Title: Cementless total knee replacements: Does surgical technique impact coronal plane stability?

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Structured Abstract:

Introduction: A total knee replacement (TKR) is the standard of care treatment for end-stage arthritis of the knee joint. Historically, bone cement has been used to establish fixation between the implanted prosthesis and bone. The increasingly younger cohort requiring TKR's alongside advances in prosthetic design and instrumentation bring the durability of cement into question. Cementless implant systems are press fit implants coated with osteo-conductive surfaces that rely on bone ingrowth for fixation, and offer a promising alternative. The current challenge with cementless implants is a lack of consensus regarding the surgical technique which most accurately determines component position and joint load distribution, and consequently how this decision affects in-vivo knee biomechanics. Our overall objective is to assess joint kinematics, function, and implant migration of the surgically repaired knee. The objective of this presentation is to examine joint function in the early post-operative period.

Methods: Forty patients undergoing a unilateral TKR will be recruited prior to surgery and randomized to surgical approach. In a gap-balancing approach component placement is determined by soft tissue releases which restore limb alignment followed by bony cuts to balance the joint space in flexion and extension. In measured-resection bone cuts are made based on knee anatomy and soft tissue releases are made with implant components in-situ. A series of questionnaires assessing satisfaction, quality of life, and physical and mental functioning and the Timed-Up-and-Go (TUG) walking test to assess functional capacity will be collected at each visit. Patients complete the TUG test while wearing inertial sensors and are required to rise from a chair, walk 3 metres, turn around, and return to a seated position. GraphPad Prism 7.00 software was used to obtain correlations and p values.

Results (n=24): Significant correlations were observed before surgery between the WOMAC Stiffness and TUG total time ($r=0.45$, $p=0.026$), time-to-goal ($r=0.50$, $p=0.013$), turn-time ($r=0.55$, $p=0.005$), and stand-to-sit time ($r=0.42$, $p=0.042$). WOMAC Function was correlated with TUG starting ($r=0.54$, $p=0.007$) and ending ($r=0.463$, $p=0.023$) knee flexion angle of the operative leg. Total-test time significantly decreased from the 2- to 6-week time point ($p=0.01$). Mean difference between TUG total-test time pre-op to 6-weeks post-op was 1.99 seconds.

Discussion: The observed correlations between WOMAC Stiffness and Function to the respective TUG metrics were expected as the stiffness score quantifies ease of joint movement and the function score is largely dependent on knee range of motion. An increase in mean TUG performance time 2-weeks post-op is likely a result of the acute pain and swelling experienced following TKR surgery. While non-significant, the two second improvement between pre-op and 6-weeks post may translate to a clinically meaningful reduction in post-op fall risk.