Journal of Arthroscopy and Joint Surgery 6 (2019) 65–69

Contents lists available at ScienceDirect

Journal of Arthroscopy and Joint Surgery

journal homepage: www.elsevier.com/locate/jajs

Research paper

Functional outcome of patellar resurfacing vs non resurfacing in Total Knee Arthoplasty in elderly: A prospective five year follow-up study☆

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ARTICLE INFO

Article history:
Received 7 April 2018
Accepted 17 September 2018
Available online 18 September 2018

Keywords:
Osteoarthritis
Resurfacing
Total knee arthroplasty
1

ABSTRACT

Introduction: Osteoarthritis of knee is one of the most common orthopaedic problems of elderly. Total knee arthroplasty is a common surgical procedure. Many of the poor functional outcomes are related to problems of patellofemoral joint and there is considerable debate whether patella should be resurfaced or not at the time of total knee arthroplasty.

Material & methods: A total of 100 subjects were evaluated and were further randomized equally into two arms by using standard computer generated random table. Each arm was designated to either RS or Non RS between June 2011 to May 2013 at Department of Orthopaedic Surgery, Goa Medical College and Hospital followed by approval of ethical committee. Exclusion criteria for the study included history of patella fracture, age <50 years, Patellofemoral instability, Prior patellectomy, Prior knee replacement surgery, Prior hip replacement surgery, Patient with osteoarthritis of hip, Prior history of tibial condyle or distal femoral fractures. Chi square test was used for statistic analysis.

Results: Knee society score including clinical and functional (KSS) were performed for assessment. There were a total of 80 female and 20 male patients. Out of 80 female knees, 41 were resurfaced and 39 were not. Out of 20 male knees, 9 were resurfaced and 11 were not. Mean clinical knee score ranging from 0 to 100 points in the resurfaced group improved from 28.6 to 84.14 and; from 24.72 to 86.2 in the non resurfaced group. The difference in the clinical knee score amongst resurfaced and non resurfaced group was not statistically significant at 5 years follow up. The mean functional knee score on a range of 0–100 point went up from 39.1 to 90.1 in resurfaced group and; from 45 to 92.4 in the non resurfaced group. The difference in functional knee score amongst resurfaced and non resurfaced groups is not statistically significant even at 5 years follow up post operatively. However NRS group received better increment in scores than RS group. Visual Analogue Scale (VAS) was used for anterior knee pain assessment pre and post operatively in both groups and was not statistically significant as well. None of the patients underwent revision of total knee replacement after the primary procedure.

Conclusion: A similar knee evaluation score was observed in both RS and NRS groups after 5 year of follow up. However, it appears that non-resurfacing had shown marginally better scores than resurfacing group.

1. Background & introduction

Osteoarthritis of knee is one of the most common orthopaedic problems of elderly. Total knee Arthroplasty (TKA) being a common surgical procedure is proven to have long term clinical success.[1–3]

There is considerable debate whether patella should be resurfaced or not at the time of total knee Arthroplasty because in sizable

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https://doi.org/10.1016/j.jajs.2018.09.006
2214-9635/

number of patients, poor functional outcomes may be due to problems of patellofemoral joint. Routine PRS appears to be an option to reduce the patello-femoral related pain but prospective randomized trials have not provided consistent results in short to medium term.

Patellar complications following Total Knee Arthroplasty (TKA) is a major mode of failure and PRS is often recommended based on higher revision rates.[4] Total knee replacement with or without patella resurfacing is still a contentious issue despite three decades of successful joint replacement surgery. The benefits of TKA are excellent pain relief with improved function and durability.[5]

Problems with the patellofemoral joint still play a major role in failure rates.[6] Early design of total knee replacements did not resurface the patella hence leading to around 50% problems with anterior knee pain[7]

Subsequently, TKA designs were modified and this also led to the development of patella resurfacing; with the first reported patella resurfacing occurring in 1974. A polyethylene dome design for the Insall-Burstein total condylar knee replacement (Zimmer, Warsaw, Indiana) was introduced[8] This led to design modification and patella resurfacing which became a cause for concern. The literature[9] showed early complications rates ranged from 4% to 50%. These complications are over or under restoration of patellar thickness, fracture, aseptic loosening, wear, component failure, patellar clunk syndrome and tendon ruptures.

The Australian Orthopaedic Association (National Joint Replacement Registry) which conducted a study on large number of subjects, concluded that rate of early revision was higher in the NRS group (4%) compared to the PRS group (3.1%) at 5 years follow up.[10] Whether Patellar Resurfacing provides better functional outcomes in patients undergoing Total Knee Arthoplasty (TKA) in Elderly? To verify this finding in Indian set up, this study has been planned.

2. Materials & methods

A total of 100 subjects were evaluated prospectively between June 2011 to May 2013 at Department of Orthopaedic Surgery, Goa Medical College and Hospital followed by approval of ethical committee. Subjects were further randomized equally into two arms by using standard computer generated random table. Each arm was designated to either PRS or NRS one day prior to surgery. Exclusion criteria for the study included history of patella fracture, Age <50 years,Patellofemoral instability, Prior patellectomy, Prior knee replacement surgery, Prior hip replacement surgery, Patient with osteoarthritis of hip, Prior history of tibial condyle or distal femoral fractures. Preoperative knee scores were clearly documented. The arthroplasty was performed by senior surgeon following standard approach with medial parapatellar arthrotomy under combined spinal and epidural anaesthesia (CSEA). All patients received size specific femoral and tibial components. All components were cemented. For PRS, patellar preparation was done using a saw (Fig. 1) and 3 peg oval patellar button component was used (Fig. 2). In cases of NRS, patelloplasty was done in which osteophytes were removed by trimming around patella and denervating it. Patellofemoral tracking was assessed in all cases after trial component insertion and after implantation of definitive implants. No selective resurfacing was done. Need for lateral release was assessed after checking patellar tracking. Soft tissue balancing was ensured on table. The degree of damage to patellar articular cartilage was recorded at the time of surgery. Suction drain was applied at the end of surgery for 24 h postoperatively. Patients were made to walk on second postoperative day and put on continuous passive motion along with isometric quadriceps exercises with full weight bearing. Postoperative complications if any were clearly documented. Patients were followed up

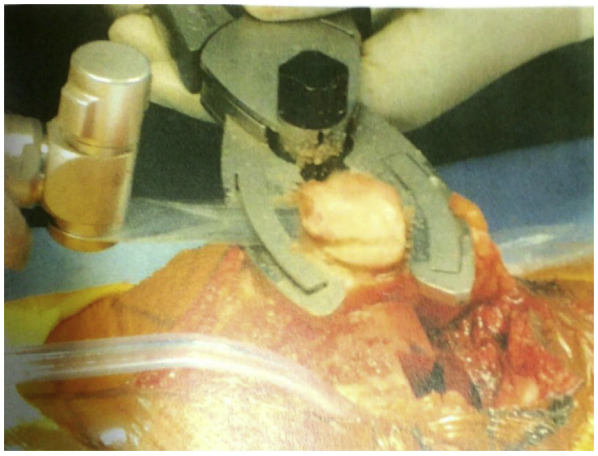

Fig. 1. Patellar preparation during patellar resurfacing in TKA.

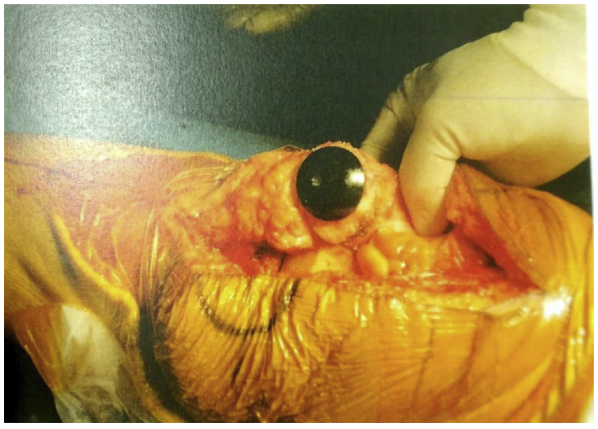

Fig. 2. Insertion of trial patellar component.

postoperatively at 6–8 weeks, 6 months L year, two years and 5 years postoperatively. Pre and post operative evaluation was done using knee society score(KSS) which consists of 100 points scale for clinical score and 100 point scale for function score. The clinical score comprises of pain, total range of flexion, flexion contracture (if present), extension lag, alignment (Varus & Valgus), and stability (Antero-posterior & Medio-lateral) parameters. The function score has points for walking, Stair climbing and walking aid used. Assessment of Anterior Knee Pain was done using Visual Analogue Scale (VAS) pre and post operatively. Standard Anteroposterior and Lateral view X-rays were taken preoperatively in all cases, immediate postoperatively, at 6 months, 1 year, 2 years and 5 years postoperatively. Postoperative X rays were evaluated for component loosening, wear and patellofemoral problems including fracture or loosening of resurfaced patella, subluxation, dislocation and wear of non resurfaced patella.

2.1. Post operative protocol

Suction drain was kept for 24 h and patients were given intravenous antibiotics for 48 h and analgesics. Physiotherapy was started within two days of surgery and immediate post operative complications were noted. Immediate post operative X rays were done to analyse for component positioning. Patients were evaluated post op by:

Table 1
Gender Distribution among patients in two groups.

	Sex	PRS	NRS	Total
Female	**No.**	41	39	80
	%	82%	78%	80%
Male	**No.**	9	11	20
	%	18%	22%	20%
Total	**No.**	50	50	100
	%	100.0%	100.0%	100.0%

1. Knee Society Score (KSS).
2. Any complications which developed.
3. Post operative radiographs to see for positioning of components.
4. Visual Analogue Scale (VAS) for Anterior Knee Pain.

Entire clinical and functional outcome was graded as following depending on the total Knee Society Score.

Poor	:	Score below 60
Fair	:	60–69
Good	:	70 79
Excellent	:	80–100

Anterior Knee Pain assessment was done using VAS ranging from 0 to 10 pre and postoperatively.

3. Results

Out of 100 subjects, there were a total of 80 female and 20 male patients. Out of 80 female knees, 41 were resurfaced and 39 were not. Out of 20 male knees, 9 were resurfaced and 11 were not (Table 1). Arthroplasty were performed in 57 right sided knees as compared to left sided, which were 43.

4. Knee society score

i. Clinical Score

Mean clinical knee score ranging from 0 to 100 points in the PRS group improved from 28.6 to 84.14 and; from 24.72 to 86.2 in the NRS group. The difference in the clinical knee score amongst two groups was not statistically significant at 5 years follow up. However, the increment in score was more in the NRS group compared to PRS group.

ii. Functional Score

The mean functional knee score on a range of 0–100 point went up from 39.1 to 90.1 in resurfaced group and; from 45 to 92.4 in the non resurfaced group. The difference in functional knee score amongst resurfaced and non resurfaced groups is not statistically significant even at 5 years follow up post operatively. However, the increment in score was more in the NRS group compared to PRS group.

iii. Mean Knee Society Score

The mean knee society score (KSS) on scale ranging from 0 to 200 points in the resurfaced group improved from 67.76 to 174.24 and; went up from 69.72 to 178.6 in the non surfaced. p value calculated using independent "*t*-test" with 96° of degrees of freedom is 0.9047, hence the difference in two groups is not statistically significant at 5 years follow up. It is clearly evident that increment in score was more in the NRS group compared to PRS group.

4.1. Overall outcome

82% of the patient in resurfaced group had excellent outcome compared to 86% in the non resurfaced group. By using simple interactive statistical analysis we found that all the sub headings in pre and postoperative groups when compared amongst resurfaced and non resurfaced groups have non significant p-value.

The statistic analysis was done using chi square test because the distribution was non normal.

Here the **variable "x" is chi square value** calculated at 2° of freedom.

Knee Score	Resurfaced	Percentage	Non resurfaced	Percentage
Excellent	41	82%	43	86%
Good	4	8%	5	10%
Fair	2	4%	0	0
Poor	3	6%	2	4%
TOTAL	50	100%	50	100%

Visual Analogue Scale (Pre-op) x = 2.0172, p = 0.5688	Resurfacing	Non − Resurfacing
Zero	0	0
One	0	0
Two	0	0
Three	0	0
Four	2(4%)	2(4%)
Five	3(6%)	3(6%)
Six	6(12%)	9(18%)
Seven	13(26%)	10(20%)
Eight	25(50%)	23(46%)
Nine	1(2%)	2(4%)
Ten	0	1(2%)

Visual Analogue Scale (Post-op) x = 2.7984, p = 0.9464	Resurfacing	Non − Resurfacing
Zero	28(56%)	25(50%)
One	1(2%)	3(6%)
Two	3(6%)	4(8%)
Three	4(8%)	3(6%)
Four	0	0
Five	3(6%)	6(12%)
Six	2(4%)	2(4%)
Seven	3(6%)	2(4%)
Eight	4(8%)	3(6%)
Nine	2(4%)	2(4%)
Ten	0	0

Visual Analogue Scale (VAS) was used for anterior knee pain assessment pre and post operatively in both groups. However, there was no statistically significant difference in the pre and post operative period when compared amongst the two groups.

4.2. Complications

There was no intra operative complication noted in either group. Two patients develop wound dehiscence, one patient had betadine allergy and one developed superficial wound infection in NRS group. In PRS group, one patient developed superficial wound infection and one developed deep wound infection in which the implant was removed and arthrodesis was done as a salvage procedure using Charnley's clamps. The clamps were removed 3 months post operatively and weight bearing was started as tolerated. None of the patients underwent revision of total knee

replacement after the primary procedure. The major patellofemoral complications of patellar loosening, patellar fracture and patellar ligament rupture was not seen in either group due to short term (5 years) follow up. Long term result and follow up are yet to be analysed.

5. Discussion

The major findings of this study was that 82% of the patients in PRS group had shown excellent outcome compared to 86% in the NRS group. Additionally, VAS revealed no significant difference between two groups. The surgery was performed by senior surgeon, whose surgical technique has remained same over the years, thereby eliminating variable surgical technique and skills as confounding variables. These variations are due to different prosthetic designs on the femoral and the patellar side, different techniques regarding the retained patella, variable degrees of arthritis of patella, variable initial diagnosis and differences between different population groups add difficulties in interpretation of results of various studies. We kept duration of follow up of 60 months for both resurfaced and non resurfaced group, as most studies have reported that anterior knee pain develops early following TKA within first 18 months. With the increase of survival rates of TKA, patellar complications such as anterior knee pain, impingement, and secondary damage to patellar articular surface are also on the rise. In contrary, patients who had patellar resurfacing can lead to reduced survival rate because of wear, loosening of the implant, fractures, osteonecrosis of the patella, increase of chance of infections and subluxation of patella. Literature suggests complications after resurfacing the patella in total knee replacement depend on four main categories; these are patient factors, design factors, surgical techniques and material properties[11]

According to matthew p., resurfacing of patella is controversial. accurate component implantation is imperative for a successful outcome if the patella is resurfaced.[12] Cherian et al., 2016 studied prs versus circumferential denervation of patella in tka and compared the rates of anterior knee pain and functional outcomes between resurfaced patellas and non resurfaced patellas in 110 patients with minimum of 2 years follow up, and found no significant differences between the groups for kss, anterior knee pain, or vas.[13]

Abdul khan and nikhil pradhan reviewed 765 patients to study post-op patellofemoral pain, clunk and crepitus in resurfaced and non resurfaced groups. Incidence of post-op pain, clunk and crepitus is lower in the resurfaced group.[14] Results from meta analysis of 1725 knees concluded with no difference between the prs and nrs groups in terms of anterior knee pain, knee pain score, KSS and knee function score. absolute risk of reoperation was reduced by 4% in prs arm.[15]

In this observational study, we also did not find any statistical differences in pain, mobility and alignment. However, NRS group has shown better increment in overall score than PRS group. Previously published literature suggests that patella resurfacing reduce the anterior knee pain[16]. Studies done by Campbell et al.,[17] Chi Peng et al.[18] and Feller et al.[19] assessing KSS among patients undergoing TKA showed similar results to our study and there was no statistical significant difference between two groups as well.

Anterior Knee Pain should not be presumed to be secondary to patella femoral resurfacing or non resurfacing etiology.[20] Another prospective study showed that there was no difference between two sides in incidence of anterior knee pain/ascending or descending stairs.[21] However, Waikakul S. et al.[22] showed that patients with resurfacing had better results in terms of Anterior Knee Pain and tenderness but patients with non resurfacing had a better improvement of position sense. The above studies emphasized that resurfacing should be used in severe articular cartilage damage, not as a routine operation. While analysing incidence of anterior knee pain, there was no significant difference as assessed by VAS in our study as well.

A longitudinal study done by Lyback et al.[23] with 52 patients has shown that anterior knee pain was present in 47% of patients with an un-replaced patella and 11% patients in resurfaced patella whereas, Holt GE et al.[24] showed that by retaining native patella they were able to retain highly satisfactory medium term results in terms of pain relief and function.

Through a prospective randomized study, Burnett et al.[20] with 10 year follow up found no significant differences in anterior knee pain, functional scores or revision rates between surfaced and non resurfaced groups.

Waters and Bently[25] observed that the overall postoperative knee scores were lower in the non resurfacing group and the difference was significant among patients with osteoarthritis. The findings of the study added that patients who had a bilateral knee replacement were more likely to prefer the resurfaced side.

Levistsky KA et al.[26] reported the incidence of anterior knee pain in the absence of resurfacing to be high as 19%, following with no incidence of reoperation in both the groups.

The patellar resurfacing alone will not prevent the occurrence of anterior knee pain, as the soft tissue balancing is equally important to mitigate the postoperative pain and complications too. With much attention and advancement of new prosthetic designs which appears to have substantially lowered the rate of complications of patellar resurfacing as the recent studies have demonstrated no appreciable risk of complications when compared with non resurfacing.

The follow up period of 5 years is barely adequate for the evaluation as the problems with wear and loosening of patellar component may increase with time. The study was carried out on a limited number of patients (N = 100). Another limitation of study is recollection bias since patients may have forgotten the tough time associated with first knee and may have higher expectations from second knee. Hence we have not included patients undergoing bilateral TKA. It shouldn't be always presumed that anterior knee pain before and after TKA is secondary to patellofemoral etiology, other factors may play a role in the dynamic development of anterior knee pain after TKA like patient and knee specific characteristics, prosthetic designs, operative technique, treatment of patella and time of assessment.

The continued study of this topic with long term follow up in randomized controlled trials remains essential to our understanding of patella in total knee arthroplasty. The development of total joint registries will allow surgeons to draw conclusions on the basis of large numbers of patients and will improve the reporting of results of patellar resurfacing in clinical trials.

6. Conclusion

Even after 20 years of debate, the decision whether to resurface the patella or not during the primary Total Knee Arthroplasty seemingly appears controversial. Despite having similar outcome scores regardless in both the groups, non resurfacing seems to provide better outcomes. There can be no definite conclusion because of many confounding factors such as component designs, surgeon experience and surgical techniques. However, our findings may be specific to certain extent because of the use of same prosthesis and the surgical techniques. None the less, a continued study of this issue with long term follow up in randomized, controlled, clinical trials remains essential to the understanding of the patella in TKA.

Contribution

Lokesh Chawla: lead member of research team who followed up the patients and data collection, assisted all surgeries.

Shivanand M. Bandekar: Conceptualized the research question and performed surgeries.

Vivek Dixit: Manuscript preparation and literature search.

Ambareesh P: Data analysis.

Arun Krishnamoorthi: Data entry and record keeping.

Sushanth Mummigatti: Preoperative work up.

Acknowledgement

We would like to thank the department of orthopaedics, Goa Medical College & Hospital along with OT Staff.

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