The mechanical properties of total joint replacement (TJR) bearing materials are important inputs to the computational models of TJRs. They significantly affect the wear and/or kinematic predictions of these models, and should therefore be measured under realistic compressive conditions. This study determined the elastic modulus and Poisson's ratio of conventional (GVF) and moderately cross-linked (XLK) ultra-high molecular weight polyethylene (UHMWPE) under compressive test conditions, similar to the operating conditions of TJRs.

A reverse engineering approach to characterise the mechanical properties of TJRs bearing materials, under realistic compressive test conditions. The measured Poisson's ratio was 0.33±0.04 (n=5) and 0.32±0.08 (n=3) (mean ± 95% confidence interval) for GVF and XLK UHMWPE respectively. The corresponding values for the elastic modulus were 365±31 and 553±51 [MPa] (mean ± 95% confidence interval, n=3) respectively (Figure 3).

The measured mechanical properties, under compressive test conditions, were lower than those reported in the literature, under tensile loading conditions. Should therefore be adopted in future computational models of TJRs for a more realistic and robust virtual modelling platform.