

Project Summary/Abstract

The long term objective of this application is to develop a novel rehabilitation approach to slow the progression of knee osteoarthritis, resulting in improved function and reduced pain for millions of patients. Unlike traditional rehabilitation approaches, the proposed approach is quantitative, combining patient-specific computer models with experimental gait analysis. The computer models are used to predict altered yet natural looking gait patterns that reduce detrimental knee loads. Subsequent gait analysis with real-time visual feedback is then used to train the patient to match the knee loads predicted by the computer model. The specific load targeted by gait retraining is the external knee adduction torque (i.e., the moment that contributes to medial compartment force), since this load is a strong indicator of knee osteoarthritis severity and progression. Initial application of the approach to two subjects but without real-time visual feedback yielded reductions as large as 50% in both peaks of the adduction torque curve, comparable to the results of high tibial osteotomy surgery but without surgical intervention.

To investigate the feasibility of this long term objective, we propose to pursue three specific aims in a feasibility study involving 10 patients with early knee osteoarthritis:

Specific aim 1: Predict with a patient-specific computational model whether similar gait modifications exist for each patient that will significantly reduce both knee adduction torque peaks.

Specific aim 2: Determine whether patients can achieve significant knee adduction torque reductions after eight gait retraining sessions using real-time model-based visual feedback.

Specific aim 3: Determine whether significant knee adduction torque reductions can be maintained for at least one month following the completion of the gait retraining program.

If successful, the proposed approach may permit customized gait retraining to be used to slow the progression of knee osteoarthritis or even as a preventative measure. The end result could be millions of patients with decreased pain and improved function who can delay or even avoid knee replacement surgery.