

FOOT PROGRESSION ANGLE AND THE KNEE ADDUCTION MOMENT IN INDIVIDUALS WITH MEDIAL KNEE OSTEOARTHRITIS

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INTRODUCTION

Progression of medial knee OA is associated with the external knee adduction moment [1]. Treatments to reduce the magnitude of the moment are therefore indicated for patients with knee OA. Regression analysis has revealed an inverse relationship between the adduction moment and an individual's self-selected foot progression angle (FPA) [2]. No study has examined if walking with a greater than self-selected FPA will further reduce the peak moment in this population. This simple strategy may be an effective method of reducing knee joint loading during activities of daily living for subjects with medial knee OA. The purpose of this study was to examine the effect of increasing FPA on the knee adduction moment during walking, stair ascent and descent in subjects with knee OA.

METHODS

10 subjects with mild to moderate medial compartment knee OA participated in this study (mean age = 63 ± 5 years, weight = 81.8 ± 12.7 kg, height = 1.68 ± 0.08 m). Subjects performed 5 walking, 5 stair ascent and 5 stair descent trials for each of two conditions: (1) self-selected FPA, and (2) increased FPA (self-selected FPA + 15 degrees). Video and force data were collected, and Visual3D (C-motion Inc.) was used to compute the normalized (% BW*Ht) external knee adduction moment. The knee adduction moment has a characteristic 2 hump pattern (see Figure 1). Dependent t-tests were used to assess the effect of increasing FPA on the 1st and 2nd peak moments during walking, stair ascent and descent. The 1st and 2nd peak moments within each task were analyzed separately.

RESULTS AND DISCUSSION

During walking, the 1st peak adduction moment did not change with increasing FPA, but the magnitude of the 2nd peak decreased significantly (Table 1). During stair ascent, a strong trend ($p=0.051$) towards a reduced 2nd peak adduction moment was noted for the increased FPA condition. The potential benefit of a smaller 2nd peak moment however was likely overshadowed by a significantly greater 1st peak adduction moment with increased FPA. No differences in the peak moment were noted during stair descent. The results of this study suggest that walking with an increased FPA can reduce the magnitude of the 2nd peak knee adduction moment in subjects with knee OA. The adduction moment is an indirect

estimate of joint loading [3], and thus, this finding suggests that walking with an increased FPA can reduce joint contact forces.

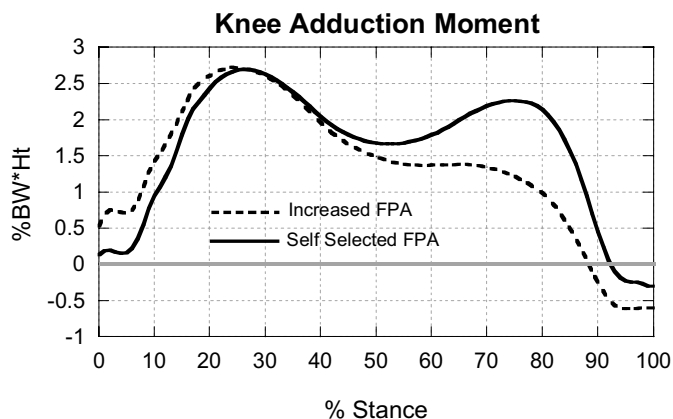


Figure 1. External knee adduction moment during the stance phase of walking. The magnitude of the 2nd peak moment was significantly smaller when walking with an increased FPA.

CONCLUSIONS

Increasing the degree of toe-out during walking decreased the peak adduction moment and presumably joint contact forces for subjects with medial compartment OA. This strategy may have beneficial effects, however it is premature to assert so at this time because the effect of increasing FPA at other joints, specifically the hip has not addressed. This will be the focus of future work.

REFERENCES

1. Sharma L, et al. *Arthritis Rheum* **41**,1233-40, 1998.
2. Hurwitz DE, et al. *J Orthopaed Res* **20**, 101-107, 2002.
3. Andriacchi, TP. *Orthop Clin N Am* **25**, 395-403, 1994.

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Table 1: Peak knee adduction moments. The mean and (SD) are reported as (%BW*Ht). The cells shaded gray indicate a statistically significant difference ($p < 0.05$). A strong trend ($p = 0.051$) was noted for a reduced 2nd peak during stair ascent with increased FPA.

FPA	Walking		Stair Ascent		Stair Descent	
	Peak 1	Peak 2	Peak 1	Peak 2	Peak 1	Peak 2
Self-selected	2.81 (0.49)	2.27 (0.63)	3.18 (1.02)	2.60 (0.94)	4.37 (0.77)	2.78 (0.73)
Increased	2.85 (0.44)	1.37 (0.53)	3.53 (1.00)	2.31 (0.83)	4.28 (0.77)	2.61 (0.80)