = -27.3 p < 0.05
Standard deviation	13.9, 18.2	10.9, 14.5	6.2, 6.9	8.9, 3.2	2.9, 2.6	
Maximum	71.0, 89.0	77.0, 92.0	91.0, 92.0	92.0, 92.0	92.0, 92.0	
Minimum	8.0, 0	27.0, 26.0	56.0, 63.0	1.0, 76.0	78.0, 77.0	

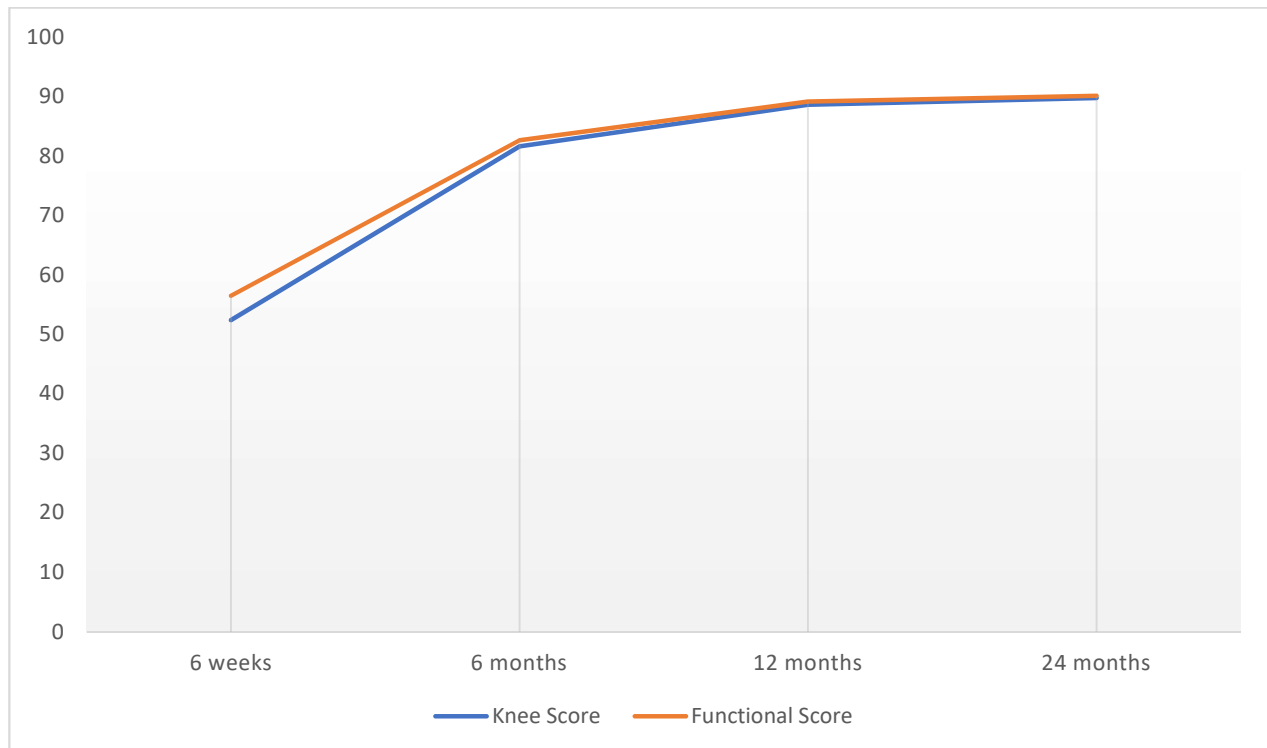


Figure 1. Graph showing improvement in Knee Society Score with time

DISCUSSION

The main objective of our study was to assess the Functional Outcome following Posterior Stabilized

Total Knee Arthroplasty without patellar resurfacing at two-year follow-up. Our results showed that there was a significant improvement in the Knee Society

Score at two-year follow-up and that no revision was required, despite not resurfacing the patella for patellofemoral arthritis as suggested by some recent studies.

Our results demonstrate improvement in functional outcome over two-year follow-up. A number of tools are currently in use when measuring the functional outcome and include The American Knee Society Score (KSS) (Insall et al. 1989), The Oxford Score, Range of Motion (ROM), Anterior Knee Pain (AKP), The Knee Injury and Osteoarthritis Outcome Score (KOOS), Visual Analogue Score (VAS) of pain, Patella Tilt, Feller Score, noise after operation and patients' satisfaction. The tool used for evaluation of functional outcome in our study was the American Knee Society Scoring System. Although Still being used in most studies, the high inter and intra-observer variation in KSS makes its use for the estimation of outcome questionable²⁵.

There was substantial improvement in the KSS as early as 6 weeks, but the maximum improvement was observed between 6 weeks and 6 months. There was little improvement of score between 12 and 24 months thus demonstrating improvement in KSS until 2 years post-operatively. The mean pre-operative Knee and Functional score was 38.6 and 43.0 respectively, and mean of 89.7 ± 3.6 and 90.1 ± 2.9 post-operatively. This was consistent with the result shown by In Suk Oh et al.²⁷ with mean pre-operative knee and functional score of 34.3 and 42.2 and post-operatively of 91.1 and 89.6. However, we seemed to have achieved this result much earlier at 24 months when compared to 78.2 months shown by In Suk Oh et al. Nerhus et al.²⁶ also showed the greatest improvement between 6 weeks and 6 months, but in terms of KOOS scoring system for TKR without patellar resurfacing, and that between 2 and 4 years the functional outcome showed a slight downward trend. Nilsson et al. (2009) however, showed contrasting results with best results in functional outcome at 1 year post-operatively. The reason for the plateau in Fig 1. Is uncertain. One explanation may be the placebo effect which may influence the results after orthopedic surgery (Moseley et al. 2002, Hróbjartsson and Gøtzsche 2004, Kirkley et al. 2008). Thus, one year down post-operatively, the patients tend to score more realistically than immediately post-operatively due to enthusiasm of having a joint replaced. Further studies may shed light on this matter.

In terms of ROM, there was improvement in active ROM in all patients. The stiffer knees (0-60° and 0-90°) showed greater improvement post-

operatively when compared to mobile knees (0-110° and 0-120°), a finding consistent with Nerhus et al.²⁶. Ritter et al. 2003, Dennis et al. 2007 showed that the primary determinant of post-operative ROM is the pre-operative ROM, finding also displayed by the results of Nerhus et al. But this was not the case in our study where there was improvement in ROM of all patients irrespective of the mean pre-operative ROM.

Four of our patients developed AKP post-operatively at 6 months. There was no correlation between the Outerbridge Severity for patellofemoral arthritis and AKP. Fortunately, none of these subjects required revision and the pain improved with extensive rehabilitation. In our subjects, pre-operatively, following the removal of patellar osteophytes, circumferential electrocautery was done to denervate the patella. This has been hypothesized to reduce AKP and improve functional scores post-operatively. A prospective, randomized controlled study in 2012 on Patellar denervation in total knee arthroplasty without patellar resurfacing showed that at 2 year follow-up, there was a statistically significant improvement in terms of KSS, ROM and VAS in patients undergoing electrocautery denervation versus patelloplasty³⁴. In another study by In Suk Oh et al.²⁷, the AKP post-operatively was not related to the severity of degenerative changes to patella and that none of these patients in their study required re-operation. In fact, AKP is related more to the component position and design rather than whether the patella was resurfaced or not^{28,29}. Despite being a complication of not resurfacing the patella, AKP in some studies has been reported to be as low as 5% and as high as 45%, but these studies described poorly designed implants to deal with patellofemoral joint and were usually retrospective studies. In conclusion, our study demonstrated that post-operative AKP can be prevented by denervating the patella and if develops as a post-operative complication, then can be managed conservatively without reoperation, saving the patient both the cost of an additional component and the need to have native patella resurfaced.

Our study is not without its limitations. The Small sample size and short follow-up may leave some questions unanswered in terms of implant survivorship and patient satisfaction over a longer time frame. Another was the measurement of ROM using a goniometer which can have questionable reliability as suggested by Ryd et al (1997), although expensive and time consuming, measurement on radiographs may be more reliable as Lavernia et al.

2008 suggested. The KSS scoring system on the other hand does not consider the patients' satisfaction regarding health and function, thus some authors have suggested using questionnaires for measuring the patients own experience of disability following TKR.

The controversy of patellar resurfacing has remained unanswered and has led to different Centers divided between resurfacing. Our department has been performing arthroplasty without patellar resurfacing with satisfactory results at follow-up. The available Meta-analysis of randomized control trials (RCTs) comparing patellar resurfacing with non-resurfacing show variable results with some reporting improved clinical results with patellar resurfacing in terms of anterior knee pain and fewer re-operations^{12,13}. Whereas, other studies show no added benefit of patellar resurfacing¹⁴. Although most of these RCTs done had a small number of subjects and short follow-up, a few did have appropriate powered study sample size and follow-up, to report on the revision rates and Passive Range of Motion¹². A study conducted by Feller et al¹⁹ and Barrack et al²⁰ did not show significant difference in pain, Knee score and function in patients with and without resurfacing. In another study, Mayman et al²¹ demonstrated that patients with resurfaced patella had lower anterior knee pain with walking and climbing stairs but the difference in Knee Society Score between groups was not significant. Similarly, Wood et al²² also demonstrated decreased anterior Knee pain in patients with resurfaced patella but the difference between the groups in terms of Knee Score, Functional Score and patient satisfaction remained insignificant. In an updated meta-analysis of randomized controlled trials in 2021²³, the study concluded that although resurfacing patella can lead to improved KSS and Function Score as well as decrease reoperation and noise after surgery, it did not significantly improve the outcomes such as AKP, KOOS, ROM, VAS, Feller Score, Oxford Score, Patellar Tilt and Patients' satisfaction. Similarly, a systematic review of Ten meta-analyses, published between 2005 and 2015, in 2018²⁴, also concluded that there was no superiority of resurfacing over non-resurfacing. The data from Norway, New Zealand and Sweden also showed no difference in rate of revision following primary total Knee arthroplasty with and without patellar resurfacing¹⁵⁻¹⁷, although there was better Passive Range of Motion at 6 months and 5 years follow-up after TKR with Patellar resurfacing in the New Zealand Registry.

In contrast, the Swedish Registry reported on 27,327 knees with and without patellar resurfacing and showed that patient satisfaction was greater in those with patellar resurfacing¹⁸, however, this difference was reduced over time. In the recent Registry of Australia, of the 136,116 Total Knee Arthroplasty, the rate of revision was higher in TKRs where the surgeons performed infrequent or no patellar resurfacing as compared to those undergoing regular resurfacing. This Australian observation is also supported by Hunt et al¹⁰, the largest analysis to date on this topic, that the risk of revision is higher when patellar resurfacing is not done. The study also gives the prediction that if patellar resurfacing had been done in the total of 53,6228 TKRs without patellar resurfacing, excess revisions of 2,841 within 10 years of primary TKR could have been avoided which would approximately cost the healthcare £55.8 million burden. Thus, the recent guidelines from NICE are supporting patellar resurfacing in primary TKR, labelling it as cost-effective, yet at the same time suggests that inadequate clinical evidence is available to support resurfacing, no resurfacing and selective resurfacing. As mentioned in the committee recommendations, lack of clinical data warrants research on selective resurfacing in knee replacement.

CONCLUSION

Significantly good results can be obtained in Posterior Stabilized Total Knee without Patellar Resurfacing at two years follow-up in terms of Functional outcome using the Knee Society Scoring System.

Anterior Knee pain did not correlate to the pre-operative Severity of patellofemoral arthritis, and that pain was mild and was managed with good rehabilitation program thus avoiding reoperation and complications to patella during resurfacing.

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