

Strain in the Medial Tibia with Fixed All-Polyethylene Bearings in Unicompartmental Knee Arthroplasty

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Several clinical studies have reported early mechanical failure by bone collapse in the medial tibia following all-polyethylene unicompartmental knee arthroplasty (UKA) in some patients. These studies are of interest to doctors and engineers alike in order to better understand why failure occurs, especially in fixed bearing, all-polyethylene UKA. The purpose of this study is to determine how different loading positions of the femoral component on the tibial component in all-polyethylene UKA affects strain observed in the proximal tibia. Strain was measured in twelve areas on a composite tibia model using the photoelastic strain analysis method. When the tibial component was centrally loaded, a maximum strain of $1000\mu\epsilon$ was located in the posteromedial region 0-1cm distal to the implant. The greatest over all strain of $2355\mu\epsilon$ was observed anteromedially when the femoral component was shifted 7mm anteriorly and 4mm medially. The translational position of the femoral component during flexion and extension of the tibia has a large impact on bony strain following all-polyethylene UKA. This study may correlate with the clinical scenario of tibial remodelling or overload observed clinically in some all-polyethylene UKA patients.