

**Human Activity and TKR Implant Wear –
Important Considerations for Pre-clinical Testing****Markus A. Wimmer**Department of Orthopaedic Surgery, Rush University Medical Center,
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With more than 3.5 million surgeries performed annually in the world, total knee replacement (TKR) has become a common surgical procedure to alleviate pain and increase functional mobility in diseased knee joints. A major limiting factor to the service life of TKRs remains the wear and breakdown of prosthetic materials. An effective pre-clinical testing protocol mimics the complex load spectrum *in vivo*. Although walking is the most frequent activity throughout the day, other daily physical activities often generate higher tibial loads, larger prosthetic movements, and more detrimental cross-shear than walking and should not be neglected. Indeed, wear features of tested components do not match those worn *in vivo*, neither regarding wear scar size and shape, nor wear morphology. Here, we will review human activity and locomotion and its use for pre-clinical testing and implant design. Specifically, it will be demonstrated that a more realistic wear pattern is generated using input profiles from TKR patients tested in the lab and field. We will also review the importance of other activities of daily life on wear. Nowadays, we have measured motion and force data and technical advancements in simulation that enable us to simulate actual *in vivo* use. Cross-validation of the prediction, using retrieved components with kinematic/kinetic information, will enable us to generalize the procedure. This will improve the quality of predictive wear testing and will further advance the design process of knee prostheses.