Effect of Subcutaneous Tissue Thickness Around the Knee on Postoperative Range of Motion After Total Knee Arthroplasty

Robin Pelia, BS[1], Ankush Kecht, BS[1], Majd Mzeihem, MD[1], Seth Roge, BS[1], Peter Chebi, BS[1], Mark H. Gonzalez, MD, PhD[1] , Samuel Chmell, MD[1]
[1]Department of Orthopaedic Surgery, University of Illinois at Chicago, Chicago, Illinois, USA
rpelia2@uic.edu

Disclosures: Robin Pelia (N), Ankush Kecht (N), Majd Mzeihem (N), Seth Roge (N), Nirav Mungalpara (N), Mark H Gonzalez (N), Samuel Chmell (N)

INTRODUCTION: An elevated body mass index (BMI) has been associated with limitations in maximum postoperative flexion after total knee arthroplasty (TKA). However, BMI may be a flawed descriptor of a patient's body habitus around the knee. Certain patients with an elevated BMI may have minimal adipose tissue around the knee, while others with a lower BMI may have a larger soft tissue envelope over the knee. Biomechanical studies have demonstrated that bony impingement between the femur and tibial limits postoperative flexion, but no study has examined whether excess soft tissue around the knee may impinge on itself during knee flexion and therefore limit range of motion (ROM). The purpose of this study is to explore the association of soft tissue thickness around the knee with limitations in postoperative flexion independent of BMI.

METHODS: A retrospective cohort study was performed using patients who underwent primary TKA with cruciate-retaining implants from 2017 to 2022. Background information, including age, sex, race, ethnicity, BMI, diabetes, smoking status, preoperative maximum knee flexion, and six-month postoperative maximum knee flexion, was collected. After excluding patients with missing data or radiographs that were presented with rotation of the knee joint, 191 patients were included in this study. This group had an average age of 64.4 years, there was a majority of male (74.3%) patients. Subcutaneous tissue thickness around the knee was quantified on preoperative radiographs using three different measurements described in prior literature: the femoral periarticular soft tissue index (fPASTI), the tibial periarticular soft tissue index (tPASTI), and the knee adipose index (KAI). Spearman's rank correlation was used to evaluate the association between the measures of soft tissue thickness and maximum postoperative flexion.

RESULTS SECTION: The spearman correlation performed for fPASTI (ρ = -0.036, 95% CI: -0.18 to 0.12, p = 0.63), tPASTI (ρ = -0.065, 95% CI: -0.21 to 0.085, p = 0.38), and KAI (ρ = -0.070, 95% CI: -0.20 to 0.082, p = 0.35) showed a weak, nonsignificant negative association between these measures and maximum postoperative knee flexion, as shown in **Table 1**. Multivariate regression performed for demographic factors did not demonstrate a significant association between these measures and maximum postoperative knee flexion as shown in **Table 2**. Preoperative knee flexion had a significant, positive association with postoperative knee flexion ($p<0.05$). No other covariate was associated with postoperative knee flexion.

DISCUSSION: Measures of soft tissue thickness around the knee, including fPASTI, tPASTI, and KAI, do not appear to be associated with postoperative flexion after TKA. Optimizing other patient factors like preoperative ROM should be a greater concern than achieving weight loss preoperatively, concerning the outcome of postoperative flexion.

SIGNIFICANCE/CLINICAL RELEVANCE: This study supports the notion that BMI does not have an effect on postoperative ROM with more clear measurement techniques than in the current literature. This highlights that patients with greater subcutaneous fat around the knee can achieve comparable benefits to those with lower levels of subcutaneous fat.

Table 1

Variable	Spearman Coefficient (95% CI)	P-value
fPASTI-Maximum Postoperative Flexion	-0.036 (-0.18 - 0.12)	0.63
tPASTI-Maximum Postoperative Flexion	-0.065 (-0.21 - 0.085)	0.38
KAI-Maximum Postoperative Flexion	-0.070 (-0.20 - 0.082)	0.35

Table 2

Variable	Coefficient	95% Confidence Interval	P-value
fPASTI	0.078	(-4.02 - 9.54)	0.42
tPASTI	0.001	(-6.34 - 6.44)	0.99
KAI	-0.069	(-12.81 - 6.50)	0.52
Pre-operative Flexion	0.191	(0.04-0.33)	**0.01**