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Original Article

Clinical and Functional Outcomes of Total Knee Replacement in Osteoarthritic Knees

Manoj Kandel[1], Deepak Banjade[1], Shrawan Kumar Thapa[1], Kabin Neupane[1], Sushan Adhikari[1]

[1]Department of Orthopaedics, Bharatpur Hospital, Bharatpur-10, Chitwan, Nepal

ABSTRACT

Introduction: The gold standard, effective treatment for high-grade osteoarthritis of knees is total knee arthroplasty (TKA). Surgical results are excellent, with favorable early postoperative health-related quality of life. Ease of daily activities of living after TKR was evaluated using clinical and functional scores.

Methods: Analysis of 42 cases with end-stage osteoarthritis of the knee who underwent TKA at a tertiary care center over a period of two years was done using prospectively collected data. Clinical and functional outcomes in patients undergoing total knee arthroplasty were evaluated using the Knee Society score, WOMAC Score, Oxford knee score, and SF-36 Questionnaire. The association between functional and clinical scores was also evaluated.

Results: The mean preoperative Oxford clinical score (OCS) was 19.86 ±2.49 which increased to a postoperative score of 42.38±1.58 at the end of 6 months. Similarly, the mean preoperative knee functional score (KFS) was 55.86±2.25 which increased to a postoperative score of 77.00±1.67 at the end of 6 months, and the mean pre-operative WOMAC Score of 93.50±3.13 improved to a post-operative score of 49.50±2.82. There was a significant increase in SF -36 SCORE, walking, stair climbing capacity, and quality of life during follow-up at 3-, 6- and 12-month intervals. There was a significant association between knee functional score and Oxford clinical score at every interval.

Conclusions: Functional ability with the return to pre-disease state and having pain-free stable mobile joint was achieved with total knee arthroplasty, as reflected by the improvement in the post-op knee clinical score and knee functional score.

Keywords: Knee functional score; Osteoarthritis; Oxford clinical score; SF-36 Questionnaire; Total knee arthroplasty; WOMAC Score

INTRODUCTION

Primary knee osteoarthritis (OA) is the leading cause of progressive pain, deformity, and stiffness causing physical and social disability in the aging population resulting secondary to degenerative articular changes.[1-4] Total knee replacement (TKR) is an extensively performed surgical procedure to decrease pain and improve function.[5]

The effectiveness of an intervention is evaluated by assessment of knee function, pathology, and its implication on a patient's quality of life.[6] The Knee Society Score (KSS), Oxford score, 36-Item Short Form Survey (SF-36) questionnaire, and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) Scoring system have been increasingly used after formally validated in multi-centered trial studies using standard psychometric procedures and are considered superior assessment tool pre- and post- TKR.[7,8]

The objective of the study was to assess the early clinical and functional outcome of primary TKR in patients with primary knee osteoarthritis using various standard scoring systems.

METHODS

This was a prospective, observational study of patients with osteoarthritis of the knee (Kellgren and Lawrence grade 3 and 4) who underwent either unilateral or bilateral Total knee replacement from August 2018 to June 2020 (over 23 months) at a tertiary care level government hospital. Ethical approval was obtained from the Institutional Review Board (IRB) (Reference Number: 075/76-001A) of the Bharatpur Hospital, Bharatpur, Chitwan, Nepal.

All patients above 50 years presenting to the outpatient department (OPD) with knee pain were evaluated clinically and radiologically (X-ray of the knee: weight-bearing anteroposterior view; stress radiographs in valgus and varus; lateral view; axial patellar view) and selected for operation in end-stage arthritis and were included in the study after informed consent was obtained.

Patients with a history of recent or past septic arthritis in the same knee, valgus deformity of the knee (Grade III: axial

Correspondence:

Dr Manoj Kandel
Department of Orthopaedics, Bharatpur Hospital, Bharatpur-10, Chitwan, Nepal,
Tel: 9845050040, Email: manojkandel17@gmail.com

deformity greater than 20°, tight lateral structures, and insufficient medial stabilizers), loss of extensor mechanism of the knee, uncontrolled diabetes, neurological deficit in ipsilateral lower limb and previously operated with TKR were excluded from the study.

The demographic, clinical data, knee society score, Oxford and WOMAC, and SF-36 were noted at the time of admission. The patients have either undergone a single-setting bilateral or unilateral total knee arthroplasty.

Operative Procedure:

All procedures were performed under tourniquet control, a standard medial parapatellar approach was used, and cemented posterior cruciate sacrificing TKR prosthesis was used. Patelloplasty with denervation of the patella was done.

The postoperative protocol included the use of intravenous followed by oral antibiotics and analgesics with deep vein thrombosis prophylaxis. Sutures were removed at 2 weeks.

Standard physiotherapy protocol was advised for all patients.[9]

Follow-up assessment was recorded at 3 months, 6 months, and 12 months.

Patients were assessed clinically for function, range of motion of knee joints, the status of pain, change in daily routine activity, and generalized well-being after TKR. KSS, Oxford, WOMAC score, and SF-36 questionnaire were calculated at all follow-up visits, and a radiological assessment was done.

Statistical analysis

All the demographic and clinical data were collected and entered into an Excel master chart. Statistical analysis was done using Statistical Package for Social Science (SPSS) version 20. Categorical data were expressed as frequency, percentages, and continuous data were analyzed using mean and standard deviation. Duncan's multiple range test was used for post hoc comparison, p-value < 0.05 was considered to be statistically significant

RESULTS

A total of 45 patients with 66 knees were included in the study. Two unilateral TKR patients lost to follow up and one bilateral TKR patient died after 7 months from natural causes. So, the final analysis was done for 42 patients (20 bilateral and 22 unilateral TKR).

There were 28 males (11 unilateral and 17 bilateral TKR) and 14 female patients (11 unilateral and 3 bilateral TKR). The mean age of the patients was 63.33 ± 8.21 years (range 50-84 years). The mean duration of surgery was 56.83 ± 7 .26 min (for unilateral TKR) and 90.43 ± 8 .26 min (for bilateral TKR). Mean duration of hospital stay was 12.13 ± 1.12 days.

33 patients (78.6%) were overweight with 6 patients were grade I obese (14.3%) (Table 1).

Table 1. Number of patients in each category as per BMI.

Body mass index (kg/m²)	Frequency n (%)
18.5 - 24.9 (Normal)	3(7.1)
25 - 29.9 (Overweight)	33(78.6)
30 - 34.99 (Grade I Obese)	6(14.3)
35 – 39.99 (Grade II Obese)	0
>40 (Morbid Obese)	0
Total	100.0%(42)

Medical co-morbidities seen in our study group were hypertension, diabetes mellitus, coronary artery disease, hypothyroidism, and chronic obstructive airway disease, which did not compromise the patient's ability to withstand anesthesia, the metabolic demands of surgery and wound healing, and the significant rehabilitation necessary to ensure a favorable functional outcome.

There was a gradually increasing range of motion was seen during subsequent follow-ups. The mean range of motion (ROM) at pre-op was 58.480 ± 6.240 which improved to 86.070 ± 2.830 at 3 months, 97.950 ± 1.960 at the end of 6 months, and 103.860 ± 4.060 at final follow-up at 12 months (Table 2).

Table 2. Trends in ROM with statistical relation

		Pre-op	3 month	6 month	12 month
Overall ROM n = 42	Mean	58.48[b]	86.07[a]	97.95[b]	103.86[c]
	Std. Deviation	6.24	2.83	1.96	4.06

Values with different superscripts are statistically significant (p<0.05)

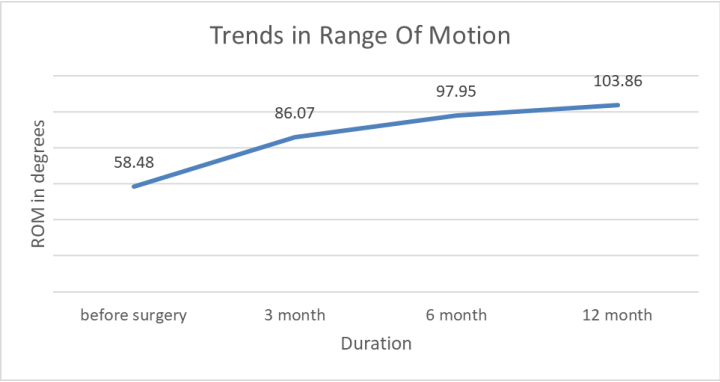

Fig. 1: Graphical representation of trends in the ROM

Oxford knee score, WOMAC Score, SF-36, and Knee Society Score were used to assess the clinical and functional status of the patients.

Mean pain score improved significantly at each follow-up till the end of twelve months.

Table 3. Changes in Pain score, KSS, and Functional score with time.

	Pre-op	3 month	6 month	12 month
WOMAC score	93.50[a] (±3.13)	69.40[b] (±3.18)	49.50[c] (±2.82)	44.48[d] (±1.98)
Oxford score	19.86 (±2.49)	35.45 (±2.28)	42.38 (±1.58)	44.57 (±1.02)
KSS	55.86[a] (±2.25)	67.31[b] (±2.02)	77.00[c] (±1.67)	89.48[d] (±2.46)
SF 36 score	23.38[a] (±1.85)	54.98[b] (±2.97)	76.05[c] (±1.89)	90.48[d] (±2.23)

Values with different superscripts are statistically significant (p<0.05)

KSS: Knee society score; WOMAC score: Western Ontario and McMaster Universities Arthritis Index score; Pre-op: Pre-operative, SF 36 score: 36-Item Short Form Survey

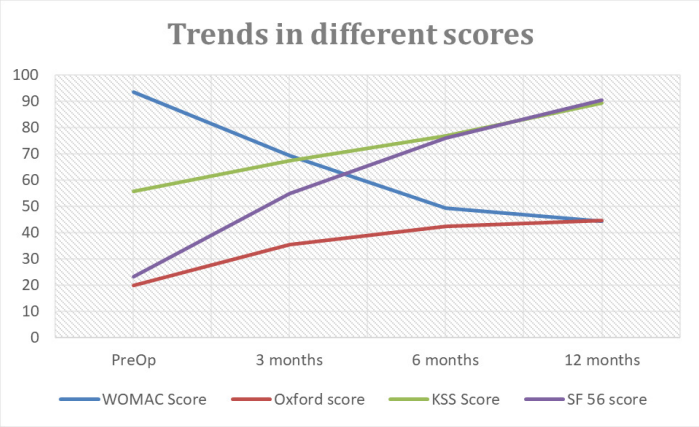

Fig. 2: Representation of changes in WOMAC score, KSS, Oxford score, and Functional Score from pre-operative to end of twelve months

Preoperative Knee Society Score, Oxford Knee Score, and SF-36 Questionnaire were compared with the Knee Society Score at 3 months, 6 months, and one year. Mean pre-operative scores improved significantly at each follow-up till the end of the first year.

A functional score of every subject was noted at the pre-operative visit as well as every follow-up visit. Average gain as compared to pre-operative functional score was assessed (Table 3).

There was a significant improvement in the correction of varus deformity of the knee with mean varus deformity of $17.24^0 \pm 3.29^0$ before surgery to $5.90^0 \pm 1.59^0$ immediately after surgery on radiographic evaluation.

Stair climbing capacity also markedly improved with a mean score of 12.38 ± 1.56 as compared to the pre-operative score of 2.74 ± 2.52.

There was a significant improvement in walking capacity in the post-operative knee with a mean score of 27.29 ± 1.27 from pre-operative walking status of 6.79 ± 2.43. There were big differences in quality of life between the pre-operative and post-surgical status of patients (p<0.05).

Table 4. Post-operative complications

Complications	Frequency n(%)
Stiffness	5 (11.90)
Anterior knee pain	2 (4.76)
Delayed wound healing	5 (11.90)
Infection	1 (2.38)
Complex regional pain syndrome	4 (9.52)

Post-operative knee stiffness was seen in 5 knees. Pre-operative range of motion in these patients was $0–56^0$, $0-62^0$, $0-64^0$, $0-60^0$, and $0-50^0$. They underwent manipulation under anesthesia 3 months after surgery. This was followed by an intensive physiotherapy program. They gained a range of motion like the rest of the patients after the rehabilitation program.

Anterior knee pain was present in 2 patients until 3 months after surgery. These symptoms were completely relieved at 6 months follow-up.

5 patients developed delayed wound healing with slight sloughing of margins. All of them had diabetes mellitus with 1 or 2 other co-morbidities. They were treated with intermittent dressing under aseptic conditions. All wounds healed by 3 weeks after surgery. 3 Patients in our study group developed a superficial infection at 6 - 8 months after surgery which required debridement and resolved. (Table 4).

DISCUSSION

Total knee arthroplasty is an effective procedure and is associated with substantial functional improvement. All patients who were having difficulty in mobilizing because of osteoarthritis found good relief after total knee arthroplasty.

The mean age of patients in our study was 63.33 ± 8.21 years (range 50 to 84 years) which is lower than Hooper et al. and Ackerman et al. study but similar to a study done by Bhole et al. [11,12,13] The most prevalent age to develop osteoarthritis of the knee was above 50 years. The most frequently affected joint was the knee. Early development of severe osteoarthritis changes among the Nepali population in this study may be because of squatting, cross-leg sitting, and hill-climbing which is supported by a study done by Bhole et al. and Haque et al.[13,14] In this study, 92.9 % of patients were overweight to obese. They achieved an excellent outcome as measured by KSS. Baker et al. and Judge et al. had similar results.[15,16] In our study, 52% of total patients who were overweight to obese underwent bilateral TKR where no complication was seen till the end of the last follow-up visit. Benjamin et al. and Ayyar et al. stated that there is a similar benefit from replacement surgery irrespective of BMI.[17,18]

With the varied amount of implant designs available the

posterior cruciate substituting design was found to be effective.[8] Our study shows a similar improvement in mobility as found by Swanik et al. Following total knee arthroplasty, patients were able to reproduce joint position and improve mobility significantly. Retention of the posterior cruciate ligament does not appear to significantly improve proprioception and balance compared with those functions in patients with a posterior stabilized total knee design.[10]

The range of motion of every subject was noted at the pre-op visit as well as every following visit so that average gain compared to the pre-op range of motion could be assessed. There was a gradually increasing range of motion was seen during subsequent follow-ups. The final mean range of motion was comparable to other posterior stabilized TKR designs as shown by Jacobs et al. (mean 113^0), Kolisek et al. (mean 118^0), and by Sancheti et al. ($128^0 \pm 8.32^0$).[19,20,21] The current study showed satisfactory functional and clinical results in the majority of patients with an acceptable limit of complications.

Two patients experienced anterior knee pain until 3 months after surgery. These symptoms resolved at 6 months follow-up without any intervention. Schurman et al. report a similar incidence of anterior knee pain to be 5 - 10%, Itokazu et al. reported 8% and Schai et al. reported 20.2% cases with post-operative anterior knee pain.[22,23,24] The majority of these patients settled with conservative measures.[19] Sancheti et al. showed that they had 7 patients with anterior knee pain out of 160 TKRs (4 un-resurfaced and 3 resurfaced).[21] None of them needed intervention.

The mean Knee Society Score and SF-36 Questionnaire improved significantly from 55.86(±2.25) to 67.31(±2.02) at 3 months, to 77.00(±1.67) at 6 months and 89.48(±2.46) at 1 year. Final KSS, SF-36 in the study was comparable to Farahini et al. who in their study showed that pre-operative KSS improved from 45.2+12.10 to 93.7+2.8.[25] Sancheti et al. and Choi et al. reported improvement in KSS from 40.1+10.7 to 90.3+5.34.[21,26]

There was a significant improvement in the correction of varus deformity with a mean of $17.24^0 \pm 3.29^0$ before surgery to $5.90^0 \pm 1.59^0$ degrees post-TKR and stair climbing capacity with a mean score of 12.38 ± 1.56 as compared to the pre-operative score of 2.74 ± 2.52.

There was a significant improvement in walking capacity in the post-op knee with a mean score of 27.29 ± 1.27 from the pre-op walking status score of 6.79 ± 2.43.

There were big differences in the quality of life between the pre-operative and post-surgical status of patients ($p<0.05$). In their respective studies conducted by Hilding et al. and Mandeville et al. after total knee replacement, they mentioned that due to overall correction in frontal knee angle, varus deformity, and relaxation in stretched and contracted capsulo-ligamentous structure, there was progression in walking standing and stair climbing capacity in all patients.[27,28]

The mean duration of hospital stay was 12.13+1.12 days which was comparable with other studies. Farahani et al reported a mean hospital stay of 6.1 days which is inconsistent with the present study results.[25] Most of our patients were illiterate coming from remote areas. Hence our government hospital made a protocol of discharge of such patients only after gait training, physiotherapy training, and suture removal.

CONCLUSION

Treatment with total knee arthroplasty provides greater pain relief and functional improvement within a few months as reflected by the improvement in the postoperative knee clinical score and functional score. The result of this study may help to counsel patients to undergo total knee replacement in indicated cases in under-developed countries with low socioeconomic status for long-term benefit and cost-effectiveness.

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