

## Arthrofibrosis Severity in Knees with Failed TKAs Differs with MRI Synovial Classification

Sara E. Sacher<sup>1</sup>, Hollis G. Potter<sup>1</sup>, Thomas P. Sculco<sup>1</sup>, Peter K. Sculco<sup>1</sup>, Timothy M. Wright<sup>1</sup>, Matthew F. Koff<sup>1</sup>

<sup>1</sup>Hospital for Special Surgery, New York, NY  
sachers@hss.edu

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**Introduction:** Total knee arthroplasty (TKA) is commonly used for treatment of end-stage osteoarthritis, with a prevalence of approximately 1 million annual cases in the US alone<sup>1</sup>. Arthrofibrosis is a debilitating post-operative complication of TKA surgery that occurs in up to 13% of TKA patients and is associated with the global formation of fibrotic tissue resulting in a reduction in range of motion<sup>3</sup>. Treating stiffness following TKA is complicated by the lack of a specific diagnostic test for arthrofibrosis. MRI can provide non-invasive, direct visualization of the soft tissues surrounding TKA. Our previous work showed that the classification of synovial reaction on MRI is associated with revision indication and that the synovial reaction classification on MRI is associated with direct measurements of tibial insert damage<sup>4</sup>. Even with these associations, the relationship between arthrofibrosis severity on MRI and the anatomic location of arthrofibrosis is unclear, and how the severity and location of arthrofibrosis relates to different MRI synovial classifications is unknown. Therefore, the purpose of this study was to evaluate the relationship between arthrofibrosis severity and location on MRI with the MRI synovial classification in primary TKA patients undergoing revision surgery.

**Methods:** IRB approval and informed written consent was obtained. Patients undergoing revision for their primary TKA were sequentially recruited. Pre-operative MRIs utilizing 3D multi-spectral imaging techniques were obtained on clinical 1.5T scanners using an 8-channel phased array knee coil. MR images were evaluated, and each knee was assigned a synovial classification (Normal, Abnormal, Arthrofibrosis, Focal Scarring, Polymeric, Infection), and evaluated for the severity of fibrosis (none, mild, moderate, severe) in the anterior and posterior compartments. Chi-squared and Fisher's exact tests were performed to detect differences in the distribution of severity of arthrofibrosis across the different MRI synovial classifications for the anterior and posterior compartments.

**Results:** 137 TKAs from 137 individuals were included in the analysis. Most patients had an MRI synovial classification of Arthrofibrosis (31%), Focal Scarring (35%), or Polymeric (21%) reactions and were included in the statistical analysis due to their prevalence. Significant differences were found within the distribution of fibrosis severity for the different synovial classifications for the anterior ( $p < 0.0001$ ) and posterior compartments ( $p < 0.0001$ ). Patients with the synovial classification of Arthrofibrosis had greater fibrosis severity in the anterior ( $p < 0.0001$ ) and posterior ( $p < 0.0001$ ) compartments as compared to patients with the synovial classification of Focal Scarring (Figs. 1 & 2). A similar distribution was found when comparing patients with the synovial classification of Arthrofibrosis to patients with the synovial classification of Polymeric ( $p < 0.0001$  for both anterior and posterior compartments). Finally, when comparing patients with the synovial classification of Focal Scarring to patients with the synovial classification of Polymeric, a larger proportion of patients with Focal Scarring had a greater severity of fibrosis in the anterior compartment ( $p < 0.0001$ ).

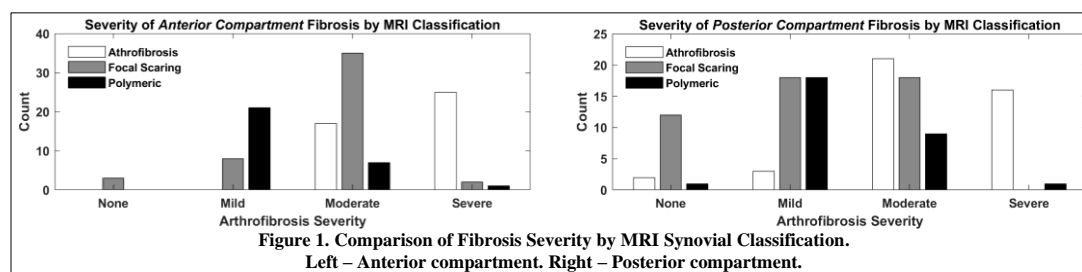


Figure 1. Comparison of Fibrosis Severity by MRI Synovial Classification. Left – Anterior compartment. Right – Posterior compartment.

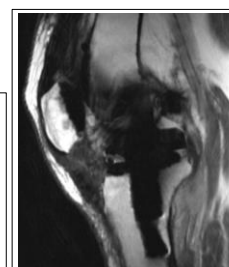


Figure 2. An example of a TKA patient with a MRI synovial classification of Arthrofibrosis, displaying severe arthrofibrosis anteriorly, and mild arthrofibrosis posteriorly.

**Discussion:** We identified differences of arthrofibrosis severity and anatomic location for different MRI synovial classifications. The MRI synovial reaction classification of Arthrofibrosis was associated with a greater proportion of patients displaying severe fibrosis when compared to Polymeric and Focal Scarring classifications. The distributions of severity were less discordant in those with Focal Scarring, supporting previous work where Focal Scarring was associated with a greater variety of revision indication<sup>4</sup>. The synovial classification of Polymeric was associated with the least severe fibrosis of the three classifications. Previous work has observed a greater proportion of patients with a Polymeric classification revised for aseptic loosening<sup>4</sup>. Our current results support these findings and suggest that fibrosis may not be the primary failure mechanism in these patients. Similar patterns were observed in both anterior and posterior compartments; however, the distribution was more discordant in the anterior region.

**Clinical Relevance:** MRI synovial classifications in patients with TKA demonstrate regional differences in fibrosis severity. MRI presents an effective and non-invasive means to discern various synovial reactions among individuals with TKA.

**References:** <sup>1</sup>Singh et al, *J. Rheumatol* 2019; <sup>2</sup>Nobel et al, *CORR* 2006; <sup>3</sup>Cheuy et al, *J. Arthroplasty* 2017; <sup>4</sup>Landy et al, *J. Arthroplasty* 2022.

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