Validation of a six Degrees of Freedom Biomechanical Simulator for the Assessment of Knee Joint Kinematics

Adrian Deichsel, Nina Marx, Matthias Klimek, Michael J Raschke, Christian Peez, Thorben Briese, Johannes Glasbrenner, Elmar Herbst, Christoph Kittl

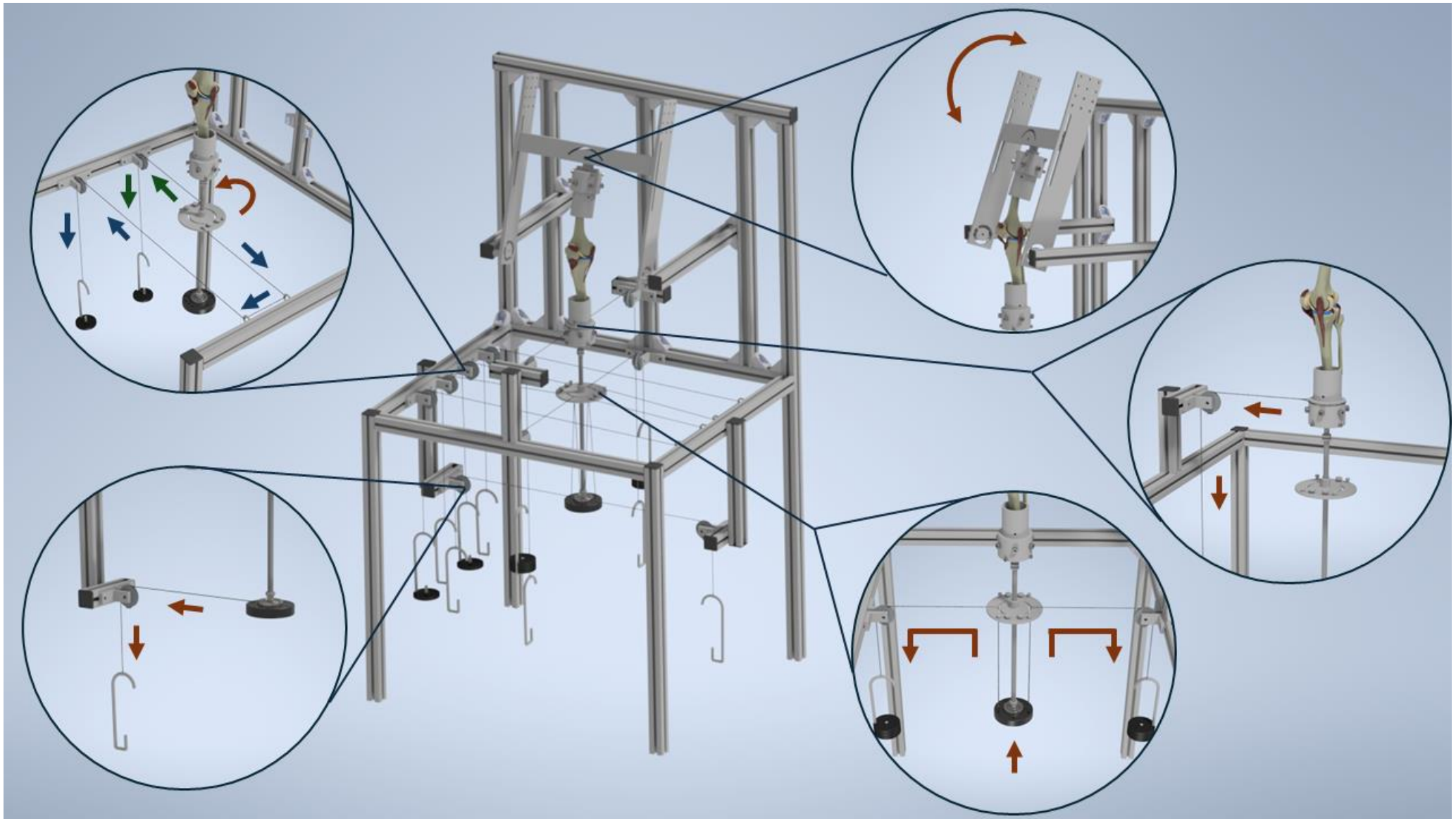
Department of Trauma, Hand, and Reconstructive Surgery, University Hospital Münster
(Director: Univ.-Prof. Dr. med. M.J. Raschke)

Conflicts of interest

The authors declare no conflict of interest.

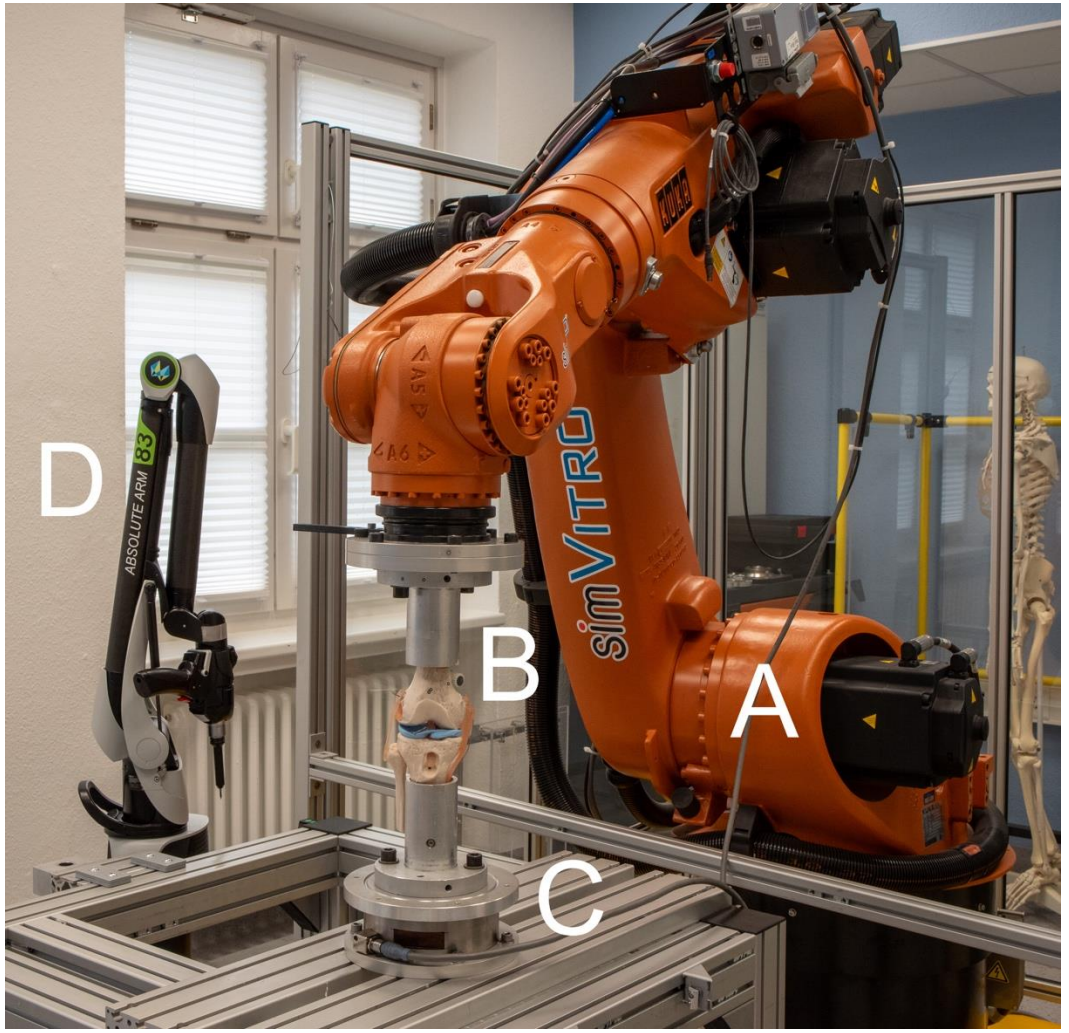
The aim of this study was to validate a novel experimental test setup for assessing human knee joint kinematics.

Methods – Novel Knee Rig



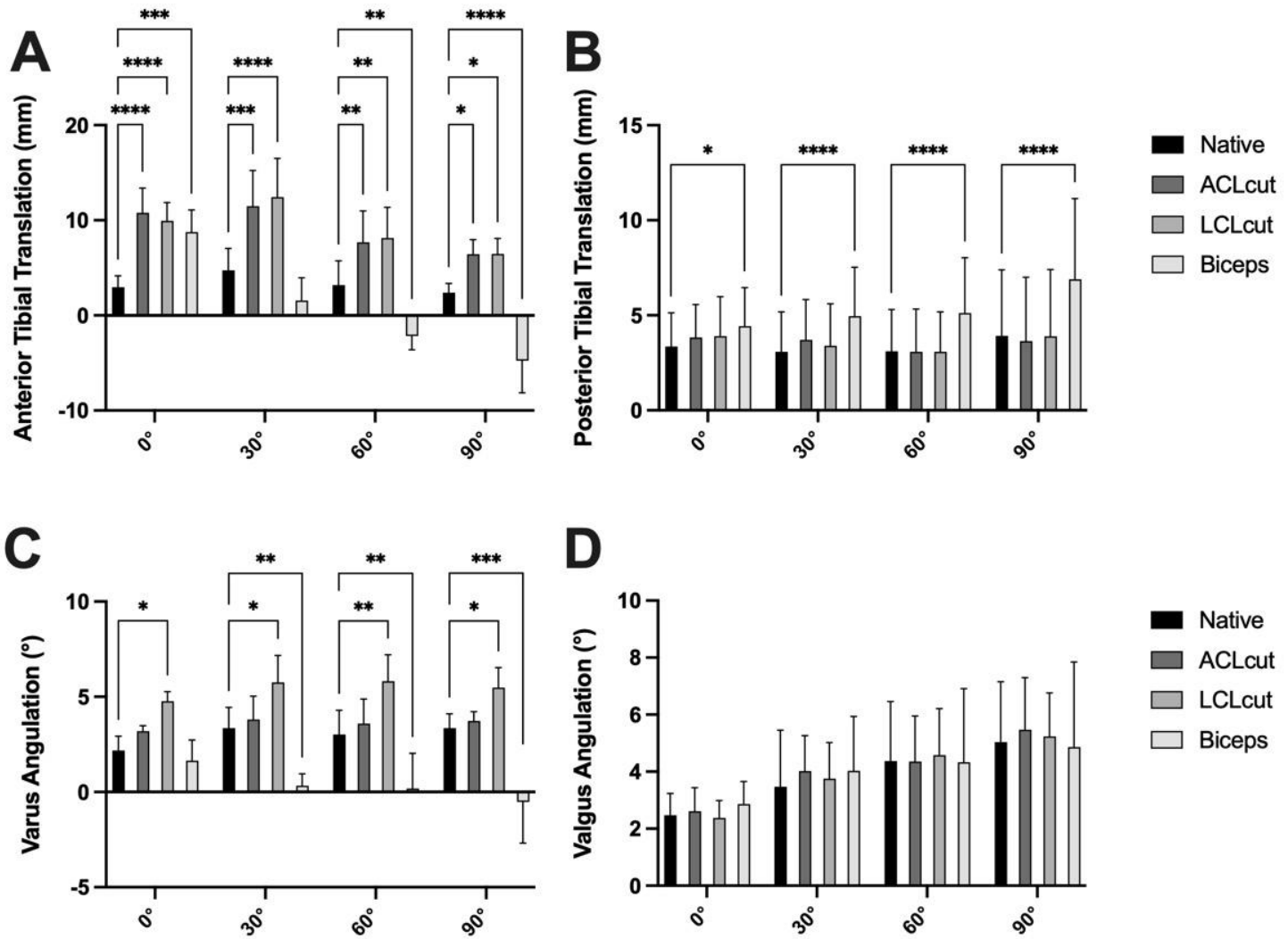
Methods – Validation Testing

- Each movement was repeated five times in the native state to determine the repeatability (intraclass correlation coefficient (ICC)).
- The anterior cruciate ligament (ACL) and the lateral collateral ligament (LCL) were sequentially severed to assess the system's responsiveness (whether changes in the knee joint condition could be significantly detected).
- For external validation, the native knee kinematics were assessed in a six degrees of freedom robotic test setup (on the right).

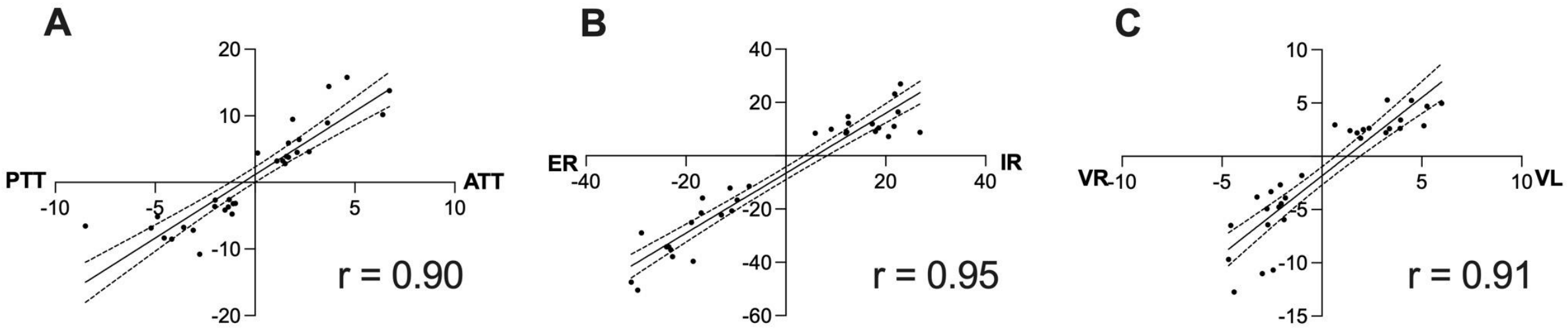


Results – Repeatability (left) ; Responsiveness (right)

ICC for every movement > 0.99



Results – External Validation to Robotic Test System



The presented knee joint simulator exhibits excellent repeatability, responsiveness, and strong correlation with the gold standard robotic test setup, making it suitable for use in biomechanical studies of the knee joint.

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Dr. med. Adrian Deichsel
adrian.deichsel@ukmuenster.de

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