

# GAIT TRAINING WITH REAL-TIME BIOFEEDBACK: MODULATING KNEE ADDUCTION MOMENTS IN PATIENTS WITH KNEE OA

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## INTRODUCTION

Development and progression of knee osteoarthritis (OA) has been attributed to different factors, including abnormal biomechanical stressors (1, 4). Deviations in joint biomechanics during walking have been associated with progression of the disease, in particular, abnormally high frontal plane moments (1). Numerous approaches have been attempted in an effort to modify knee frontal plane moments with mixed results (3, 5, 6). The ability to apply patient-specific interventions has been advocated and offers the possibility of identifying and modifying the underlying pathomechanics. Manipulating biomechanical factors that contribute to loading at the knee joint, however, can require subtle adjustments in the walking pattern. The purpose of this study was to investigate the effect of patient-specific gait training, with real-time biofeedback, on frontal plane knee moments during walking in adults with symptomatic knee OA.

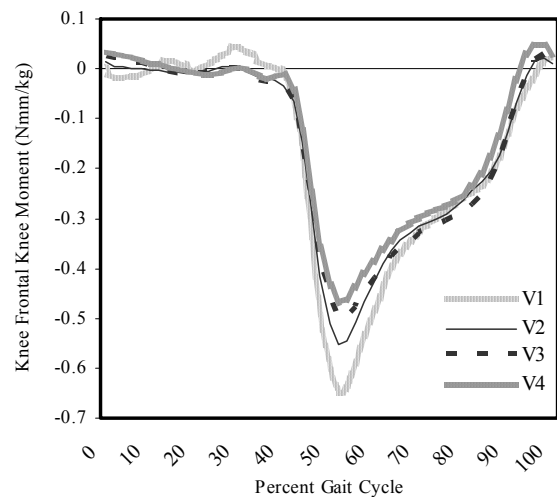
## METHODS

Subjects with radiographic KL grade  $\geq 2$  and ipsilateral knee pain or stiffness on most days of the month, participated in this study. During the first visit, all subjects underwent a physical and over-ground gait evaluation. The physical evaluation assessed strength and range of motion in the trunk and lower limbs. The gait evaluation was conducted along an 8m walkway using a three-dimensional motion analysis system (Optotrak, NDI; Kistler) with subjects walking at 1.12 m/s. Gait data were processed using Visual 3D software (C-Motion). The gait information, in combination with the physical evaluation information, was used to establish patient-specific goals for gait training and home exercise programs, where appropriate. Subjects participated in supervised treadmill gait training twice a week for 12 weeks. Subjects walked on an instrumented treadmill (Gaitway, Kistler) for 8 minute intervals with 3 to 5 minute rest periods. During the gait training, the subjects were provided with real-time biofeedback (Visual 3D) for correction of kinematic patterns that were thought to contribute to abnormal kinetics. Over ground kinetics and kinematics during walking were reassessed during the 8th, 16th, and 24th visits. The performance of exercise was checked periodically to encourage compliance.

## RESULTS AND DISCUSSION

Fifteen subjects (9 female, 6 male; mean age 74.4 +/- 6.9; mean weight 81.09 +/- 14.11) took part in this study. Relative to baseline values, there was a significant reduction in the peak adduction moment after the first month of training ( $p = .0034$ ; Figure 1, V1 vs. V2). Overall the peak external knee adduction moment during gait was reduced by 0.29% ( $p < .001$ ) from baseline (mean  $-.665 \pm .22$ ) to the third month of training (mean  $-.497 \pm .267$ ; Figure 1, V1 vs V4).

The feedback provided during gait training addressed subject-specific goals based on baseline information and monthly reassessments. The goals of gait training mostly included modifications to trunk and pelvic kinematics. During treadmill walking, at subjects' self-selected speeds, real-time images of the subjects skeleton or specific angular information for one segment, in one plane, over several gait cycles, was provided on an intermittent basis. Feedback was also provided during rest periods to reinforce corrected patterns. The ability to dynamically modify kinematics patterns was subject specific.



**Figure 1:** Ensemble average of normalized knee frontal plane moment. Peak moment significantly decreased from baseline (V1) to the end of three-month training regime (V4).

## CONCLUSIONS

The results of this study indicate that knee frontal plane moments can be reduced by supervised gait training with real-time biofeedback.

## Acknowledgements

Supported from Beeson Career Development Award (NIH/NIA 1K23AG030945).

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