Pull-out Response of a Steel Post Inserted in Bovine Bone: Fixation of Knee Prosthesis

Khaled Gammoudi
Ecole Nationale d’Ingénieurs de Sfax, LASEM, University of Sfax, Tunisia
Institut Supérieur des Études Technologiques de Gafsa, University of Gafsa, Tunisia

Maher Dammak
Ecole Nationale d’Ingénieurs de Sfax, LASEM, University of Sfax, Tunisia
Institut Préparatoire aux Études d’Ingénieurs de Sfax, University of Sfax, Tunisia

Mohamed Kharrat
Ecole Nationale d’Ingénieurs de Sfax, LASEM, University of Sfax, Tunisia
Faculté des Sciences de Gafsa, University of Gafsa, Tunisia

Abstract

Total Knee Arthroplasty (TKA) is the standard of care in the treatment of end-stage degenerative joint disease of the knee. Several investigations have been carried out to study cemented and uncemented fixation for the tibial components. For the aim of fixing and stabilizing the tibial component, post fixations are usually used. Pull-out strength of the post is one of the most important factors to be considered for the mechanical analyses of these fixations. In this study, the effect of initial interference fit on pull-out strength in cementless fixation between bovine tibia and smooth stainless steel post has been investigated. A cylindrical stainless steel post inserted in a pre-drilled bovine tibia with an initial interference fit was taken as an in-vitro model to assess the contribution of post fixation to the initial stability of the TKA tibial component. Pull-out experiments were carried out using traction-compression test machine. Finite element models were developed for the analysis of the experimental ultimate pull-out force results. Analysis of the interfacial shear stress indicates that the micro-slip initiates at the lower edge of the post/bone interface, characterized by the weakest radial stress, and progresses toward the upper edge as the pull-out force increases.

Keywords
Design, TKA, FEM, Steel post, Pull-out