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Original Article

Rehabilitation outcomes following revision for failed unicompartmental knee arthroplasty

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ABSTRACT

Background: To investigate the post-operative outcomes of a revised UKA to a TKA compared to a primary TKA.

Methods: 33 revised UKA were matched to primary TKA and assessed using SF-36, Oxford Knee Scores (OKS) and Knee Society Scores (KSS).

Results: Both cohorts attained statistically similar SF-36 scores ($p > 0.05$). KSS improved by 51.12 in rev-UKA and 50.25 in primary TKA ($p = 0.977$) at 2 years. OKS scores were similar at 6 months ($p = 0.094$) and 2 years ($p = 0.235$).

Interpretation: Revision of UKA does not require a longer period of rehabilitation to achieve satisfactory return to function.

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1. Introduction

The incidence and treatment of unicompartmental arthritis of the knee joint has increased substantially over the last decade. This is attributed to better access to healthcare services resulting in patients receiving medical treatment at an earlier stage in the progression of arthritis.

Surgical options for unicompartmental arthritis of the knee include a high tibial osteotomy or minimally resurfacing unicompartmental knee arthroplasty (UKA). Unicompartmental knee arthroplasty as an early surgical option has gained popularity in the last decade.² This surge in popularity is attributed to advantages of shorter operative time, less post-operative pain and shorter hospital stay. Improved knee kinematics and proprioception also lends

benefit to the rehabilitation of the patient. Advances in prosthetic design, operative technique and patient selection have produced results comparable to a primary total knee arthroplasty.³

The longevity of a unicompartmental knee arthroplasty is still considerably shorter than that of a primary total knee arthroplasty.⁴ Some surgical centers have reported 10 year UKA survival rates of more than 90%.^{5,6}

With increasing numbers of UKA surgeries, revision of a UKA may become more commonplace. A UKA revised to a TKA has been shown to be the best option in terms of survivorship and risk of re-revision.

Studies have compared the outcome of revised UKA to TKA. A majority of these studies utilized knee functional scores and recorded the outcomes on a single cohort of

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patients. There have been few controlled trials comparing the outcomes of revised UKAs to patients who have underwent primary total knee arthroplasties.^{7,8}

Challenges presented during revision surgery are brought about by loss of tibia bone stock, requiring augmentation with stems and wedges. This poses greater technical challenges.⁹

The aim of this study was to compare a cohort of patient who underwent revision unicompartmental arthroplasties in our center to a similar cohort of patients who underwent primary total knee arthroplasty. Pre-operative Quality of life scores (SF-36), Knee society scores and Oxford knee scores were used as qualitative tools for comparison. Pre-operative and peri-operative results were also documented.

2. Material and methods

A total number of 33 patients (24 females and 7 males) were included in the revision unicompartmental knee arthroplasty study group. These patients were matched to a database of patients who underwent primary total knee arthroplasty at our institute within the same time frame. Both groups were matched for age, BMI and gender. Operations were performed between the years 1999 and 2012 by the same group of senior arthroplasty surgeons. All UKAs were of metal backed and fixed bearing designs.

Of these 33 revision UKA patients, 8 patients underwent bilateral primary unicompartmental knee arthroplasties. Indications for revision of UKA included signs and symptoms of pain and instability or infection in the operated knee, as well as radiographic evidence of implant loosening, polyethylene liner wear and periprosthetic fractures.

We collected data over a 2 year prospective period. Time to failure of a UKA was defined as the duration from primary unicompartmental knee arthroplasty to revision surgery. The types of implants used and the length of hospital stay were compared between both groups.

Improvements in SF-36, Oxford knee scores and Knee society scores were tabulated and comparison was made between both groups using the Wilcoxon Signed Ranked test.

All patients underwent similar post-operative management protocols. This includes thromboembolic and antibiotic prophylaxis.

The SF-36, Oxford knee scores and Knee society scores were taken at a single Orthopaedic Diagnostic Center led by a team of certified physiotherapists and allied health professionals.

Statistical assessment of the scores between both cohorts were analyzed using the non parametric Wilcoxon Signed Ranked Test. A probability of $p < 0.05$ was taken as being statistically significant. All data was analysed using SPSS 16.0.

3. Results

The average time taken for all 33 unicompartmental knee arthroplasties in the first group of patients to revision was 53.6

Table 1 – Pre-operative SF-36 scores in both groups of patients.

	Revision UKA mean scores	Primary TKR mean scores	p value <0.05
SF1	34.09	39.7	0.294
SF2	64.65	74.18	0.945
SF3	21.21	20.45	0.947
SF4	29.18	34.88	0.205
SF5	69.64	63.79	0.459
SF6	67.25	68.03	0.923
SF7	50.76	55.30	0.645
SF8	80.81	75.76	0.814

months (Range 5 → 144 months). The average age of our patients in the revision unicompartmental knee surgery group was 60.1 (48 → 81 years) and 63.1 (47 → 80.5 years) in the primary total knee arthroplasty group.

From 1999 to 2012, a total of 1760 unicompartmental knee implants were performed at our institution. 33 patients required revision. The failure rate was 1.8% over a period of 13 years.

There were no significant differences in SF-36 scores pre-operatively in both groups of patients ($p = 0.05$) (Table 1).

There were significant improvements in quality of life indices across all domains following revision of failed

Graph 1 – 2-year follow up SF-36 scores in revision unicompartmental knee arthroplasty group.

Graph 2 – 2-years follow ups SF-36 scores in primary total knee arthroplasty group.

Mean SF-36 scores at 6 months

Graph 3 – Mean SF-36 scores of Revision UKA and TKA at 6 month interval.

Mean SF-36 scores at 2 years

Graph 4 – Mean SF-36 scores of Revision UKA and TKA at 2 years interval.

unicompartmental knee arthroplasty and primary total knee arthroplasty at 6 months and 2 years intervals (Graphs 1 and 2).

We compared the degree of improvements of SF-36 scores over all domains for significant differences in both groups using the Wilcoxon Signed Rank test.

Using $p = 0.05$, the mean scores in all 8 SF-36 domains were statistically similar in both the revision unicompartmental arthroplasty and the primary total knee arthroplasty cohorts at 6 months and 2 years post operation (Graphs 3 and 4).

Our results indicate that patients who undergo revision unicompartmental knee arthroplasty to a total knee

Table 2 – Improvement at 6 months between revision UKA and primary TKA including interquartile range.

	Degree of improvement at 6 months (median) + (interquartile range)		p value >0.05
	Revision UKA	Primary TKA	
SF1	37.5 (12.5 to 53.8)	27.5 (5 to 40)	0.173
SF2	75 (0 to 100)	50 (0 to 100)	0.943
SF3	49.5 (19.25 to 59.75)	30.5 (0 to 46.5)	0.113
SF4	5.0 (–5 to 22.25)	10.0 (–4.25 to 20.0)	0.974
SF5	10.0 (0 to 20.0)	10.0 (0 to 30.0)	0.896
SF6	50.0 (0 to 87.5)	0 (0 to 50.0)	0.067
SF7	0 (0 to 0)	0 (19.8 to 0)	0.904
SF8	6.0 (–4–24)	10.0 (–4–19)	0.781

Table 3 – Improvement at 2 years between revision UKA and primary TKA including interquartile range.

	Degree of improvement at 2 years (median) + (interquartile range)		p value >0.05
	Revision UKA	Primary TKR	
SF1	30.0 (12.5 to 58.75)	30.0 (15 to 43.75)	0.603
SF2	62.5 (6.25 to 93.75)	50.0 (0 to 100)	0.844
SF3	30.5 (20.25 to 59.0)	24.5 (10.0 to 39.75)	0.117
SF4	7.5 (–8.75 to 20.0)	5.0 (–5.0 to 15.0)	0.903
SF5	5.0 (–10.0 to 20.0)	5.0 (–7.5 to 13.75)	0.986
SF6	25.0 (0 to 75.0)	12.5 (0 to 62.0)	0.762
SF7	0 (0 to 0)	0 (0 to 67.0)	0.671
SF8	10.0 (–7.0 to 31.0)	4.0 (–7.0 to 16.0)	0.322

Table 4 – Mean improvement in Oxford knee score in revision UKA and TKA + range.

	Revision UKA	Primary TKR	p = 0.05
6 months	–16.83 (–40 to 20)	–12.96 (–30 to 8)	.094
2 years	–19 (–40 to 1)	–15.25 (–33 to 15)	.235

arthroplasty and primary total knee arthroplasties achieved similar quality of life outcomes within a 2 year period (Tables 2 and 3).

We compared the progress of Oxford knee scores and Knee society scores in both groups of patients at the same time intervals. There were significant improvements in the Knee society scores and Oxford knee scores at both intervals (Tables 4–6).

Oxford knee scores improved by a statistically similar margin in both cohorts.

Demonstrate similar knee society scores in both cohorts.

The average hospital stay was shorter in the revision unicompartmental knee arthroplasty group with an average of 5.9 days (3–6 days) compared to 6.2 (4–11days) in the primary total knee arthroplasty group.

Within the 33 patients in the revision unicompartmental arthroplasty group, 1 patient suffered a left popliteal artery pseudoaneurysm complicated by compartment syndrome and infection post-operatively. This single patient was found to have a pseudoaneurysm post-operatively which led to compartment syndrome. The infection settled after an arthrotomy washout and intravenous antibiotics. Re-revision surgery was not required.

18 patients who underwent revision required stems and augments during the revision surgery. 1 patient was revised to a constrained implant. 14 patients were revised using primary total knee arthroplasty components (Table 7).

Table 5 – Mean improvement in knee society score (functional) in revision UKA and TKA + range.

	Revision UKA	Primary TKR	p = 0.05
6 months	+17.29 (–40 to 75)	+16.64 (–20 to 65)	.889
2 years	+19.79 (–25 to 65)	+16.88 (–20 to 60)	.602

Table 6 – Mean improvement in knee society scores in revision UKA and TKA + range.

	Revision UKA	Primary TKR	$p = 0.05$
6 months	+41.13 (–15 to 79)	+40.33 (–68 to 93)	0.909
2 years	+51.12 (–15 to 84)	+50.25 (–25 to 97)	0.977

The main cause for revision was aseptic loosening. 6 patients underwent revision due to progression of osteoarthritis, 5 patients had wear of the polyethylene liner and 3 patients underwent surgery for periprosthetic fractures.

The average time taken for revision unicompartmental knee arthroplasty was longer with an average time of 116 min (75–185) compared to 77 min (50–110) in the primary arthroplasty group. This is attributed to increased technical difficulty due to bone loss, necessitating the use of augments and stems during surgery.

4. Discussion

Unicompartmental knee arthroplasty as a surgical treatment for unicompartmental arthritis has demonstrated good results in terms of function.¹⁰

Detractors of unicompartmental knee arthroplasties however point towards a lower implant survival rate¹¹ and requirement of revision surgery which is technically more demanding as evidence to suggest that performing a UKA might not be as beneficial as perpetuated.

10 year survival rates of UKA range from 79%¹²–96%.¹³ Studies show significant improvement in functional scores and quality of life following unicompartmental knee arthroplasties. However UKAs still demonstrate a higher revision rate compared to primary total knee arthroplasties.

Few controlled studies have been performed to compare the post-operative results of revised UKAs to primary total knee surgeries. Non-controlled retrospective studies reporting on functional scores were generally in favor of revision UKAs with most reporting excellent to good results.

Chou et al² reported better functional scores for primary TKRs at 1-year post operation compared to revision UKAs suggesting inferior results associated with revision surgery. This was a single cohort study. 33 revision UKAs were reviewed with 18 out of 33 patients requiring augments and stems and wedges. 2 patients underwent re-revision due to infection and loosening while 4 patients had post-operative complications of myocardial infarct and distal deep vein thrombosis. Oxford knee scores were compared with a group of primary total knee arthroplasties however there was no

clear description on how patients were matched. Levin et al¹⁴ and Johnson et al¹⁵ demonstrated better results in revision of unicompartmental knee arthroplasties using the Bristol knee score as the basis for comparison. There was no mention of how patients were matched against a group of primary total knee arthroplasties. A 10-year survival rate of 91% was reported. Levin et al's study reviewed revision of Robert Bringham unicompartmental knee implants. Patients with inflammatory arthritis of the knee were included in the study.

Becker et al¹ conducted a matched pair retrospective analysis of 28 revision unicompartmental knee arthroplasties to primary total knee arthroplasties using radiographs, WOMAC and Knee society scores as evaluation tools. He reported inferior functional results in comparison to bicondylar knee arthroplasty, citing lower WOMAC and Knee society scores and the need for a thicker polyethylene insert during revision.

Turlough O'Donnell et al¹⁶ reported no significant difference in range of motion, functional outcome or radiologic outcomes between revision UKAs and primary TKRs. Turlough et al compared a cohort of 55 revision unicompartmental knee arthroplasties to primary total knee arthroplasties using pre-operative and post-operative range of movement and Knee society scores. He concluded that there was no significant difference in range of movement and knee function.

From the results of our study, revision of failed unicompartmental knee arthroplasties is associated with longer operative tourniquet time due to increased technical difficulties caused by bone loss, necessitating the use of augments and stems. We had a complication rate of 3% in our study. However we managed to demonstrate good improvement and results in terms of patient directed quality of life indices as well objective functional knee assessments following revision surgery.

5. Conclusion

Patient who require revision of a unicompartmental knee arthroplasty can benefit from surgical outcomes similar to a primary total knee arthroplasty, despite technical difficulties and longer operative duration. This information will aid the physician in counseling patients undergoing revision of a UKA, as they do not require a longer period of rehabilitation to achieve a good quality of life and outcome.

In opting for a unicompartmental knee arthroplasty, patients benefit from earlier relief of symptoms and a longer duration of a good quality of life.

We however still advise a strict criteria to be adhered to in the selection of patients for this procedure.¹⁷

5.1. Strength and weakness

The patients in our study were assessed at similar and timely intervals post-operatively to minimize confounding bias due to patients reporting outcomes at different time intervals of rehabilitation. We also explored quality of life outcomes in patients which has not yet been studied on a matched pair basis.

Table 7 – Number of augments used in 20 revised unicompartmental knee arthroplasties.

Augments and stems	Numbers
Tibia stem	19
Femur stem	4
Metal wedge	2
Cancellous screws	2
Constrained implant	1

This is a retrospective study with confounding bias. In the study group, there were patients who underwent bilateral knee arthroplasties.

The duration of follow up of our patients was 2 years. The results from our study do not address the long term survivorship issues of a revised unicompartmental knee arthroplasty. Reported data however indicates a higher increase in the cumulative revision risk of a revised UKA compared to a primary TKA.¹⁸

Long term studies on newer unicompartmental and total knee implants and a stricter patient selection criteria may demonstrate lower cumulative revision risk of revised UKAs.

Conflicts of interest

All authors have none to declare.

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