

# Post-Operative Swelling Did Not Return to Preoperative Levels in Most Patients Two Years after Total Knee Arthroplasty

Kristen Barton, Nina Carson, Jason Michael Jennings, Douglas A Dennis, Jeri Erica Forster, Craig A Hogan, Jennifer Stevens-Lapsley, Michael Bade

**INTRODUCTION:** Knee swelling is common after total knee arthroplasty (TKA), which can be attributable to both effusion and edema. Swelling post-TKA can result in pain, decreased range of motion, muscular inhibition, limitations in function, and negative perception of recovery. There are no studies that have provided long-term data (>90 days) on the trajectory of knee swelling post-TKA. The primary objective of this study was to determine how swelling changes and when swelling returns to “normal” over time. The secondary objectives of the study were to determine if post-TKA swelling is associated with patient reported outcomes (pain, stiffness, and function and with patient satisfaction), functional outcomes, or impairment measures (quadriceps strength, pain during functional measures, and knee range of motion).

**METHODS:** Participants (n=138) were assessed pre-TKA, 10 weeks, six months, and two years after TKA as part of a randomized controlled trial (mean age 64.2±7.2 years, 60% female, mean body mass index 28.7±4.9kg/m<sup>2</sup>). Demographic information was collected at the pre-operative visit. Patient reported outcomes (WOMAC and patient satisfaction), functional outcomes (6-minute walk test (6MWT) and 30s sit-to stand test (30STS)), and impairment measures (quadriceps strength, pain during functional measures, and knee range of motion) were collected at each clinic visit. Swelling was assessed using bioelectrical impedance analysis (BIA) and quantified post-TKA (reported as a 1-(involved BIA/uninvolved BIA) x 100). Significance for all statistical tests was accepted at p≤0.05.

**RESULTS:** Mean swelling pre-TKA was 2.06±7.8% and then 15.3±10.6%, 9.6±7.3%, and 5.4±7.1% at 10 weeks, 6 months, and 2 years, respectively, after TKA (Figure 1). Post-TKA, 5% of patients returned to pre-TKA swelling at 10 weeks, 12% of patients returned to pre-TKA swelling at 6 months, and 28% of patients returned to pre-TKA swelling at 2 years. In comparison to pre-TKA swelling, swelling at 10 weeks, 6 months, and 2 years post-TKA was significantly higher (all p<0.0001). BIA ratio was significantly correlated to WOMAC function pre-TKA (0.19, p=0.03; Table 1). BIA ratio was significantly correlated to 6MWT at 10 weeks post-TKA (0.24, p=0.007; Table 2). BIA ratio was not correlated to WOMAC, patient satisfaction, 6MWT, 30STS, quadricep strength, pain during functional measures, and knee range of motion at 6 months post-TKA or 2 years post-TKA (p=0.10-0.95; Tables 1-3).

**DISCUSSION AND CONCLUSION:** In most patients, post-operative swelling did not return to pre-TKA levels by 2 years after TKA. Further to this, swelling remained elevated 6 months and 2 years post-TKA, it is not associated with recovery of impairments and function. To our knowledge, this is the first study to quantify long-term swelling after TKA. These data may assist providers in appropriate education to patients regarding swelling management in the post-operative course.

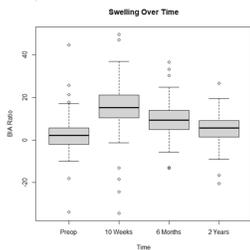


Figure 1. Bioelectrical impedance (swelling) ratio post-TKA over time.

Table 1. Correlation between bioelectrical impedance analysis (swelling) ratio and WOMAC and patient satisfaction.

Timepoint	WOMAC		Patient Satisfaction	
	r	p-value	r	p-value
Pre-TKA	0.19	0.03	0.02	0.88
10 Weeks Post-TKA	0.24	0.007	0.01	0.92
6 Months Post-TKA	0.01	0.95	0.01	0.95
2 Years Post-TKA	0.01	0.95	0.01	0.95

Table 2. Correlation between bioelectrical impedance analysis (swelling) ratio and functional outcomes.

Timepoint	6MWT		30STS	
	r	p-value	r	p-value
Pre-TKA	0.01	0.95	0.01	0.95
10 Weeks Post-TKA	0.24	0.007	0.01	0.95
6 Months Post-TKA	0.01	0.95	0.01	0.95
2 Years Post-TKA	0.01	0.95	0.01	0.95

\*Values are the p-value

Table 3. Correlation between bioelectrical impedance analysis (swelling) ratio and quadriceps strength, pain during functional measures, and knee range of motion.

Timepoint	Quadriceps Strength		6MWT Pain		30STS Pain	
	r	p-value	r	p-value	r	p-value
Pre-TKA	0.01	0.95	0.01	0.95	0.01	0.95
10 Weeks Post-TKA	0.01	0.95	0.01	0.95	0.01	0.95
6 Months Post-TKA	0.01	0.95	0.01	0.95	0.01	0.95
2 Years Post-TKA	0.01	0.95	0.01	0.95	0.01	0.95

\*Values are the p-value