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OMEGA

ROTATING HINGE KNEE SYSTEM

Retrospective

Observational

Study

AUTHOR CONTRIBUTIONS

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Clinical and Functional Outcomes of the Omega Rotating Hinge Knee System in Revision Knee Arthroplasty

ABSTRACT

Background

Revision total knee arthroplasty (TKA) is a demanding reconstructive procedure performed to address failed primary knee replacements resulting from aseptic loosening, infection, instability, wear, periprosthetic fracture or bone loss. The primary goals of revision arthroplasty are to relieve pain, restore knee function and improve patient quality of life while overcoming challenges related to compromised bone stock and soft-tissue deficiency. Omega Rotating hinge knee prosthesis, have been developed to provide enhanced fixation, improved biomechanical stability and durable clinical outcomes in complex revision settings. Despite these theoretical advantages, there remains limited evidence regarding the clinical and functional performance of the Omega prosthesis in patients undergoing revision knee arthroplasty, highlighting the need for further evaluation of its effectiveness and survivorship.

Objective

To evaluate the clinical and functional outcomes in the patients undergoing revision knee arthroplasty with the Omega Rotating hinge knee system.

Methods

A retrospective multicentre study was undertaken in 40 patients who underwent revision knee arthroplasty with the Omega knee prosthesis. Data were acquired from SIMS hospital, Sushrushah Hospital, KIMS Sunshine Hospital and Amandeep Hospital. Clinical and functional outcomes such as pain score, knee score, function score, flexion, extension and total range of motion (ROM) were examined pre-operatively and post-operatively. Statistical analysis was performed using IBM SPSS Statistics, Version 26.0. The Wilcoxon signed-rank test was used for paired comparisons since the data were not regularly distributed. Clinical significance was determined using effect size (r).

Results

The mean age of the study population was 64.7 ± 8.6 years (range 45–88 years). The study population was composed of 55.0% women. Mean follow-up time was 16.88 ± 6.73 months. Post-operative improvement was significant for all outcome measures. Pain score was reduced from 7.70 ± 0.79 to 0.53 ± 0.91 ($p < 0.001$). The knee score increased from 21.10 ± 3.62 to 75.10 ± 3.95 ($p < 0.001$) and the function score improved from 17.00 ± 9.66 to 69.38 ± 5.90 ($p < 0.001$). Total ROM, flexion and extension also showed significant improvements. All parameters measured had large effect sizes. No prosthesis-related failure or revision operation was detected throughout follow-up.

Conclusion

Omega Rotating hinge knee prosthesis resulted in significantly better pain alleviation, knee score, functional score and range of motion. The prosthesis showed good short-term clinical performance and safety in patients with revision knee arthroplasty.

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Keywords: *Omega Knee Prosthesis, Total Knee Arthroplasty, Revision knee arthroplasty, Functional Outcome, Range of Motion, Knee Score, Prosthetic Outcome, Rotating Hinge Knee,*

Introduction

Total knee arthroplasty (TKA) is widely regarded as one of the most successful and cost-effective surgical procedures in modern orthopaedics. The procedure aims to relieve pain, correct deformity, restore mobility and improve the overall quality of life in patients with advanced knee joint pathology. With increasing life expectancy, rising prevalence of osteoarthritis and growing functional demands among the elderly population, the number of revision knee arthroplasties performed worldwide continues to increase substantially.

Revision total knee arthroplasty represents one of the most challenging procedures in contemporary orthopaedic practice. The increasing number of primary knee arthroplasties performed worldwide has been accompanied by a corresponding rise in revision surgeries. Common indications for revision knee arthroplasty include aseptic loosening, periprosthetic joint infection, instability, polyethylene wear, implant failure, periprosthetic fractures and severe bone loss. These conditions frequently result in pain, functional impairment, compromised mobility and reduced quality of life, necessitating complex reconstructive procedures.

Revision arthroplasty is technically demanding because of extensive bone defects, soft-tissue compromise, ligament insufficiency, altered anatomy and the need for restoration of joint stability. Achieving durable fixation and satisfactory functional outcomes in such cases remains a significant challenge for orthopaedic surgeons. Consequently, implant selection plays a critical role in ensuring mechanical stability, restoring knee biomechanics, facilitating early mobilization and improving long-term prosthesis survivorship. Modern constrained and rotating hinge prosthetic systems have therefore become increasingly important in the management of complex primary and revision knee arthroplasty cases where conventional implants may not provide adequate stability.

The Omega Rotating Hinge Knee System is a fully constrained prosthesis specifically developed for patients with severe ligamentous insufficiency, extensive bone loss, soft-tissue instability and complex reconstructive requirements. The system combines the stability of a constrained hinge mechanism with controlled rotational movement, thereby minimizing excessive stress transfer to the bone and implant interface while maintaining joint stability. The femoral component is manufactured from CoCrMo alloy and incorporates an asymmetric design intended to maintain optimal contact between the femoral and tibial articulating surfaces throughout the range of motion. The thinner anterior femoral condyle may reduce parapatellar pain, while the deeper trochlear groove facilitates physiological patellar tracking and minimizes the risk of patellar clunk syndrome. Furthermore, the reduced femoral box design helps preserve bone stock, which is particularly advantageous in revision procedures.

The tibial component is also manufactured from CoCrMo alloy and features a rotating platform design that allows controlled internal and external rotation while reducing torsional stresses transmitted to the implant fixation interfaces. A highly polished tibial baseplate and secure locking mechanism contribute to implant stability and durability. The prosthesis utilizes a highly congruent ultra-high-molecular-weight polyethylene (UHMWPE) tibial insert designed to maximize contact area during both flexion and extension, thereby improving load distribution and reducing polyethylene wear. The central non-

weight-bearing hinge mechanism provides a minimum jump height of 40 mm, enhancing resistance to subluxation and improving prosthetic stability. In addition, the modular design incorporates titanium alloy stems, augments, and wedges that facilitate reconstruction of bone defects frequently encountered in revision arthroplasty. Collectively, these features are intended to optimize load transmission, restore knee biomechanics, improve functional recovery, and enhance implant longevity.

Assessment of arthroplasty outcomes requires evaluation of multiple clinical and functional parameters. Pain relief remains one of the most important indicators of surgical success, while validated knee scores and functional scores provide objective measures of postoperative recovery. Restoration of adequate range of motion is equally important because activities such as walking, stair climbing, sitting, rising from a chair and squatting depend on satisfactory knee mobility. Therefore, comprehensive evaluation of pain, function and motion is essential when assessing the performance of any knee prosthetic system.

The evidence from Indian patient populations is still limited despite difference in lifestyle, cultural practices and functional requirements as compared to western populations. Assessment of implant performance in the clinic is therefore important to inform clinical decision making and optimize patient outcomes.

Therefore, the present multicentre retrospective observational study was performed to evaluate the clinical and functional results after implantation of the Omega Rotating Hinge Knee System in patients undergoing revision knee arthroplasty.

MATERIALS AND METHODS

Study Design

Retrospective multicentre study.

Study Setting

The study was conducted using patient records from four tertiary orthopaedic centres:

- SIMS Hospital
- Sushrushah Hospital
- KIMS Sunshine Hospital
- Amandeep Hospital

Study Population

A total of 40 patients who underwent implantation of the Omega Knee Prosthesis were included in the study.

Inclusion Criteria

- Patients undergoing revision knee arthroplasty using the Omega Knee Prosthesis.

- Availability of complete preoperative and postoperative clinical records.
- Minimum follow-up duration of six months and a maximum of 28 months.
- Patients above 18 years of age.

Exclusion Criteria

- Incomplete medical records.
- Missing postoperative outcome assessments.
- Follow-up duration less than six months.
- Patients requiring additional major reconstructive procedures unrelated to the prosthesis.
- Revision arthroplasty with other third party brands.

Data Collection

Patient records were reviewed retrospectively. The following variables were collected:

- Age
- Gender
- Diagnosis
- Femoral component size
- Tibial component size
- Follow-up duration
- Pain score
- Knee score
- Functional score
- Extension
- Flexion
- Total range of motion
- Prosthesis outcome

Outcome Measures

Primary Outcomes

- Pain score improvement

- Knee score improvement
- Functional score improvement
- Range of motion improvement

Secondary Outcomes

- Prosthesis-related complications
- Implant survivorship during follow-up
- Prosthesis outcome assessment

Statistical Analysis

Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics version 26.0. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages.

Normality was assessed using the Shapiro–Wilk test. Since the outcome variables were not normally distributed, preoperative and postoperative comparisons were performed using the Wilcoxon signed-rank test.

Effect size (r) was calculated using the formula:

$$r = \frac{Z}{\sqrt{N}}$$

Effect sizes were interpreted as:

- Small: $r = 0.10$
- Moderate: $r = 0.30$
- Large: $r \geq 0.50$

A p-value less than 0.05 was considered statistically significant.

RESULTS

Baseline Characteristics

The study involved 40 patients who had implantation of the Omega Knee Prosthesis. The average age of the study population was 64.7 ± 8.6 years (range 45–88 years). The study population was made up of 55.0% females (n=22) and 45.0% males (n=18). The mean follow-up period was 16.88 ± 6.73 months.

Table 1. Baseline Characteristics of Study Population

Variable	Value
Number of patients	40
Age (years), Mean ± SD	64.7 ± 8.6
Age range (years)	45–88
Male	18 (45.0%)
Female	22 (55.0%)
Follow-up duration (months), Mean ± SD	16.88 ± 6.73
Minimum follow-up (months)	6
Maximum follow-up (months)	28

Study Centre Distribution

Patients were recruited from 4 participating orthopaedic centres. The maximum number of patients was from Amandeep Hospital (32.5%) followed by KIMS Sunshine Hospital (30.0%), SIMS Hospital (20.0%) and Sushrushah Hospital (17.5%).

Table 2. Distribution According to Study Centre

Study Centre	Frequency	Percentage (%)
Amandeep Hospital	13	32.5
KIMS Sunshine Hospital	12	30.0
SIMS Hospital	8	20.0
Sushrushah Hospital	7	17.5
Total	40	100.0

Diagnostic Profile

The most frequent diagnosis was the “Other” category (32.5%), followed by aseptic loosening (27.5%), periprosthetic joint infection (17.5%), osteoarthritis (15.0%) and instability/post traumatic disorders (7.5%).

Table 3. Distribution According to Diagnosis

Diagnosis	Frequency	Percentage (%)
Aseptic Loosening	11	27.5
Periprosthetic Joint Infection	7	17.5
Osteoarthritis	6	15.0
Instability/post-traumatic	3	7.5
Other	13	32.5
Total	40	100.0

Clinical and Functional Outcomes

All clinical and functional outcome parameters measured improved significantly after surgery. Preoperatively mean pain score was 7.70 ± 0.79 and post operatively it was 0.53 ± 0.91. Likewise, knee score, function score, flexion and extension and range of motion total were all significantly improved. All comparisons were statistically significant by the Wilcoxon signed-rank test ($p < 0.001$).

Clinical and Functional Outcomes

Parameter	Preoperative Mean ± SD	Postoperative Mean ± SD	Mean Change	Z value	p value
Pain Score	7.70 ± 0.79	0.53 ± 0.91	-7.18	-5.649	<0.001
Knee Score	21.10 ± 3.62	75.10 ± 3.95	+54.00	-5.926	<0.001
Function Score	17.00 ± 9.66	69.38 ± 5.90	+52.38	-5.886	<0.001
Extension Lag (°)	6.13 ± 5.72	1.13 ± 3.10	-5.00	-4.141	<0.001
Flexion (°)	77.00 ± 20.03	96.25 ± 10.83	+19.25	-4.347	<0.001
Total ROM (°)	70.88 ± 21.98	95.13 ± 13.12	+24.25	-4.615	<0.001

All parameters demonstrated statistically significant postoperative improvement.

Effect Size Analysis

Effect size analysis was performed to assess the clinical magnitude of improvement following surgery. All outcome measures demonstrated large effect sizes ($r > 0.50$), indicating substantial clinical benefit.

Table 5. Effect Size Analysis

Outcome Variable	Z value	Effect Size (r)	Interpretation
Pain Score	5.649	0.893	Large
Knee Score	5.926	0.937	Large
Function Score	5.886	0.931	Large
Extension Lag	4.141	0.655	Large
Flexion	4.347	0.687	Large
Total ROM	4.615	0.730	Large

The largest clinical effect was observed for knee score improvement (r = 0.937), followed closely by function score improvement (r = 0.931) and pain reduction (r = 0.893).

Prosthesis Outcomes

No prosthesis-related failures, revision procedures, implant loosening requiring reoperation or major prosthesis-related complications were observed during the follow-up period.

Table 6. Prosthesis Outcomes

Variable	Category	n (%)
Prosthesis Outcome	Functional/Stable	40 (100.0)
Prosthesis Failure	Yes	0 (0.0)
Prosthesis Failure	No	40 (100.0)
Revision Surgery	Yes	0 (0.0)
Revision Surgery	No	40 (100.0)

All 40 patients demonstrated a stable and functional Omega Knee Prosthesis at final follow-up. No prosthesis-related failures, revision surgeries, or implant removals were observed during the study period. The overall prosthesis retention rate was 100%

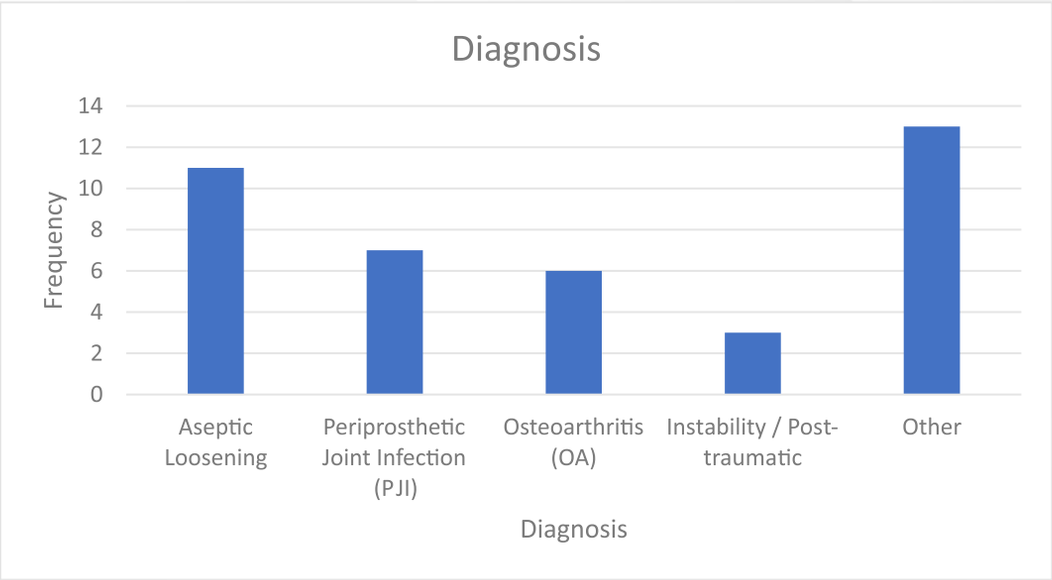

Figure 1: Distribution of patients according to diagnosis categories.

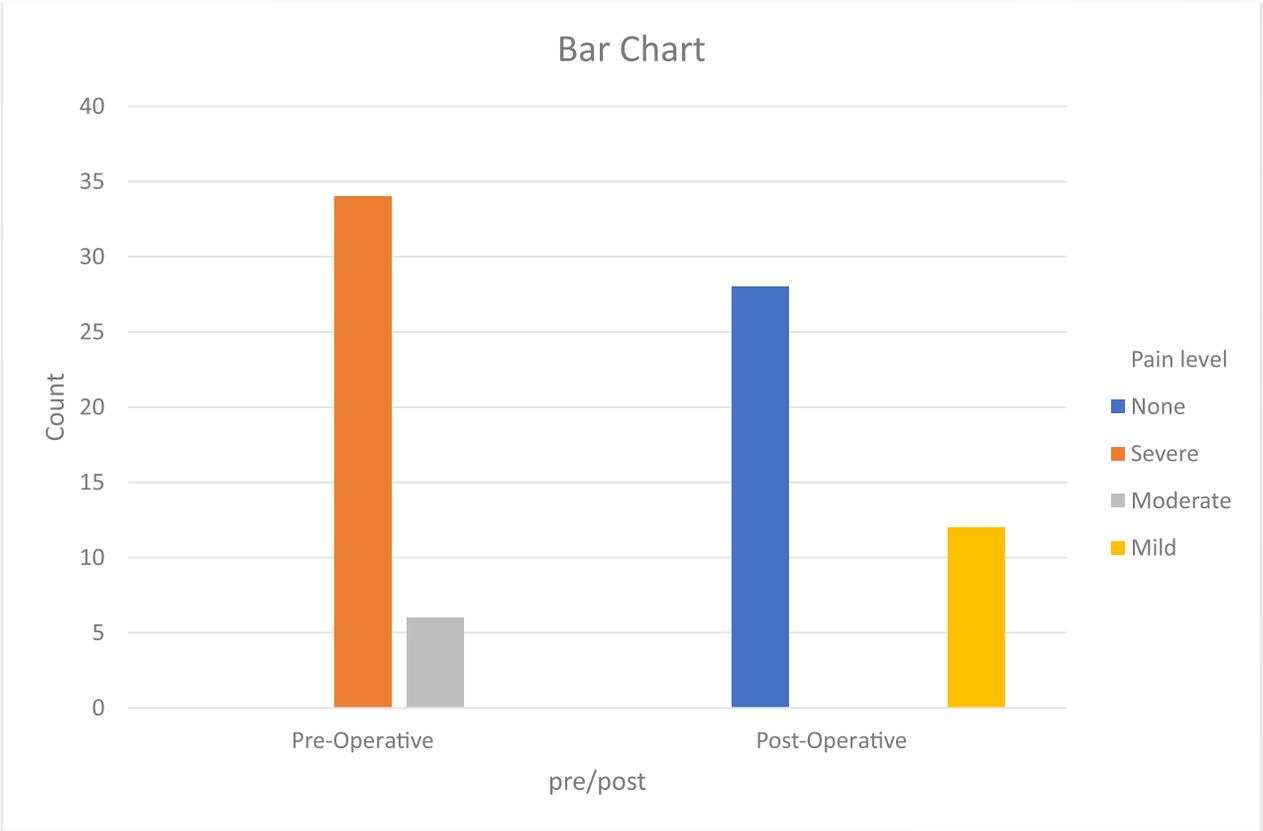

Figure 2: Comparison of preoperative and postoperative pain scores.

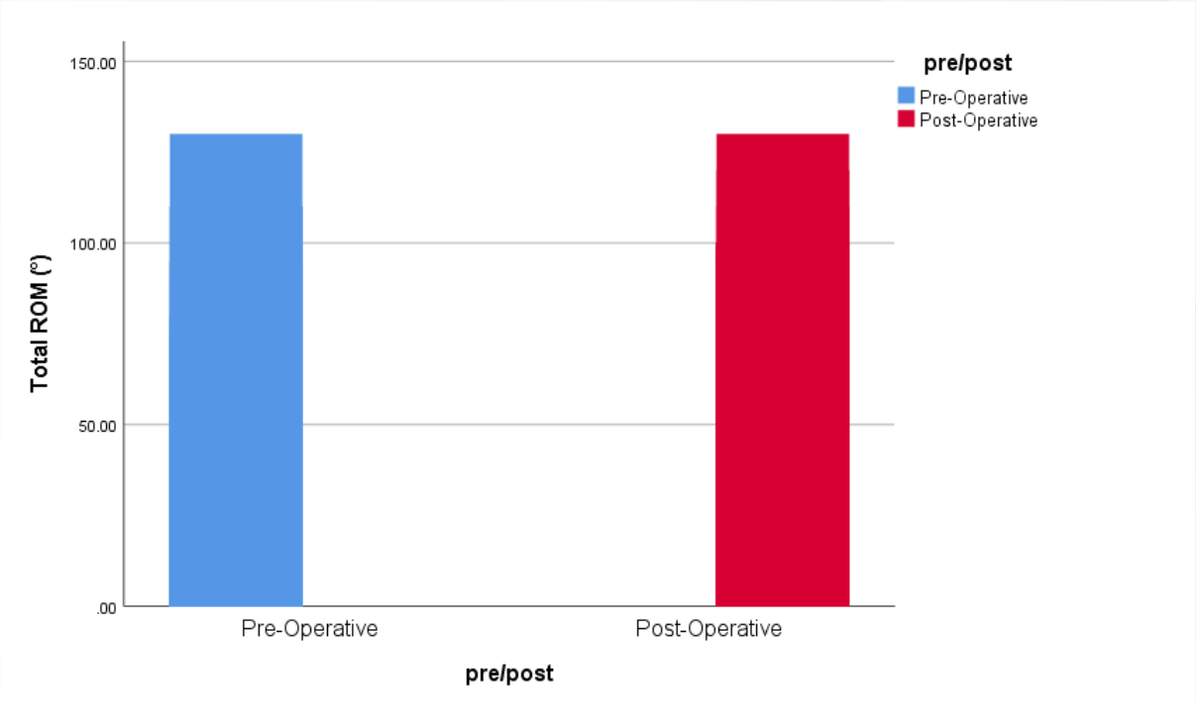

Figure 3: Comparison of preoperative and postoperative total ROM

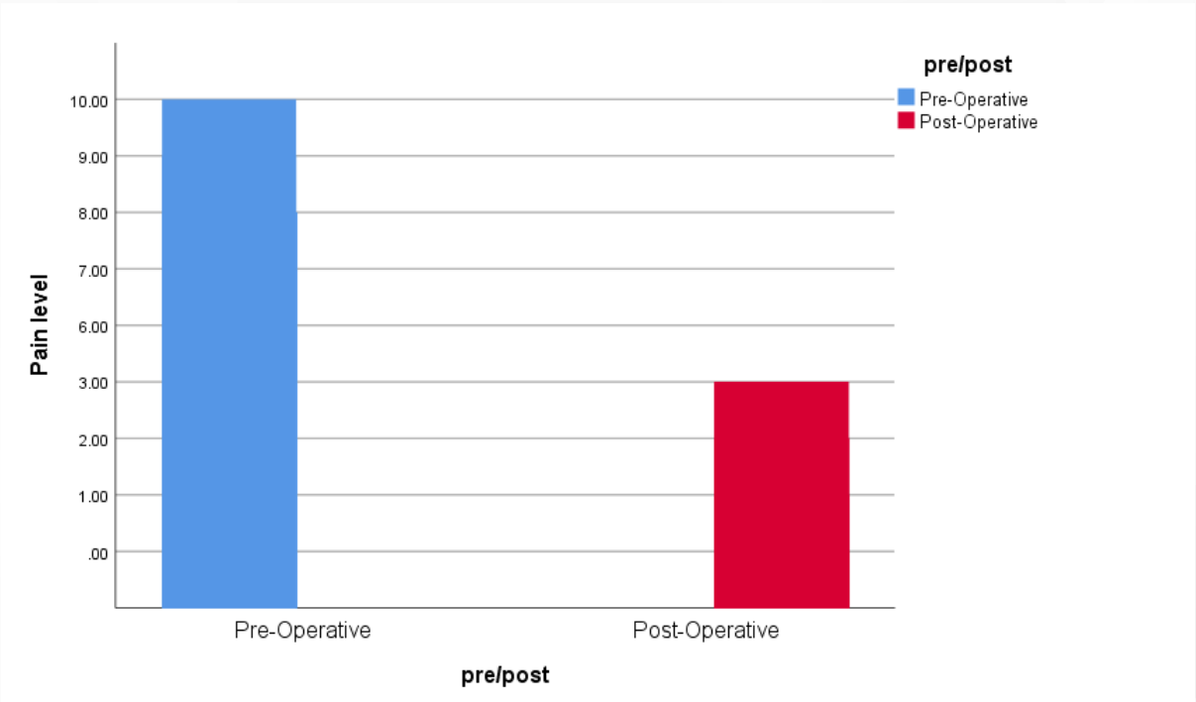

Figure 4: Comparison of preoperative and postoperative Pain level

Overall, the study demonstrated substantial improvement in pain relief, knee function, functional capacity and range of motion following implantation of the Omega Knee Prosthesis, with no observed prosthesis-related failures during the follow-up period.

LIMITATIONS

There are a number of limitations to the present study that should be noted when interpreting the findings. First, the retrospective design may create selection bias and information bias because of the reliance on previously recorded clinical data. Second, the study was performed on a relatively small sample size of 40 individuals, which may restrict the generalizability of the results to broader populations. Third, the fact that the trial was performed at several centers, where surgical techniques, rehabilitation protocols and postoperative treatment differed, may have influenced the findings.

Another noteworthy restriction is the short follow-up period, with a mean follow-up period of 16.88±6.73 months. This length of time is adequate for assessment of short-term clinical and functional results, but insufficient for assessment of long-term prosthesis survivability, implant wear, aseptic loosening and late sequelae. Moreover, the lack of a control group or comparison with other prosthetic systems limits the capacity to assess the relative superiority of the Omega rotating hinge knee Prosthesis. We urge future research with bigger sample sizes, longer follow-up and comparison designs to confirm the present findings and to assess long-term performance of the implant.

CONCLUSION

The present multicentre retrospective observational study indicated that implantation of the Omega rotating hinge knee prosthesis resulted in considerable improvement in pain alleviation, knee function, functional capacity and range of motion in patients having revision knee arthroplasty. There was considerable improvement in all clinical parameters assessed including pain score, knee score, function score, flexion, extension and total range of motion. All end measures had large effect sizes, showing that improvements were not only statistically significant but also clinically important. During the follow-up period, there were no failures linked to the prosthesis, revision surgeries or severe problems associated to the implant, further supporting the safety and efficacy of the Omega rotating hinge knee prosthesis. In conclusion, the Omega Knee Prosthesis provided an outstanding short-term clinical outcome with satisfactory implant function in a varied patient population. These data indicate its use as a reliable alternative for primary and revision knee arthroplasty. Further prospective trials with long-term follow-up are required to evaluate implant survivability, durability and long-term functional results.

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DATA AVAILABILITY

The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

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