

EFFECT OF PERIPHERAL ARTERIAL DISEASE ON KEY POINTS DURING THE GAIT CYCLE

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INTRODUCTION

Peripheral arterial disease (PAD) is a chronic arterial occlusive disease of the lower extremities caused by atherosclerosis [1]. PAD induced a decrease in blood supply to the legs typically causing pain in the calf, thigh or buttock during walking and which dissipates when the individual ceases activity (intermittent claudication) [2].

Research has shown that PAD influences walking performance, physiological responses, lower limb gait characteristics and lower limb movement variability [3,4,5]. However, there has been little research on the angular kinematics at key points of the gait cycle such as ipsilateral and contralateral initial contact and toe-off in this population.

Therefore, the aim of this study was to examine the influence of PAD on key points of the gait cycle during walking compared to age and mass matched healthy controls.

METHODS

Participants (n=28) presenting with PAD were selected based on an appropriate history of PAD, with absence of significant peripheral neuropathy. PAD in either leg was confirmed by absence of peripheral pulses, imaging confirmed lower limb artery stenosis or occlusion, ankle-brachial pressure index (ABI) <0.9 and +ve Edinburgh Claudication Questionnaire response [6]. Details of the participants' medical history and medications were recorded as previously described [3]. A further group of participants (n=25) free of PAD (ABI >0.9) and who were non regular exercisers were recruited from the community via email bulletin boards and local newspaper and television coverage to act as age and mass matched controls (CON). Participants were excluded from the study if they required mobility aids, had observable gait abnormalities or medical conditions which influenced gait. All participants volunteered and gave written informed consent to participate in this study as approved by the institutional ethics committee.

All testing was conducted in a human performance laboratory. Participants were assessed early in the morning arriving at the laboratory in a fasting state (12 h). After completing informed consent and study information procedures, all participants underwent assessment of ABI, body composition and gait testing.

Participant gait joint angular movements were determined by 2D video analysis. Major joint segments were identified using reflective markers placed on five landmarks on the ipsilateral (right leg) limb of the participant's body. The reflective markers were positioned at the shoulder (acromion), hip (greater trochanter of femur), knee (lateral epicondyle of femur), and ankle (lateral malleolus of fibula)

and head of the fifth metatarsal. Angular kinematics were determined at the ankle, knee and hip of the ipsilateral limb during ipsilateral initial contact, contralateral limb (left leg) toe-off, contralateral initial contact, ipsilateral toe-off and ipsilateral re-contact.

Participants were instructed to walk normally without shoes along a 10-m walkway whilst the participant was in a pain free state.

Data were analyzed via one-way ANOVA with one between-subject factor (PAD vs. CON). An alpha level was .05 was adopted for this study.

RESULTS AND DISCUSSION

Participants were similar in age, height, mass and percentage of body fat. ABI for both the left and right leg were higher in the CON participants compared to PAD participants (P < .001).

PAD participants demonstrated significantly reduced angular kinematics (P < .05) of the ipsilateral limb at the hip (-7.2° vs -11.1°) and ankle (-2.8° vs -8.3°) during ipsilateral toe-off and reduced ipsilateral limb ankle angular kinematics (0.5° vs. 3.1°) at ipsilateral re-contact compared to the CON group. There was significantly reduced ipsilateral hip angular kinematics (-10.9° vs. -15.2°) (P < .05) at contralateral leg initial contact for PAD participants compared to the CON group.

CONCLUSIONS

This study demonstrated that PAD has a detrimental effect on the key points of the lower limb during the gait cycle. This detrimental effect may influence mobility and balance in PAD patients, thereby increasing the risk of falls and other mobility problems. The findings of this study support research that indicates the unfavorable effect of PAD on gait and mobility.

REFERENCES

1. Meru AV, et al., *Atherosclerosis*. **187**:221-237, 2005.
2. McDermott MM, et al., *Ann Intern Med*. **144**:10-20, 2006.
3. Crowther RG, et al., *J Vasc Surg*. **45**:1172-1178, 2007.
4. Crowther RG, et al., *Clin Biomech*. **23**:357-364, 2008.
5. Crowther RG, et al., *Clin Biomech*. **23**:1080-1085, 2008.
6. Leng GC, et al., *J Clin Epidemiol*. **45**:1101-1109, 1992.