 Acta Chir Orthop Traumatol Cech. 84, 2017, No. 1
p. 30–34

ORIGINAL PAPER
PŮVODNÍ PRÁCE

The Importance of Patellar Resurfacing in Total Knee Arthroplasty for Symptomatic Valgus Degenerative Deformity

Význam náhrady kloubní plochy pately u totální náhrady kolenního kloubu při symptomatické valgózní degenerativní deformitě

O. B. VUKADIN, Z. B. BLAGOJEVIĆ, Z. LJ. BAŠČAREVIĆ, N. S.SLAVKOVIĆ, V. STEVANOVIĆ, B. D. VUKOMANOVIĆ

Institute for orthopaedic surgery "Banjica" Belgrade, Serbia

ABSTRACT

PURPOSE OF THE STUDY

Patellar surface replacement during total knee arthroplasty is still a matter of discussion among orthopedic surgeons. The purpose of this study was to examine possible benefits of patellar surface replacement in selected patients with symptomatic degenerative valgus deformity. We have not found any studies in the literature that compare the results of patella management solely for valgus or varus knee deformity nor those that compare both.

MATERIAL AND METHODS

Patients were randomly assigned to a group that would receive patellar surface replacement during total knee arthroplasty and a group of patients in whom total knee arthroplasty was performed without patellar surface replacement. 60 patients were included in the study. Total knee arthroplasty with patellar resurfacing (TKAPR) was performed in 30, and without PR (TKA) in 30 of them. Results were prospectively gathered and compared at regular intervals.

RESULTS

There were no significant differences between groups for examined parameters except for Oxford Knee Score at 6 months which was in favor of patellar resurfacing group.

DISCUSSION

The decision whether to replace the patella or not is currently exclusively a matter of surgeon's choice. Establishing selection criteria for patients that would benefit from patella resurfacing could, therefore, be very useful for both patients and orthopaedic surgeons performing total knee replacement.

CONCLUSIONS

Although evidence in our study could not strongly suggest performing patella resurfacing in patients with valgus deformity, the results were slightly better in the patella resurfacing group and this trend could increase if larger series of patients would be employed. A longer follow-up period would be required for clear-cut decisions and more prospective studies are warranted.

Key words: knee, arthroplasty, patella, replacement, valgus, deformity.

INTRODUCTION

Total knee arthroplasty (TKA) is a rapidly evolving surgical procedure. Designs and concepts have been changing through the years, leading to excellent and reproducible results. The estimated number of annual procedures in the year 2030 in the US is around 3.4 million (14). The consensus about the necessity of patellar joint surface replacement is yet to be achieved. There is evidence in favor of patellar surface replacement, but for many orthopedic surgeons there is no clear benefit of this part of total knee replacement. Literature is supportive of both opinions. A higher number of implant complications was observed after patella replacement, especially with early designs of implants (4, 10). Reoperations due to patellar problems were, on the other hand, much more common in patients with unresurfaced patella (18). Use of patella replacement in selected cases has been suggested (9, 12) but indications for selective patellar surface replacement are not well-established or proven and anterior

knee pain remains a common cause of dissatisfaction following total knee arthroplasty (5, 6, 10).

Valgus knee deformity is a well-established pathological entity with its specific structural and anatomical malformations. This type of knee deformity accounts for around 10% of patients with degenerative knee changes (7, 19). Anatomical and biomechanical disorders evolving in valgus deformity are accompanied by an increased stress to patella and tendency of lateral patellar dislocation (7, 21).

The surgical procedure during total knee arthroplasty for valgus knee is technically specific and different from procedures for other types of knee deformities (7, 13, 17, 19, 22). The degree of deformity determines the degree of soft tissue releases needed and the choice of level of constraint of the implant (17, 22). Soft tissue release and gap balancing are challenging as well as implant positioning, especially in the rotational plane (17, 21, 22). All of this affects patellar tracking and represents stress raisers to patella surface during knee movement. Replacing the patellar surface could, therefore, be potentially helpful in patients with degenerative valgus deformity during total knee arthroplasty. To our knowledge, there are no studies regarding selective patellar resurfacing in patients with valgus knee.

The aim of this study was to evaluate the significance of patella resurfacing in patients with valgus degenerative knee treated with total knee arthroplasty.

MATERIAL AND METHODS

Methodology

This is a prospective cohort clinical study conducted at the *Banjica* Institute for Orthopedic Surgery, School of Medicine, University of Belgrade, Serbia. The study was approved by the hospital's Board and its Ethics Committee. The patients included in the study signed an informed consent.

The inclusion criteria were as follows: symptomatic angular valgus deformities of more than 10° and less than 25° with knee arthrosis in patients older than 55 years in whom radiographic signs of patellofemoral arthrosis are present as well as Outerbridge Grade III and IV intraoperative degenerative patellar or femoral defects (15).

Patients with rheumatoid arthritis and inflammatory arthritis were excluded from the study. Septic arthritis-induced degenerative knee disorder was another exclusion criterion.

A Microsoft Excel prospective database was created to include: basic demographic data (age, gender, sex), surgical intervention data (type of surgical procedure, duration of intervention and intraoperative and postoperative complications), preoperative Knee Society Score (KSS, part 1 – anatomic parameters and part 2 – functional parameters) and Oxford Knee Score (OKS), and both scores in regular postoperative 3 and 6-month, 1 year and 2-year intervals. These scores cover the functional patient status as well as implant stability radiographic parameters. Pain was assessed using Visual Analogue Scale (VAS) preoperatively and in regular check-ups. Random Allocation Software Version 2.0 was used for the purpose of randomization.

The comparative analysis was made after patients had been assigned to two groups with regard to operative approach. Patients with TKA with patella resurfacing constituted the first group (TKAPR), while patients in whom TKA was performed without patella resurfacing constituted the second (TKA).

The follow-up comprised regular clinical and radiographic check-ups, 3 and 6 months and one and two years after surgery. All patients were obliged to fill out the symptomatic questionnaire form. An independent researcher was assigned for regular data harvesting. The data were further evaluated with the aim of establishing possible advantages of the conducted treatment modality.

Operative technique

All patients were operated by the same surgical team. The same type of implant was used in all patients – Zimmer Nexgen LPS-type with cemented fixation. In brief, after a longitudinal skin incision, the standard median parapatellar approach was used. Distal femoral cut was performed according to preoperative planning in order to place the femoral component perpendicular to the lower extremity's mechanical axis. Proximal tibial resection was then performed in order to position the tibial component perpendicular to the tibial mechanical axis. Bone cuts were made with minimum bone resection needed. Lateral soft tissue release was made in a stepwise manner. Rotation of the femoral component was determined in accordance with the transepicondylar axis. The size of the components was determined and femoral cuts completed. The soft tissue balance was reassessed, release repeated if necessary and the articular insert chosen. After trial components proved to be well-balanced, uncompromised range of motion definitive components were cemented and implanted after thorough preparation. The patellar surface was inspected and in random selected patients, if cartilage showed degenerative changes graded Outerbridge III or more, patella was prepared. Osteophytes were removed. Depth and diameter of patella were measured and resection was made accordingly to a selected patellar component (resecting 8–9 mm from surface if at least 11 mm of total bone of patella remained). The resected surface was prepared for cementation and a three-peg all-poly patellar component of the Zimmer Nexgen LPS implant was cemented and implanted.

Statistical analysis

The data are expressed as mean and median values. We used Fisher's exact test, Student's t-test and the Mann-Whitney test. The point of statistical significance was set at 0.05. For the purpose of statistical analysis, SPSS version 20.0.0. was used.

Table 1. Age and gender distribution between groups and median deformity angle

	TKA group	TKAPR group	p-value
Age	66.6 ± 6.431	68.1 ± 7.034	0.392
Gender (M/F ratio)	13/17	14/16	0.795
Degree of deformity	18.1	16.7	0.113

Table 2. Preoperative scores distribution in TKA and TKAPR group

Score	TKA group	TKAPR group	p-value
Knee Society Score part 1	6.13 ± 9.912	4.63 ± 9.679	0.486
Knee Society Score part 2	28.33 ± 11.321	23.17 ± 9.603	0.053
Oxford Knee Score	15.77 ± 5.870	13.00 ± 5.292	0.056
Visual Analogue Scale	7.87 ± 1.465	8.4 ± 1.248	0.162

Table 3. Comparative values of postoperative scores in examined groups

Score	TKA group	TKAPR group	p-value
Knee Society Score part 1			
after 3 months	82.83 ± 8.601	84.77 ± 6.597	0.111
after 6 months	90.73 ± 3.258	90.67 ± 4.816	0.341
after 1 year	92.70 ± 2.329	93.43 ± 3.395	0.700
after 2 years	92.20 ± 2.265	92.27 ± 2.447	0.849
Knee Society Score part 2			
after 3 months	83.17 ± 9.513	84,83 ± 10.866	0.252
after 6 months	91.67 ± 4.795	93 ± 5.509	0.256
after 1 year	95.5 ± 4.015	96.67 ± 3.556	0.259
after 2 years	95.5 ± 3.848	96.93 ± 3.118	0.117
Oxford Knee Score			
after 3 months	40.20 ± 2.172	40.57 ± 2.622	0.306
after 6 months	42.73 ± 1.911	43.8 ± 2.172	0.046
after 1 year	45.23 ± 1.851	44.57 ± 2.144	0.309
after 2 years	45.20 ± 2.024	45.27 ± 2.348	0.758
Pain (Visual Analogue Scale)			
after 6 months	0.77 ± 0.728	0.70 ± 0.651	0.771
after 1 year	0.40 ± 0.563	0.27 ± 0.45	0.370
after 2 years	0.43 ± 0.626	0.23 ± 0.430	0.215

RESULTS

Overall, 60 patients were included in the study. Total knee arthroplasty with patellar resurfacing (TKAPR) was performed in 30, and without PR (TKA) in 30 of them. Median age of patients in TKA was 66.6 ± 6.431, and in TKAPR group 68.1 ± 7.034. There was no difference between the groups regarding age, $p = 0.392$, $p > 0.05$. There was no statistical difference between the two groups of patients when male to female ratio was analyzed ($p = 0.795$, $p > 0.05$). Median angle of valgus deformity in TKAPR group was -16.7 , and 18.1 in TKA group. No statistical difference was noted regarding this parameter between the two groups ($p = 0.113$, $p > 0.05$). (Table 1).

Preoperative values of preoperative Knee Society Score, part 1 (KSS 1) score in TKA group was 6.13 ± 9.912 and in the TKAPR group 4.63 ± 9.879, and no statistically significant differences were found between the groups regarding this parameter, ($p = 0.486$, $p > 0.05$). Preoperative values of KSS part 2 were 28.33 ± 11.321 and 23.17 ± 9.603 in the TKA and TKAPR groups, respectively, without statistical difference between the groups ($p = 0.053$, $p > 0.05$). Similar results were obtained when preoperative values of Visual Analogue Scale (VAS) and Oxford Knee Score (OKS) were compared between the groups. (Table 2).

There were no complications related to the operative procedure. In one patient in the TKA group lateral dislocation of patella occurred which was treated with secondary operative lateral retinacular release. This patient was excluded from further analysis. Mean operative time for total knee arthroplasty without patellar resurfacing was 64.3 ± 11.4 minutes, and 70.9 ± 10.5 minutes in the group of patients in whom patellar resurfacing was added. There was no statistical difference between these two values.

Values of KSS 1 score 3 months after surgery were 82.83 ± 6.597 in TKA group and 84.77 ± 8.601 in TKAPR group, without a statistically significant difference in these values between the groups ($p = 0.111$, $p > 0.05$). Values of KSS 2 score 3 months after surgery were 83.17 ± 69.513 in TKA group and 84.83 ± 10.866 in TKAPR group, without statistically significant difference between these values between the groups ($p = 0.252$, $p > 0.05$). Both KSS 1 and KSS 2 remain with a stable increase trend at 6-month, 1-year and 2-year postoperative regular follow-ups, without a statistically significant difference compared with values obtained 3 months after surgery. ($p = 0.117$, $p > 0.05$). (Table 3).

The values of VAS 6 months after surgery were 0.77 ± 0.728 in TKA group, and 0.70 ± 0.651 in TKAPR group of patients, without a statistically significant difference between these values between the groups ($p = 0.771$, $p > 0.05$). The same trend remained 1 year after the intervention (0.40 ± 0.563 for TKA group, and 0.27 ± 0.450 for TKAPR group), again without statistical difference between the groups ($p = 0.370$, $p > 0.05$). There was no difference between the groups at check up 2 years after surgery ($p = 0.215$, $p > 0.05$). (Table 3).

Oxford Knee Score values 3 months after surgery were 40.20 ± 2.172 in the TKA group and 40.57 ± 2.622 in TKAPR group, without statistical difference when these values were compared ($p = 0.306$, $p > 0.05$). 6 months after surgery, these values were 42.73 ± 1.911 and 43.80 ± 2.172 in TKA and TKAPR groups respectively, and statistically significant difference was reached in favor of the TKAPR group ($p = 0.046$, $p < 0.05$). The subsequent follow-up at one year postoperatively, on the other hand, did not show a significant statistical difference. ($p = 0.309$, $p > 0.05$). At 2 years, similar findings were noticed ($p = 0.759$, $p > 0.05$).

DISCUSSION

Complications related to patella after total knee arthroplasty are still the most common complications other than infection (7, 19, 22). In valgus knee deformity there is a tendency for patella to dislocate laterally due to deforming forces influencing the knee (7, 13, 21).

We have tried to establish the relationship between the patellar surface replacement during total knee arthroplasty and the improvement of the knee function postoperatively.

Decision whether to replace the patella or not is currently exclusively a question of surgeon's choice, since literature results are not fully conclusive with no specific guidelines addressing this issue. A distinct advantage of patella resurfacing is the lower rate of reoperations due to anterior knee pain (8, 16, 18). The contact between the cartilage or bone and surface of metallic implant could result in cartilage and bone erosion over time. Other claims, like higher patient satisfaction, better function and lower complication rate have not been indisputably proven. (3, 5, 6, 8, 16). Proponents of non resurfacing argue that there is not enough evidence to support the benefits of patella resurfacing and that this part of total knee arthroplasty is unnecessary and could lead to patella osteonecrosis, loosening of patellar component, wear, extensor mechanism rupture and patella maltracking (2, 9, 18, 20). In the literature we didn't find any study that would compare the results of patella management solely for valgus or varus knee deformity nor any that would compare both. Establishing the selection criteria for patients that would benefit from patella resurfacing could, therefore, be very useful to patients and orthopedic surgeons performing total knee replacement.

Earlier designs of implants didn't pay much attention to the patellofemoral articulation which resulted in high numbers of patellar complications. (2, 8, 10) Nowadays, implant designs are much closer to the anatomic shapes of articulation between the femur and the patella, so complications due to implant design are less common (4, 5, 16, 18).

The most common complication that can be attributed, though not exclusively to the patella, is anterior knee pain. The mechanism of anterior knee pain has not been fully explained in the absence of evident rotational malalignment and implant failure. Decision analysis was evaluated in several studies regarding expectancy of anterior knee pain and they were all in favor of patella resurfacing (18, 23, 25). Secondary resurfacing in patients primarily treated without patella resurfacing doesn't provide satisfactory results (1, 11, 18, 24). Patella maltracking in most cases could be attributed to tibiofemoral rotational malalignment and not to whether the patella was resurfaced or not.

The valgus load of the knee brings high stresses to patellofemoral articulation. Patellar complications associated with total knee arthroplasties for valgus knees represent 3–22% of all complications (7, 19, 21). These findings were not confirmed in our study. There was only one event of patellar dislocation in the group of patients treated without patella resurfacing and it required a surgical intervention – lateral retinacular release with no further complications. Superficial wound infection – dehiscence, was noted in one patient in the group of patients treated with patella resurfacing and it healed uneventfully.

This study had some limitations. The number of operations is relatively low but sufficient for statistical analysis. The required inclusion criteria of radiographic signs of patellofemoral arthrosis may contain some bias toward patellar resurfacing. We believe that inclusion of the patients without radiographic signs of patellofemoral arthrosis would also lead to some bias, but toward patella nonresurfacing. Therefore, some bias in this study design could not be avoided but we believe that this does not affect the final results. The time of the onset of anterior knee pain after surgery could not be established. In the literature there was a tendency of anterior knee pain to appear early after surgery or not at all (1, 5, 24). We noted the presence of pain as measured on the Visual Analogue Scale in controls but it was not solely attributed to the anterior knee. Also, we excluded from the study only patients with a gross rotational anomaly in the implant (the tibial and the femoral component) position but we could not separate those patients with smaller deviations in the rotational position of the femur and the tibia, both of which could also be the source of knee pain and functional disabilities.

On the other hand, the advantages of this study were the uniform patient population and the adequate method of randomization. The patients were operated by the same surgical team so the impact of the surgical treatment on the functional and anatomic results between two groups diminished. The groups in this study were matched regarding gender and age, type and grade of deformity. The fact that we found significant differences between the groups in only one questioned parameter (Oxford Knee Score at 6 months) could not hide that the average results were slightly better in the group treated with patellar resurfacing in all categories. There was only one complication related to patella-dislocation, in the group of patients treated without patellar resurfacing. There were no differences between the groups in the overall rate of complications. Occasional knee pain was noted slightly more often in the group of patients treated without patellar resurfacing. No secondary resurfacing was performed during the period of the study although lateral retinacular release was performed in one case.

CONCLUSIONS

This study could not strongly provide the evidence for or against performing patella resurfacing in patients with valgus deformity of the knee. The results were slightly better in the patella resurfacing group and the statistical significance in the differences could possibly be reached with a higher number of patients. A longer follow-up period is required for definite decisions to be made and more prospective studies are warranted. Finding a model that could select patients specifically for the anterior knee pain could probably and eventually solve this everlasting dilemma in the orthopedic community.

References

1. Barrack RL, Berlot AJ, Wolfe MW, Waldeman DA, Milicic M, Myers L. Patellar resurfacing in total knee arthorplasty. A prospective randomized double blind study with five to seven years of follow up. J Bone Joint Surg Am. 2001;83:1376–1381.
2. Bayley JC, Scot RD, Ewald FC, Holmes GB. Metal backed patella component failure following total knee replacement. J Bone Joint Surg Am. 1988;70:668–674.
3. Brander VA, Stulberg SD, Adams AD, Harden RN, Bruehl S, Stanos SP, Houle T. Predicting total knee arthroplasty pain. A prospective, observational study. Clin Orthop Relat Res. 2003;416:27–36.
4. Budhiparama NC. The patella in total knee arthroplasty. In: Tanavalee A, Mow CS, Abbas AA, Azores GMS, Budhiparama NC, Lo NN (eds). Asean Arthroplasty Association (AAA) Comprehensive Hip&Knee Textbook. 1. Holistic Publishing Co. Ltd, Bangkok, 2013, pp 98–124.
5. Campbell DG, Duncan WW, Ashworth M, Mintz A, Stirling J, Wakefield L, Stevenson TM. Patellar resurfacing in total knee arthroplasty: a ten-year randomized prospective trial. J Bone Joint Surg Br. 2006;88:734–739.
6. Elson DW, Brenkel IJ. Predicting pain after total knee arthroplasty. J Arthroplasty. 2006;21:1048–1053.
7. Favorito PJ, Mihalko WM, Krackow KA. Total knee arthroplasty in the valgus knee. J Am Acad Orthop Surg, 2002;10:16–24.
8. Forster MC. Patellar resurfacing in total knee arthroplasty for osteoarthritis: a systematic review. Knee. 2004;11:427–430.
9. Hasegawa M, Ohashi T. Long term clinical results and radiographic changes in the nonresurfaced patella after total knee arthroplasty: 78 knees followed for a mean 12 years. Acta Orthop Scand. 2002;73:539–545.
10. Healy WL, Wasilewski SA, Takei R, Oberlander M. Patellofemoral complications following total knee arthroplasty. Correlation with implant design and patient risk factors. J Arthroplasty. 1995;10:197–201.
11. Karnezis JA, Vosinakis JC, Rex C, Fragkiadakis EG, Newman JH. Secondary patellar resurfacing in total knee arthroplasty: results of multivariate analysis in two case- matched groups. J Arthroplasty. 2003;18:469–476.
12. Kim BS, Reitman RD, Schai PA, Scot RD. Selective patellar nonresurfacing in total knee arthroplasty. 10 year results. Clin Orthop Relat Res. 1995;367:81–88.
13. Krackow KA, Mihalko WM. Flexion-extension joint gap changes after lateral structure release for valgus deformity correction in total knee arthroplasty: a cadaveric study. J Arthroplasty. 1999;14:994–1004.
14. Kurtz S, Ong K, Lau E, Mowat F, Halpern M. Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. J Bone Joint Surg Am. 2007;89:780–785.
15. Outerbridge RE. The etiology of chondromalacia patellae. J Bone Joint Surg Br. 1961;43:752–757.
16. Pakos EE, Nizani EE, Trikalinos TA.. Patellar resurfacing in total knee arthroplasty. A meta analysis. J Bone Joint Surg Am. 2005;87:1438–1445.
17. Pang HN, Yeo SJ, Chong HC, Chin PL, Chia SL, Lo NN. Joint line changes and outcomes in constrained versus unconstrained total knee arthroplasty for the type II valgus knee. Knee Surg Sports Traumatol Arthrosc. 2013;21:2363–2369.
18. Parvizi J, Rapuri VR, Saleh KJ, Kuskowski MA, Sharkey PF, Mont MA. Failure to resurface the patella during total knee arthroplasty may result in more knee pain and secondary surgery. Clin Orthop Relat Res. 2005;438:191–196.
19. Ranawat AS, Ranawat CS, Elkus M, Rasquinha VJ, Rossi R, Babhulkhar S. Total knee arthroplasty for severe valgus deformity. J Bone Joint Surg Am. 2005;87(Suppl 1, Pt 2):271–284.
20. Rand JA. Failures in patellar replacement in total knee arthroplasty. In: Bellemans J, Ries MD, Victor JMK (eds). Total knee arthroplasty. Springer, Berlin, 2005, pp 57–64.
21. Rossi R, Bruzzone M, Bonasia DE, Marmotti A, Castoldi F. Evaluation of tibial rotational alignment in total knee arthroplasty: a cadaver study. Knee Surg Sports Traumatol Arthrosc. 2010;18:889–893.
22. Rossi R, Rosso F, Cottino U, Dettoni F, BonasiaDE, Bruzzone M. Total knee arthroplasty in the valgus knee. International Orthopaedics (SICOT) 2014;38:273–283.
23. Slover J, Espehaug B, Havelin LI, Engesaeter LB, Furnes O, Tomek I, Tosteson A. Cost effectiveness of unicompartmental and total knee arthroplasty in elderly low-demand patients. A Markov decision analysis. J Bone Joint Surg Am. 2006;88:2348–2355.
24. Wood DJ, Smith AJ, Collopy D, White B, Brankov B, Bulsara MK. Patellar resurfacing in total knee arthroplasty: a prospective randomized trial. J Bone Joint Surg Am. 2002;84:187–193.
25. Zanger P. Detsky A. Computer assisted decisions analysis in orthopaedics: resurfacing the patella in total knee arthroplasty as an example. J Arthroplasty. 2002;15:283–288.

Corresponding author:
Ognjen B. Vukadin
Institute for orthopaedic surgery "Banjica" Belgrade
Mihajla Avramovica street 28
11000 Belgrade, Serbia
E-mail: vukadinognjen@yahoo.com