GAIT ALTERATIONS IN PERIPHERAL ARTERIAL DISEASE ARE NOT WORSENED BY THE PRESENCE OF DIABETES

Hafizur Rahman[1], Molly Schieber[1], Iraklis I. Pipinos[2,3], Jason M. Johanning[2,3], Sara A. Myers[1]

CENTER FOR RESEARCH IN HUMAN MOVEMENT VARIABILITY

UNMC UNIVERSITY OF NEBRASKA MEDICAL CENTER

[1]University of Nebraska at Omaha, Omaha, NE, USA
[2]Omaha Veterans' Affairs of Medical Center, Omaha, NE, USA
[3]University of Nebraska Medical Center, Omaha, NE, USA

INTRODUCTION

- Peripheral arterial disease (PAD) is a vascular disease where atherosclerotic blockages restrict blood flow to muscles in the lower extremities[1-6].
- PAD is characterized by intermittent claudication, or pain during walking that results from ischemia and has been found to alter gait patterns[1-6] .
- Diabetes affects multiple cell types within the vascular wall adversely and has been found to contribute to atherosclerosis[7-8]
- Amongst those with PAD, 20-30% also have diabetes which has been reported to increase the risk of lower extremity amputation compared to persons with PAD without diabetes[7].
- Although a relationship between diabetes and PAD exists, the gait mechanics involved remain indistinct.

Purpose: To determine whether the presence of diabetes in addition to PAD results in greater functional impairment during ambulation.

Hypothesis: Biomechanical adaptations caused by PAD will be to a greater magnitude in individuals also inflicted with diabetes.

METHODS

- Subjects with PAD were screened by a vascular surgeon and split into two groups: PAD and no comorbidities (PAD-NC) and PAD with diabetes (PAD-D). All patients with diabetes were without neuropathy.
- Joint angles, forces, moments and powers were calculated in the sagittal plane and kinetics were normalized to body weight. Spatiotemporal variables were calculated using a custom MATLAB code. A mixed ANOVA was used to determine main effect of group and condition.

Table 1. Means and standard deviations for group characteristics. The groups were matched for speed.

Group	N	Age (years)	Height (m)	Weight (kg)	ABI
Controls	12	64.4(7.7)	1.78(5.1)	89.8(16.6)	n/a
PAD-NC	14	62.9(5.1)	1.78(6.1)	90.73(8.6)	0.52(.25)
PAD-D	15	63.2(5.1)	1.75(6.8)	87.2(13.1)	0.38(.20)

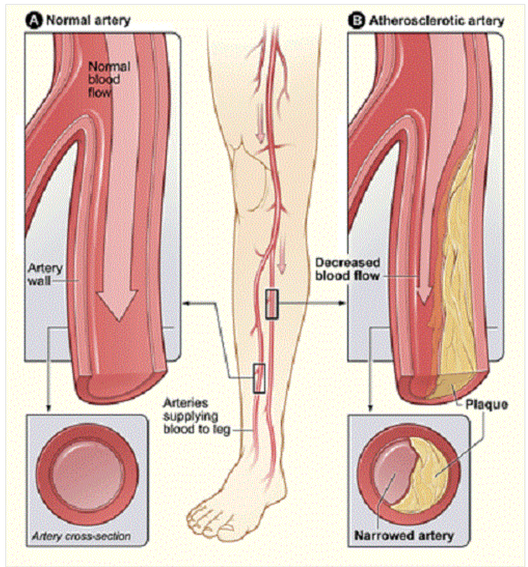

Figure 1 & 2. Subjects walked over ground while kinematics and kinetics were recorded (60Hz, 600Hz). After baseline biomechanics were captured, subjects performed the 6 minute walk test to induce claudication pain. Immediately following subjects repeated the over ground walking without rest between trials for the pain condition.

RESULTS

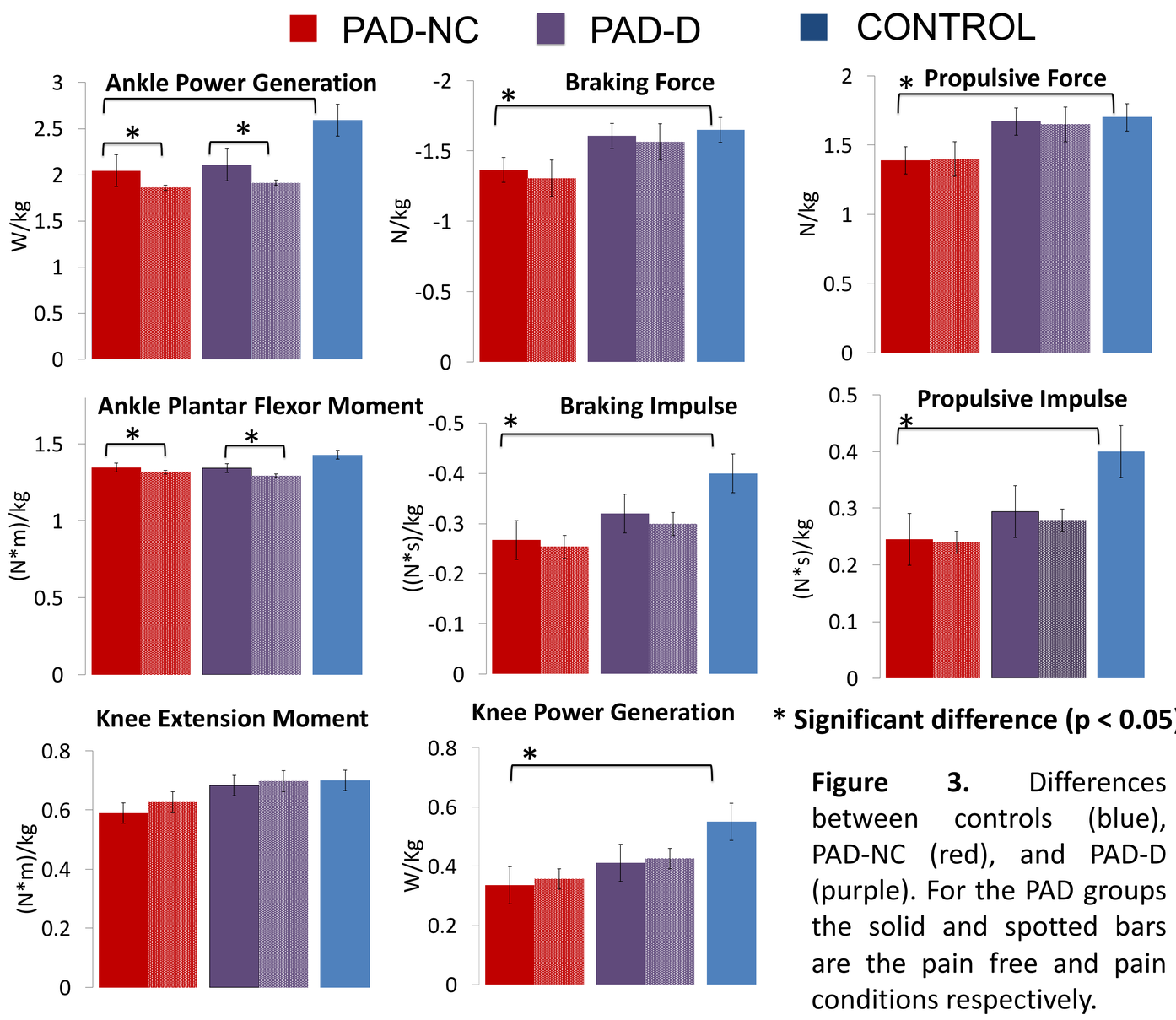

Figure 3. Differences between controls (blue), PAD-NC (red), and PAD-D (purple). For the PAD groups the solid and spotted bars are the pain free and pain conditions respectively.

Table 2. Means and standard deviations for spatiotemporal variables.

Groups	PAD-NC		PAD-D		Control
	Pain free	Pain	Pain free	Pain	Pain free
Stride Time (s)	1.23	1.21	1.19	1.20	1.15(0.08)
Stride Length (m)	1.32*	1.28*	1.32*	1.29*	1.44(0.09)
Step Width (m)	0.98	0.89	0.94	0.97	0.09(0.03)

- No significant differences were found between PAD groups.
- Significant differences were found between conditions in PAD groups for ankle power generation, ankle plantar flexor moment, and stride length.

DISCUSSION

- Differences in kinetic variables between control and PAD groups before the onset of pain are in agreement with previous literature reported by our lab[4-6] .
- Contrary to the hypothesis, no main effect of group, outside of propulsion impulse, was found. This indicates that the mechanisms driving gait deficiencies in patients with PAD are larger than the addition of diabetes on gait.
- PAD causes severe myopathy, including altered muscle morphology and mitochondrial function. Therefore, in combination with our findings, it is likely that these problems dominate additional gait deficits caused by diabetes.
- Future research should determine the contribution of muscular abnormalities to gait alterations and investigate whether improvements in muscular function from treating PAD lead to successive improvements in gait in these patients.

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