Numerical analysis of the cut-out phenomena in intertrochanteric femoral fracture

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\textbf{ABSTRACT}

Hip fractures are one of the major pathologies which affect to population nowadays, being especially prevalent in the elderly population. In the fractures which do not affect the intra-articular surface, the so-called extracapsular fractures, the treatment consists of the bone fragments internal fixation using osteosynthesis devices such as intramedullary nails. On many occasions the femoral head and the fixation device cannot bear the loads and rotations due to the joint motion, leading to the phenomena known as “cut-out”. The fixation device suffers undesired micro displacement and/or rotations, which finally results in stiffness lose. Besides, the trabecular healthy bone surrounding the intramedullary nail is damaged due to the movements and high compression stresses. This phenomenon usually results in a new surgical intervention, which can be critical in the elderly population. A proper intramedullary nail positioning can avoid these rotations and the final problem.

Thanks to macro scale numerical models we can reproduce the mechanical behaviour of the femur and the fixation. We are able to analyze the behaviour of the whole structure and study how the stability of the femoral head is affected by physiological loads. Torque and local stresses located in the surrounding bone are the principal variables that can determine which is the best position of the intramedullary nail and those loads more harmful for its global stability.