Total knee arthroplasty preoperative synovial fluid volumes and their continuing relationship to patient reported outcomes

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Introduction: Total knee arthroplasty (TKA) for end stage osteoarthritis is now one of the most performed elective surgeries in modern medicine with estimates predicting 1.26 million annual TKA surgeries by 2030. Even though medical technology and surgical techniques have advanced since TKA surgery was implemented decades ago, TKA surgery recipients still report a 20% or higher poor patient reported outcomes. Little investigation has been done relating the qualities and quantity of synovial fluid (SF) to patient outcomes. Due to SF's role in controlling the local joint environment, it is likely that patient's SF has an impact on the success of their TKA. While performing an ongoing study looking at the relationship between electrochemical properties of SF and patient satisfaction, a correlation was observed between patient's preoperative SF volumes and patient satisfaction scores. Preliminary analysis found lower patient satisfaction in patients with low preoperative SF volumes less than one-year post-op. We hypothesize a continuing correlation between the volume of preoperative SF during TKA and patient reported outcomes beyond one year.

Methods: IRB approval was first obtained for our study and patient consent was obtained prior to surgery. One hundred twenty-two human SF samples were collected in the operating room using a 10cc syringe at the time of TKA. The SF retrieved was after superficial exposure and before the arthrotomy. Maximal fluid was attempted to be aspirated first in the medial gutter and if no fluid was present then it was attempted in the superior patellar pouch or intercondylar notch. The fluid was measured in the syringe and recorded before electrochemical testing was done. If the patient had more than 10 mL of SF, the volume was recorded as 10 mL. The patient's stiffness, pain, and daily function were self-reported using a Knee injury and Osteoarthritis Outcome Score, Joint Replacement (KOOSJR) survey after three to twelve months post-op and again after one year The KOOSJR scores of patients with less than 2 mL of synovial fluid were compared to those of patients with at least 2 mL of synovial fluid using a Mann-Whitney test.

Results: The volume of synovial fluid retrieved ranged from 0-10 mL with an average of 4.5 mL. Seventy-three KOOSJR scores have been collected at less than one-year post-op while eighteen have been collected after one year. Patients with less than 2 mL SF had an average score of 70.8 ± 11.3 at <1 year (n=17) and 67.8 ± 3.5 at >1 year (n=4). Patients with at least 2 mL SF had an average score of 81.3 ± 16.1 at <1 year (n=56) and 85.1 ± 15.2 at >1 year (n=14). Statistical analysis found that patients with at least 2 mL of preoperative SF have significantly higher KOOSJR scores than patients with less than 2 mL preoperative SF at both less than one year (p=0.013) and over a year (p=0.031).

Discussion: Ongoing data shows a correlation between a patient's preoperative SF volume and their satisfaction with TKA outcome over the span of the first 1-2 years of the implant. We will continue to enroll patients to evaluate the correlation between preoperative SF volume (along with other properties) and patient satisfaction over the lifespan of the implant. Future research will aim to better understand the cause of this relationship.

Significance: There is a group of patients that are unsatisfied with the results of their total knee arthroplasty. The cause of this dissatisfaction may be multifactorial. It is important to consider environment in which the implant is being placed and factors which may lead to lower patient satisfaction with TKA outcomes.

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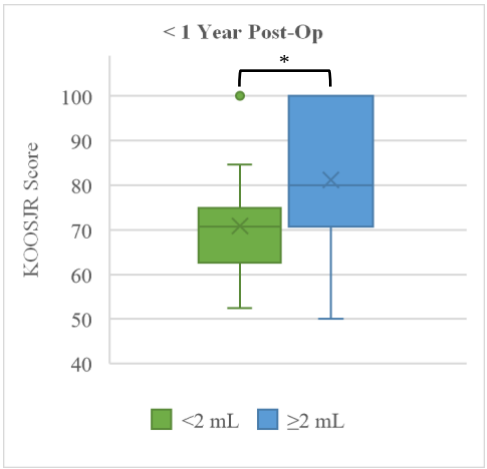
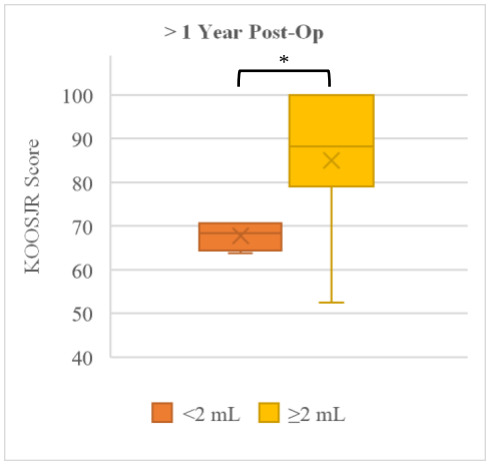


Figures: Average KOOSJR score of patients with less than 2 mL of SF and at least 2 mL SF. Scores obtained less than one year post-op are on the left while score obtained over one year post-op are on the right.
* The means of the two groups are significantly different ($p < 0.05$).



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