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Titel des Beitrags: Optimised robot-based system for the exploration of elastic joint properties.

Abstract: Numerous publications provide measured biomechanical data relating to synovial joints. However, in general, they do not reflect the non-linear elastic joint properties in detail or do not consider all degrees of freedom (DOF), or the quantity of data is sparse. To perform more comprehensive, extended measurements of elastic joint properties, an optimised robot-based approach was developed. The basis was an industrial, high-precision robot that was capable of applying loads to the joint and measuring the joint displacement in 6 DOF. The system was equipped with novel, custom-made control hardware. In contrast to the commonly used sampling rates that are below 100 Hz, a rate of 4 kHz was realised for each DOF. This made it possible to implement advanced, highly dynamic, quasi-continuous closed-loop controllers. Thus oscillations of the robot were avoided, and measurements were speeded up. The stiffness of the entire system was greater than 44 kNm(-1) and 22 Nm deg(-1), and the maximum difference between two successive measurements was less than 0.5 deg. A sophisticated CT-based referencing routine facilitated the matching of kinematic data with the individual anatomy of the tested joint. The detailed detection of the elastic varus-valgus properties of a human knee joint is described, and the need for high spatial resolution is demonstrated.

Zeitschriftentitel / Abkürzung: