

Can visual aides influence rehabilitation and length of stay following knee replacement? A randomized controlled study

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Abstract

Arthroplasty is increasingly performed with in Australia, with a 2.7% rate increase of total knee arthroplasty (TKR) over the last year. With an increasing burden on the public health system and increasing waiting lists, all efforts are being made to decrease length of stay and improve the post operative rehabilitation process. There is currently insufficient evidence to make a conclusive statement about visual aids and improved goal attainment post TKR. The purpose of this study is to evaluate one such visual aid clinical photographs of patients knee range of motion (ROM) pre- and post-operatively and their effect on length of stay. Photographs of knee range of motion were obtained pre and post-operatively while the patient was anesthetized. In this study, a randomized, single blinded design allocated patients to either be shown or not shown their photographs on day 1 post operatively. Primary outcome measures were the number of days the patient remained in hospital. Secondary measures were Western Ontario and McMaster Universities Arthritis Index scores, Oxford Knee Scores, American Society of Anesthesiologists Score and knee ROM. Thirty-two patients (3 exclusions) were randomized to the photo group and 27 patients (4 exclusions) were randomized to the no photo group. The median length of stay between groups was not significantly different. Currently there is not enough evidence to conclude that visual aids effect length of stay or rehabilitation pathways. Further assessment with larger cohort groups is needed. Preoperative targeting and rehabilitation for patients with lower functional status may shorten post operative length of patient stay in our institution.

Introduction

Total knee arthroplasty (TKR) is increasingly performed in Australia and is an effective

treatment for severe osteoarthritis of the knee. There were 48,502 knee replacements undertaken in Australia in 2013, an increase of 2.7% compared to the number reported in 2011.¹ Cost per patient bed per day varies between 421 Australian Dollars (\$) and \$ 626 per day.² Length of patient stay (LOS) and the cost of patient rehabilitation influence the total costs significantly.³ On average there is a 321-day waiting list for TKR in NSW.² Reducing LOS and increasing bed availability would allow more orthopedic procedures to be undertaken, thereby directly reducing waiting lists.

Length of stay has been directly correlated to American Society of Anesthesiologists Score (ASA), day of surgery, body mass index (BMI) and age.^{4,5} Anecdotally patients who have direct discussion and visual demonstration of active knee range of movement with their surgeon post operatively, have mobilized and discharged earlier. There are currently no randomized trials in the literature specifically looking at rehabilitation, following knee arthroplasty, with the use of visual aides. Our hypothesis is that patients who could visualize their post operative range of motion would be more likely to achieve discharge goals earlier and hence decrease their length of stay.

Materials and Methods

Institutional approval and patient ethics approval was obtained via the Hunter New England Research Ethics Committee. Patients were recruited from the Royal Newcastle Centre a tertiary referral teaching hospital from 2012 to 2014.

All patients underwent a unilateral primary TKR and were recruited from the elective waiting list. During the consent process patient range of movement, demographics, Western Ontario and McMaster Universities Arthritis Index scores (WOMAC), Oxford knee score (OKS) and ASA were recorded. Five consultant surgeons were involved in this study. A standard midline median parapatellar approach and tourniquet was used in all patients. Genesis II (Smith & Nephew, Memphis, TN, USA), Nexgen CR (Zimmer, Warsaw, IN, USA) or Triathlon (Stryker, Kalamazoo, MI, USA) total knee systems were implanted according to individual surgeon preference. All arthroplasty was performed using a hybrid combination with hydroxyapatite (HA) coated femoral component and cemented tibial baseplate. Posterior stabilized components were utilized only when extra stability was deemed necessary by the operating surgeon. Patellar resurfacing was not performed routinely. Patient photographs were taken at two stages showing the operative knee in extension and flexion of all enrolled patients. First stage photographs

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were taken immediately before surgery and second stage photographs while on table at the completion of surgery. Patients were randomized post operatively into two groups using a concealed envelope with the operating surgeon blinded to the randomization. Patients randomized into the photograph group were then issued with an A4 color photo of their pre-operative and post-operative range of motion to keep at the bedside on day 1 proceeding surgery (Figure 1). The second group of patients did not receive any visual aid. Both patient groups received identical post-operative rehabilitation protocols as per our institution. Our protocol requires early mobilization day 1 post operatively with physiotherapy. Discharge was approved when patients were deemed safe and functionally independent according to strict in house physiotherapy and occupational therapy review. Patient records were then collated at discharge and LOS recorded and discharge range of movement. Patients who had postoperative complications, which affected their LOS, were excluded (Figure 2).

Power calculation was performed by the Hunter Medical Research Institutes statistics department. A minimally clinically important difference was set as a decrease in LOS of 3.5 days. An alpha of 0.05 was selected. The study had 80% power to detect a 3.5-day difference in the median LOS at the 5% significance threshold (assuming the median LOS in control is 7 days)

Statistical analysis was conducted by the

Hunter Medical Research Institute statistics department. Descriptive statistics for demographics and patient characteristics are presented as means (standard deviation) and median (min, max) for continuous variables, and number (%) for categorical variables. Kaplan-Meier estimates of the LOS were plotted for whether the patients were shown photos or not, and log-rank tests were used to assess equality of length of stay distributions. Linear regression was used to assess associations between patient characteristics and length of stay, with bootstrapping to estimate standard errors.

Statistical analyses were performed using SAS v9.4 (SAS Institute, Cary, NC, USA) and STATA v13.1 (StatCorp, College Station, TX, USA).

Results

There was no difference between group demographics; baseline patient demographics are shown in Table 1. Patient pain profile and functional scores are shown in Table 2. A total of 69 patients were enrolled. Three patients withdrew consent before randomization and were not included in the trial. Of the remaining patients 35 were randomized to the photo group and 31 patients to the usual care group. Three patients were excluded from the photo group compared to 4 patients from the usual care group. There was no difference in perioperative complications between the groups that directly influenced their LOS ($P=0.11$; Figure 2).

The median LOS for those shown the photo was 5.2 days. For patients who underwent usual care LOS was 5.8 days. Overall, no statis-

tically significant difference in LOS was observed ($P=0.25$; Supplementary Material).

Patients with a 10 unit higher WOMAC at baseline had on average an additional 0.25-day LOS, this effect was statistically significant ($P=0.048$; Supplementary Material). Patients with a 10 unit higher OKS had on average an additional 0.5-day LOS and this was statistically significant ($P=0.011$; Supplementary Material). Patients with an initial ROM <90 degrees pre-operatively had on average 0.2 less days LOS but not statistically significant ($P=0.54$; Supplementary Material). Patients with a higher ASA score had on average an additional 0.3 days LOS, but again this effect was not statically significant ($P=0.34$; Supplementary Material). Day of surgery during the week did not have any significance on LOS (Supplementary Material).

Discussion

Higher costs are incurred in those patients who remain in hospital for longer periods of time. Awareness of those factors which result in an increased stay may allow better planning and a reduction in the length of stay after TKR. Anecdotally patients who have direct discussion and visual demonstration of active knee range of movement with their surgeon post-operatively, have mobilized and discharged earlier. With the increasing rate of arthroplasty procedures being performed, there is an associated increasing burden on the public health system. This is not only a financial burden but also a public health issue, with increasing waiting lists and poorer access to surgical care. Currently, to minimize this burden, focus

Table 1. Patient demographics.

Characteristic	No Photo, mean (SD)	Photo, mean (SD)	Total, mean (SD)
Age	70 (10)	69 (10)	69 (10)
ASA	2.3 (0.5)	2.4 (0.6)	2.3 (0.6)

ASA, American Society of Anesthesiologists Score.

Table 2. Patient pain/functional profiles.

Characteristic	No Photo, mean (SD)	Photo, mean (SD)	Total, mean (SD)
WOMAC pre-surgery	37.4 (11.3)	39.0 (13.9)	38.4 (12.9)
OKS pre-surgery	17.3 (6.4)	16.3 (8.3)	16.7 (7.5)
ROM day 0	95.4 (18.8)	100.2 (17.2)	98.0 (17.9)
ROM on discharge	85.1 (7.5)	84.1 (8.7)	84.6 (8.1)
Operative time, min	89 (31)	85 (21)	87 (26)

WOMAC, Western Ontario and McMaster Universities Arthritis Index scores; OKS, Oxford knee score; ROM, range of motion.



Figure 1. Pre and post-operative patient photographs.

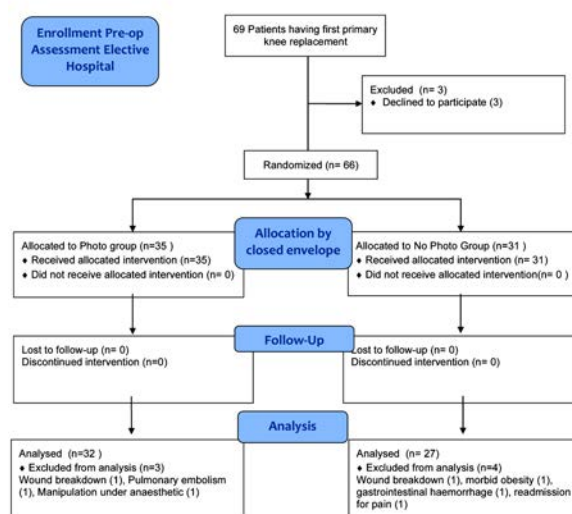


Figure 2. Patient cohort flow chart.

is directed at streamlining patient care, decreasing length of stay and fine-tuning the post-operative rehabilitation process.

To our knowledge, this is the first attempt to address specifically visual aids and rehabilitation goals to assess length of stay in patients with primary unilateral TKR. This study has failed to demonstrate that a visual aid (photograph) effects length of stay significantly. Previous studies have identified that length of stay is multi-factorial and has been directly correlated and increased by ASA, pre-operative pain and functional profiles (WOMAC, OKS), day of surgery and age. This study confirms previously reported relationships that pre-morbid status negatively affects LOS with OKS and WOMAC scores showing statistical difference⁵⁻⁷ Previous studies have also demonstrated patients with poor preoperative functions tend to recover slower (reference). Given these scoring systems (WOMAC and OKS) are subjective markers of function it is not surprising perhaps that patients with poorer expectations and functional limitations do worse in the short term postoperatively. As shown in previous rehabilitation studies,⁸ there may be a role for preoperative rehabilitation of these patients, which may decrease length of stay in our institution. Other objective functional and physiological profiles however in our study such as ASA showed no correlation unlike as demonstrated by previous studies.^{5,9} Our institution also demonstrated no difference in LOS when surgery performed on particular days of the week as described by Smith *et al.*⁴

Patients with lower total ROM showed a trending to significance of decreased LOS.

Perhaps this surprising finding can be explained by patients having already developed strategies and coping mechanisms preoperatively to manage with limited ROM. This may explain why this patient cohort trends to reaching discharge rehabilitation goals earlier.

As our primary measure demonstrated no significance in LOS decrease with cut off of 72 hours further study is required to demonstrate smaller difference in LOS. Extrapolating from this it can be argued that our patient numbers may be too low. Further analysis with greater patient numbers needs to be conducted prior to a formal statement against the use of visual aids being made.

Conclusions

Despite no statistical significance being demonstrated in our study, currently there is not enough evidence to conclude that visual aids effect length of stay or rehabilitation pathways. Further assessment with larger cohort groups is needed. Preoperative targeting and rehabilitation for patients with lower functional status may shorten post operative LOS in our institution.

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