

The Paradox of Preoperative Activity: Do Highly Active Participants Return to Preoperative Physical Activity Levels Two Years After Total Knee Arthroplasty?

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INTRODUCTION:

Patients often elect to proceed with a total knee arthroplasty (TKA) due to pain, limited mobility, and decreased function related to knee osteoarthritis. Patients with TKA do not meet physical activity (PA) guidelines and are less physically active than age matched peers.

Following TKA, PA declines despite the well-known benefits for long-term health. Little is known about the long-term trajectories of PA and which patients are more likely to return to their preoperative PA levels. The objective of this study was to examine PA levels up to two years after TKA and the association between preoperative PA and postoperative activity two years after TKA.

METHODS:

This was a secondary analysis from a randomized controlled trial comparing two different rehabilitation programs within the first 10 weeks after TKA (n=138). Participants with knee osteoarthritis between 50 and 85 years of age undergoing TKA were assessed preoperatively, 10 weeks, six months, and two years after TKA. Study participants were provided with activity trackers (ActiGraph wGT3X-BT, ActiGraph Corp., Pensacola, FL, USA) and instructed to wear them on their hip during waking hours for 10 days at each timepoint. For valid activity data, activity tracker wear time had to be ≥ 10 hours on any given day for at least four days during the collection period for reliable estimates of physical activity. We analyzed steps/day and characterized PA as sedentary behavior (<1.5 metabolic equivalents (METs)), light PA (1.5-3.0 METs) and MVPA (≥ 3 METs).

Outcome PA measures included light PA, MVPA and steps/day. Differences between preoperative and two years after TKA PA were estimated using repeated measures models, controlling for the study treatment group, sex, and age with a log transformation for steps/day. Participants were additionally characterized into two groups based on meeting or exceeding preoperative PA levels (yes/no) for 1.) light PA, 2.) MVPA and 3.) Steps/day. Logistic regressions were used to model return to each preoperative PA level as a function of the corresponding preoperative PA variable, controlling for age, sex, and treatment group.

RESULTS:

Participants had a mean age of 62.2 ± 7.2 years, were 40.6% male, and mean body mass index of $28.7 \pm 4.9 \text{ kg/m}^2$. Preoperatively, participants spent $10.5 \pm 3.2\%$ of their time in light PA and $4.45 \pm 2.2\%$ in MVPA and took $5,426 \pm 2,206$ steps/day on average (Table 1).

Two years after TKA, 54.2% of participants returned to preoperative light PA levels, 53.1% returned to preoperative MVPA levels, and 55.6% returned to preoperative steps/day (Table 1). There was an 8% increase in steps/day (95% CI 0.6%, 15%, $p=0.03$) and a 0.75% increase in MVPA (95% CI 0.30%, 1.21%, $p=0.001$) from the preoperative assessment to two years after TKA.

After adjusting for age, sex, and treatment group, the odds of returning to preoperative PA levels two years after TKA decreased as preoperative light PA increased (OR = 0.74, 95% CI [0.61, 0.91], $p=0.004$), and as preoperative MVPA increased (OR=0.62, 95% CI [0.47, 0.82], $p=0.0008$), and as preoperative steps/day increased (per 100 steps: OR=0.96, 95% CI [0.93, 0.98], $p=0.002$).

DISCUSSION AND CONCLUSION:

The results demonstrated that, on average, participants were more active two years after TKA than they were preoperatively. Assuming a minimum of 10 hours of activity based upon the valid wear guidelines, a 0.75% increase in MVPA equates to an increase of 4.5 minutes per day, and 31.5 minutes per week in MVPA, bringing participants closer to achieving recommended levels of MVPA. These results diverge from prior research showing decreased PA in the early recovery period after TKA. However, with 53.1% of participants returning to preoperative MVPA levels and 55.6% returning to preoperative steps/day two years after TKA, almost half of participants did not return to their preoperative PA levels. These results indicate substantial variation in PA recovery after TKA. Reasons for variation in PA research findings after TKA could be due to differences in the surgical population, differences in surgical technique, the influence of the rehabilitation program, and the longer length of follow up.

The large proportion of participants not returning to preoperative PA levels presents a paradox of preoperative physical activity: participants who were more active before surgery had reduced odds of achieving increased PA levels two years after TKA. These results are helpful for setting expectations and goals for individuals undergoing TKA to address pain or functional limitations. Furthermore, identifying individuals unable to return to preoperative PA levels or identifying those who had higher preoperative PA levels may present an opportunity to provide interventions to increase long term PA

levels. Future research on characterizing preoperative factors associated with long-term recovery after TKA will also enhance PA recommendations.

PA

Table 1: Descriptive statistics and percentage of participants to return to preoperative activity levels.

Time Point	Sedentary Behavior Mean (SD) Median (Range)	Light Physical Activity Mean (SD) Median (Range)	MVPA Mean (SD) Median (Range)	Steps/Day Mean (SD) Median (Range)
Preoperative (n=113)	85.0 (4.4) 85.2 (68.5, 93.4)	10.5 (3.2) 10.2 (5.0, 22.8)	4.45 (2.2) 4.19 (0.72, 11.7)	5426 (2206) 5148 (1910, 11949)
	-	NA	NA	NA
10 weeks after TKA (n=116)	85.4 (4.3) 86.2 (71.6, 95.2)	10.4 (3.2) 9.86 (3.43, 23)	4.18 (2.1) 3.84 (1.00, 11.8)	5208 (1993) 4937 (1818, 12592)
	-	51.0 (40.7, 61.3)	54.1 (43.7, 64.2)	58.2 (47.8, 68.1)
6 months after TKA (n=114)	84.6 (4.3) 85.1 (70.3, 95.4)	10.8 (3.1) 10.4 (3.2, 18.9)	4.56 (2.1) 4.30 (1.17, 12.5)	5669 (2134) 5296 (1225, 15474)
	-	50.5 (40.1, 61.0)	59.0 (48.4, 68.9)	55.8 (45.2, 66.0)
Two years after TKA (n=95)	84.5 (4.9) 85.2 (67.7, 92.3)	10.2 (2.9) 9.78 (5.02, 17.6)	5.25 (2.8) 4.91 (1.70, 17.6)	6167 (3231) 5434 (1449, 23137)
	-	54.3 (42.9, 65.4)	53.1 (41.7, 64.3)	55.6 (44.1, 66.6)