RESEARCH PAPER

Functional Outcome of Mobile Bearing Rotating Platform in Total Knee Replacement

Hari Kishore A[1*], Thulasi Raman[2], Jeeva S[3]

[1]Postgraduate, Department of Orthopaedics, Meenakshi Medical College Hospital and Research Institute, Kanchipuram, MAHER University, Chennai. Email: harikishoremd95@gmail.com (Corresponding Author)

[2]Professor and HOD, Department of Orthopaedics, Meenakshi Medical College Hospital and Research Institute, Kanchipuram, MAHER University, Chennai

[3]Assistant Professor, Department of Orthopaedics, Meenakshi Medical College Hospital and Research Institute, Kanchipuram, MAHER University, Chennai

ABSTRACT

Introduction: Total knee replacement (TKR) is an established treatment for advanced osteoarthritis of the knee, providing pain relief, correction of deformity, and improvement in joint function. Mobile-bearing rotating platform prostheses were developed to reduce polyethylene wear, improve conformity, and allow more physiological knee kinematics, thereby potentially enhancing functional outcome.

Materials and Methods: This prospective follow-up study was conducted in the Department of Orthopaedics at Meenakshi Medical College Hospital and Research Institute, Kanchipuram, over a period of 18 months. A total of 25 patients with osteoarthritis of the knee who underwent primary total knee replacement using a mobile-bearing rotating platform prosthesis were included. Patients were assessed preoperatively and postoperatively at 12 weeks and 24 weeks. Functional outcome was evaluated using the Visual Analogue Scale (VAS), Knee Society Score (KSS), WOMAC score, Oxford Knee Score (OKS), and range of motion (ROM).

Results: The mean age of the patients was 63.4 ± 7.8 years, with females constituting 64.0% of the study population. Significant postoperative improvement was observed in all functional parameters. The mean VAS score improved from 8.1 ± 0.9 preoperatively to 1.8 ± 0.7 at 24 weeks. The mean KSS improved from 38.6 ± 8.7 to 84.5 ± 6.8, WOMAC score from 68.4 ± 9.6 to 19.6 ± 5.4, OKS from 18.3 ± 4.2 to 40.2 ± 3.8, and ROM from 82.4 ± 14.6° to 117.6 ± 8.9°. All improvements were statistically significant ($p < 0.001$). No major postoperative complications were observed.

Conclusion: Mobile-bearing rotating platform total knee replacement provided significant short-term improvement in pain, function, and range of motion, with good patient satisfaction and minimal complications, indicating that it is an effective option for the management of osteoarthritis of the knee.

Keywords: Mobile Bearing, Rotating Platform, Total Knee Replacement

How to cite this article: Hari Kishore A, Raman T, Jeeva S. Functional Outcome of Mobile Bearing Rotating Platform in Total Knee Replacement. Int J Drug Deliv Technol. 2026;16(20s): 254-260. DOI: 10.25258/ijddt.16.20s.32

Source of support: Nil.

Conflict of interest: None

Introduction

In the present study, the mean age of the patients was 63.4 ± 7.8 years, with a median age of 64 years, and the majority belonged to the 61–70-year age group. Females constituted 64.0% of the study population, reflecting the known epidemiological trend that knee osteoarthritis predominantly affects older adults and is more common among women. Similar demographic patterns have been reported in previous studies, including those by Roque et al. and Powell et al., where elderly patients undergoing total knee arthroplasty formed the majority .

The principal finding of this study was the significant improvement in pain relief, functional outcome, and range of motion following mobile-bearing rotating-platform total knee replacement (TKR). The mean Visual Analog Scale (VAS) score improved from 8.1 ± 0.9 preoperatively to 1.8 ± 0.7 at 24 weeks. Functional outcomes also showed marked improvement, with the Knee Society Score (KSS) increasing from 38.6 ± 8.7 to

84.5 ± 6.8, WOMAC score improving from 68.4 ± 9.6 to 19.6 ± 5.4, and Oxford Knee Score (OKS) from 18.3 ± 4.2 to 40.2 ± 3.8. Additionally, the mean range of motion improved significantly from 82.4 ± 14.6° to 117.6 ± 8.9°, with all results being statistically significant ($p < 0.001$).

These findings support the theoretical advantages of mobile-bearing prostheses, which are designed to reduce contact stress and improve joint kinematics by allowing rotational movement at the articulating interface. Previous studies have emphasized improved conformity, reduced polyethylene wear, and better load distribution with such designs. Long-term studies, including those by Milligan et al., have demonstrated excellent implant survivorship and sustained functional outcomes, supporting the effectiveness of rotating-platform systems .

Comparative literature further supports these results. Powell et al. reported improved long-term functional outcomes in rotating-platform implants, while Wang et al. demonstrated better Knee Society Scores and range of motion in mobile-bearing prostheses. However, some meta-analyses have shown no significant difference between mobile-bearing and fixed-bearing designs, indicating that while rotating-platform TKR is effective, its superiority remains debatable .

In this study, postoperative outcomes did not significantly differ based on age or sex, suggesting consistent benefits across demographic groups. No major complications were observed during follow-up. Minor complications included anterior knee pain (8%), delayed wound healing (4%), and stiffness (4%). Notably, no cases of insert dislocation were seen, although this remains a recognized but rare complication.

Overall, the findings demonstrate that mobile-bearing rotating-platform TKR provides excellent short-term outcomes with significant improvement in pain, function, and range of motion, along with a low complication rate, making it an effective treatment option for knee osteoarthritis.

Materials And Methods

This prospective follow-up study was conducted in the Department of Orthopaedics at Meenakshi Medical College Hospital and Research Institute, Kanchipuram, over a period of 18 months. The study population consisted of patients diagnosed with osteoarthritis of the knee who underwent surgical management in the form of primary total knee replacement. A total of 25 patients were included in the study and were selected using purposive sampling based on predefined inclusion and exclusion criteria. Patients aged between 45 and 80 years with a confirmed diagnosis of osteoarthritis of the knee and planned for primary knee replacement surgery were included. Patients were excluded if they had a history of previous knee surgery, active infection, age less than 40 years, prior patellectomy, high tibial osteotomy, septic arthritis, or rheumatoid arthritis.

Data collection procedure

After selection of eligible patients, a detailed clinical history was obtained and thorough clinical examination was performed. Baseline assessment included evaluation of pain and functional status using the Visual Analogue Scale (VAS), Knee Society Score (KSS), WOMAC score, Oxford Knee Score (OKS), and patient satisfaction survey. Standard radiological evaluation was carried out using bilateral knee X-rays in anteroposterior and lateral views, along with standing views. Based on clinical and radiographic findings, the diagnosis and grade of osteoarthritis of the knee were established. Routine preoperative investigations were performed in all patients. Written informed consent for surgery as well as participation in the study was obtained from all patients.

Surgical technique

Under anesthesia and strict aseptic precautions, the knee joint was exposed through a medial parapatellar approach using a tourniquet. Medial soft tissue release was performed in cases of varus deformity. Proximal tibial resection was carried out using a tibial guide, followed by femoral preparation through an intramedullary approach. An intramedullary rod was inserted, and anterior and posterior femoral cuts were made using appropriate guides. Flexion and extension gap balancing were assessed using spacer blocks, and necessary adjustments were made.

Trial components were inserted after preparation of the tibial stem, and knee alignment, stability, and patellar tracking were evaluated. Patellar osteophytes were removed and resurfacing was performed when indicated. Final femoral and tibial components were implanted using antibiotic-impregnated bone cement. Adequate range of motion and proper tracking were confirmed intraoperatively. Hemostasis was achieved, followed by wound closure with drain placement and application of dressing and immobilizer.

Postoperatively, early mobilization and range of motion exercises were initiated, with weight-bearing as tolerated. Sutures were removed on the 12th postoperative day. Patients were followed up at 12 and 24 weeks, and functional outcomes were assessed using Knee Society Score (KSS), WOMAC, and Oxford Knee Score (OKS).

Postoperative protocol and follow-up: Outcome measures included assessment of functional outcome following mobile-bearing rotating platform total knee replacement, with the primary outcome evaluated using the Visual Analog Scale (VAS) for pain, Knee Society Score (KSS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and Oxford Knee Score (OKS).

Statistical analysis: The collected data were entered and analyzed using IBM SPSS Statistics. Descriptive statistics such as mean, standard deviation, frequencies, and percentages were used to summarize the data. Preoperative and postoperative scores were compared using paired *t*-test to determine the significance of improvement. A *p*-value of less than 0.05 was considered statistically significant. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as proportions. Where applicable, correlation analysis was performed to assess the relationship between different functional outcome scores.

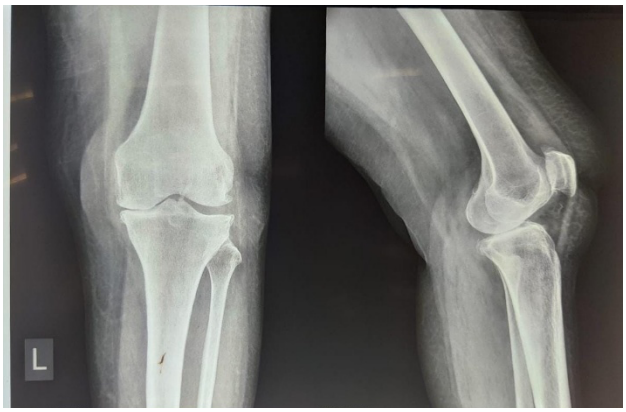

Figure 1. Pre-operative X-ray - Standing AP view & Lateral view

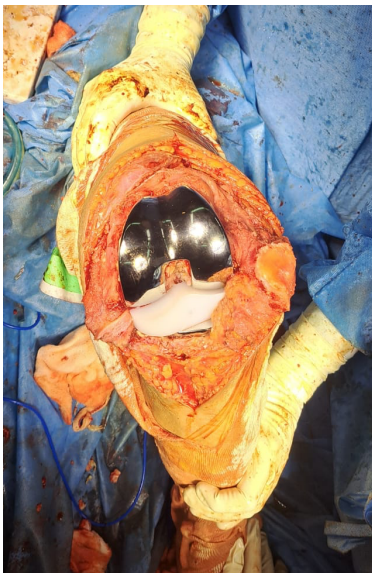

Figure 2 - Intra-op Implantation image

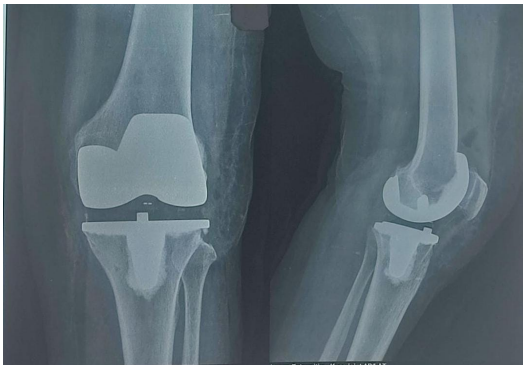

Figure 3 - Post operative X-ray- Ap & Lateral view

RESULTS

A total of 25 patients with osteoarthritis of the knee who underwent mobile-bearing rotating platform total knee replacement were included in the study and completed follow-up. The mean age of the study participants was 63.4 ± 7.8 years, with a median age of 64 years (IQR: 58–69) and a range of 48–78 years. The majority of patients belonged to the 61–70 years age group (40.0%), followed by the 51–60 years age group (28.0%). Female patients were more common than male patients, accounting for 64.0% of the study population.

Table 1. Age distribution of study participants (n = 25)

Age group (years)	Number (n)	Percentage (%)
45–50	2	8.0
51–60	7	28.0
61–70	10	40.0
>70	6	24.0
Total	25	100

The mean value was 63.4 ± 7.8, with a median of 64 and an interquartile range (IQR) of 58–69. The observed values ranged from 48 to 78.

Table 2. Sex distribution of study participants (n = 25)

Sex	Number (n)	Percentage (%)
Male	9	36.0
Female	16	64.0
Total	25	100

Among the 25 patients, 14 (56.0%) underwent surgery on the right knee and 11 (44.0%) on the left knee.

Table 3. Side affected (n = 25)

Side	Number (n)	Percentage (%)
Right	14	56.0
Left	11	44.0
Total	25	100

The distribution of cases based on side showed that the right knee was involved in 14 patients (56.0%), while the left knee was involved in 11 patients (44.0%). Overall, a slight predominance of right-sided involvement was observed in the study population.

Table 4. Preoperative clinical and functional parameters (n = 25)

Parameter	Mean ± SD	Median (IQR)	Range
VAS score	8.1 ± 0.9	8 (7–9)	6–10
KSS	38.6 ± 8.7	39 (32–45)	24–55
WOMAC score	68.4 ± 9.6	69 (62–75)	50–84
OKS	18.3 ± 4.2	18 (15–21)	11–27
Range of motion (°)	82.4 ± 14.6	85 (70–92)	55–110

The preoperative assessment showed a mean VAS score of 8.1 ± 0.9, with a median of 8 (IQR: 7–9) and a range of 6–10. The mean Knee Society Score (KSS) was 38.6 ± 8.7, with a median of 39 (IQR: 32–45) and a range of 24–55. The WOMAC score had a mean of 68.4 ± 9.6, median of 69 (IQR: 62–75), and ranged from 50 to 84. The Oxford Knee Score (OKS) showed a mean of 18.3 ± 4.2, with a median of 18 (IQR: 15–21) and a range of 11–27. The mean range of motion was 82.4 ± 14.6°, with a median of 85° (IQR: 70–92°) and a range of 55° to 110°.

Table 5. Comparison of functional outcome scores over time (n = 25)

Parameter	Preoperative Mean ± SD	12 weeks Mean ± SD	24 weeks Mean ± SD	p value
VAS score	8.1 ± 0.9	3.4 ± 0.8	1.8 ± 0.7	<0.001
KSS	38.6 ± 8.7	71.2 ± 7.9	84.5 ± 6.8	<0.001
WOMAC score	68.4 ± 9.6	34.1 ± 7.2	19.6 ± 5.4	<0.001
OKS	18.3 ± 4.2	31.8 ± 4.5	40.2 ± 3.8	<0.001
Range of motion (°)	82.4 ± 14.6	104.8 ± 10.2	117.6 ± 8.9	<0.001

All measured functional outcomes showed statistically highly significant improvement over the follow-up period. Post hoc pairwise comparison showed that the improvement from preoperative to 12 weeks and from 12 weeks to 24 weeks was statistically significant for all functional parameters.

Table 6. Pairwise comparison of functional outcome scores

Parameter	Pre-op vs 12 weeks p value	12 weeks vs 24 weeks p value	Pre-op vs 24 weeks p value
VAS score	<0.001	<0.001	<0.001
KSS	<0.001	<0.001	<0.001
WOMAC score	<0.001	<0.001	<0.001
OKS	<0.001	<0.001	<0.001
Range of motion	<0.001	<0.001	<0.001

At 24 weeks, the mean KSS was 85.7 ± 6.5 among males and 83.8 ± 7.1 among females. The difference was not statistically significant. Similarly, no significant sex-wise difference was found in WOMAC, OKS, or range of motion.

Table 7. Comparison of 24-week functional outcomes according to sex

Variable	Male Mean ± SD (n=9)	Female Mean ± SD (n=16)	p value
KSS	85.7 ± 6.5	83.8 ± 7.1	0.514
WOMAC score	18.9 ± 5.1	20.0 ± 5.7	0.638
OKS	40.8 ± 3.5	39.9 ± 4.0	0.578
Range of motion (°)	119.3 ± 8.2	116.6 ± 9.4	0.478

Thus, postoperative functional outcome did not differ significantly between male and female patients. Patients aged ≤60 years showed slightly better postoperative

functional scores compared to those aged >60 years; however, the difference did not reach statistical significance.

Table 8. Comparison of 24-week functional outcomes according to age group

Variable	≤60 years Mean ± SD (n=9)	>60 years Mean ± SD (n=16)	p value
KSS	86.9 ± 5.9	83.2 ± 7.2	0.196
WOMAC score	17.8 ± 4.6	20.6 ± 5.8	0.221
OKS	41.1 ± 3.3	39.7 ± 4.1	0.386
Range of motion (°)	120.2 ± 7.8	116.1 ± 9.4	0.269

Although younger patients had marginally better postoperative outcomes, age was not significantly associated with functional recovery in the present study.At 24 weeks, 18 patients (72.0%) reported excellent satisfaction, 5 (20.0%) reported good satisfaction, and 2 (8.0%) reported fair satisfaction. No patient reported poor satisfaction.

Table 9. Patient satisfaction at 24 weeks (n = 25)

Satisfaction category	Number (n)	Percentage (%)
Excellent	18	72.0
Good	5	20.0
Fair	2	8.0
Poor	0	0
Total	25	100

No major postoperative complications such as implant loosening, deep infection, periprosthetic fracture, or revision surgery were observed during the follow-up period. Two patients (8.0%) developed mild anterior knee pain, and one patient (4.0%) had delayed wound healing, which was managed conservatively.

Table 10. Postoperative complications (n = 25)

Complication	Number (n)	Percentage (%)
Anterior knee pain	2	8.0
Delayed wound healing	1	4.0
Stiffness	1	4.0
Deep infection	0	0
Insert dislocation	0	0
Revision surgery	0	0

Discussion

In the present study, the mean age of the patients was 63.4 ± 7.8 years, with a median age of 64 years, and the majority of patients belonged to the 61–70-year age group. Females constituted 64.0% of the study population, reflecting the well-established epidemiological trend that knee osteoarthritis predominantly affects older adults and shows a higher prevalence among women. Similar demographic patterns have been reported in previous studies, including those by Roque et al. and Powell et al., where the study populations comprised elderly individuals undergoing total knee arthroplasty, thereby aligning with the age and sex distribution observed in our series .

The principal finding of this study was the significant improvement in pain relief, functional outcome, and range of motion following mobile-bearing rotating-platform total knee replacement (TKR). The mean Visual Analog Scale (VAS) score improved markedly from 8.1 ± 0.9 preoperatively to 1.8 ± 0.7 at 24 weeks postoperatively, indicating substantial pain reduction. Functional outcomes also showed considerable improvement, with the Knee Society Score (KSS) increasing from 38.6 ± 8.7 to 84.5 ± 6.8, the WOMAC score improving from 68.4 ± 9.6 to 19.6 ± 5.4, and the Oxford Knee Score (OKS) improving from 18.3 ± 4.2 to 40.2 ± 3.8. Additionally, the mean range of motion improved significantly from 82.4 ± 14.6° preoperatively to 117.6 ± 8.9° at 24 weeks. All these improvements were statistically significant, with p-values less than 0.001, demonstrating the effectiveness of the procedure.

These findings support the theoretical advantages of mobile-bearing prostheses, which are designed to reduce contact stress and enhance joint kinematics by allowing rotational movement at the articulating interface. Studies by Huang et al. and Callaghan et al. have highlighted that such designs improve conformity and reduce polyethylene wear, thereby contributing to better functional outcomes. Furthermore, long-term studies such as those conducted by Milligan et al. have demonstrated excellent implant survivorship and sustained functional results over extended follow-up periods, reinforcing the durability and effectiveness of rotating-platform systems .

Comparative studies in the literature further validate these observations. Powell et al. reported superior long-term patient-reported outcomes, including improved Oxford Knee Score and WOMAC scores, in patients receiving rotating-platform implants compared to fixed-bearing designs. Similarly, Wang et al., in a meta-analysis of randomized controlled trials, demonstrated better postoperative Knee Society Scores and range of

motion with mobile-bearing prostheses. However, it is important to note that not all studies have shown clear superiority. Meta-analyses by Moskal and Capps have reported no significant differences between mobile-bearing and fixed-bearing implants in terms of clinical outcomes, revision rates, or complications, suggesting that while rotating-platform TKR is highly effective, its superiority over fixed-bearing designs remains a subject of debate .

In our study, postoperative outcomes did not show statistically significant differences based on age or sex, indicating that the benefits of rotating-platform TKR are consistent across different demographic groups. Additionally, no major complications such as deep infection, implant failure, or revision surgery were observed during the follow-up period. Minor complications included anterior knee pain in 8.0% of patients, delayed wound healing in 4.0%, and stiffness in 4.0%. Notably, no cases of insert dislocation were observed, although this remains a known but relatively rare complication associated with rotating-platform designs.

Overall, the findings of this study demonstrate that mobile-bearing rotating-platform total knee replacement provides excellent short-term outcomes in terms of pain relief, functional improvement, and range of motion, with a low complication rate. These results support its use as an effective surgical treatment option for patients with knee osteoarthritis.

Conclusion

The present study concludes that mobile-bearing rotating platform total knee replacement is an effective surgical option for patients with osteoarthritis of the knee, resulting in significant improvement in pain relief, functional outcome, and range of motion. Marked postoperative improvement was observed in VAS, Knee Society Score, WOMAC score, Oxford Knee Score, and knee mobility, indicating enhanced joint function and daily activity performance. The procedure demonstrated good early clinical outcomes with high patient satisfaction and a low complication rate. Although younger and male patients showed slightly better functional scores, age and sex were not significantly associated with final outcomes. Overall, mobile-bearing rotating platform prostheses provided satisfactory short-term results and represent a reliable option for total knee replacement. Further studies with larger sample sizes and longer follow-up are required to assess long-term outcomes and compare with fixed-bearing designs.

Limitations of the Study

This study had certain limitations, including a small sample size of 25 patients and its conduct at a single center, which may limit generalizability. The follow-up period was short (24 weeks), preventing assessment of long-term outcomes and implant survivorship. The absence of a fixed-bearing comparison group limited direct comparison. Additionally, factors such as BMI, deformity severity, and comorbidities were not analyzed separately. As a hospital-based observational study using purposive sampling, the possibility of selection bias cannot be excluded.

References

1. Roque VA, Agre M, Barroso J, Brito I. Managing knee osteoarthritis: Efficacy of hyaluronic acid injections. Acta Reumatol Port. 2013;38:154-161.
2. Abdel MP, Ollivier M, Parratte S, Trousdale RT, et al. Effect of postoperative mechanical axis alignment on survival and functional outcomes of modern total knee arthroplasties with cement: A concise follow-up at 20 years. J Bone Joint Surg Am. 2018;100:472-478.
3. Banks SA, Deckard E, Hodge WA, Meneghini RM. Rationale and results for fixed-bearing pivoting designs in total knee arthroplasty. J Knee Surg. 2019;32:590-595.
4. Milligan DJ, O'Brien S, Doran E, Gallagher NE, Beverland DE. Twenty-year survivorship of a cemented mobile bearing total knee arthroplasty. Knee. 2019;26:933-940.
5. Ferguson KB, Bailey O, Anthony I, et al. A comparison of lateral release rates in fixed- versus mobile-bearing total knee arthroplasty. J Orthop Traumatol. 2015;16:87-90.
6. Huang CH, Liau JJ, Cheng CK. Fixed or mobile-bearing total knee arthroplasty. J Orthop Surg Res. 2007;2:1.
7. Capella M, Dolfin M, Saccia F. Mobile bearing and fixed bearing total knee arthroplasty. Ann Transl Med. 2016;4:127-129.
8. Callaghan JJ, Insall JN, Greenwald AS, et al. Mobile-bearing knee replacement: Concepts and results. Instr Course Lect. 2001;50:431-449.
9. Hoff WA, Komistek RD, Dennis DA, et al. Three-dimensional determination of femoral-tibial contact positions under in vivo conditions using fluoroscopy. Clin Biomech (Bristol, Avon). 1998;13:455-472.
10. Thompson NW, Wilson DS, Cran GW, et al. Dislocation of the rotating platform after low contact stress total knee arthroplasty. Clin Orthop Relat Res. 2004;(425):207-211.

11. Quinlan ND, Wu Y, Chiaramonti AM, Guess S, Barfield WR, et al. Functional flexion instability after rotating-platform total knee arthroplasty. J Bone Joint Surg Am. 2020;102:1694-1702.
12. Hamelynck KJ. The history of mobile-bearing total knee replacement systems. Orthopedics. 2006;29:S7-S12.
13. Moskal JT, Capps SG. Rotating-platform TKA no different from fixed-bearing TKA regarding survivorship or performance: A meta-analysis. Clin Orthop Relat Res. 2014;472:2185-2193.
14. Wang K, Zhang FF, Yan X, Shen Y, Cai W, et al. Superior mid- to long-term clinical outcomes of mobile-bearing total knee arthroplasty compared to fixed-bearing: A meta-analysis based on a minimum of 5 years of study. J Knee Surg. 2021;34:1368-1378.
15. Powell AJ, Crua E, Chong BC, Gordon R, McAuslan A, Pitto RP, *et al.* A randomized prospective study comparing mobile-bearing against fixed-bearing PFC Sigma cruciate-retaining total knee arthroplasties with ten-year minimum follow-up. *Bone Joint J*. 2018 Oct;100-B(10):1336-44.