

A Single Session of Ischemic Preconditioning Alters Gait Mechanics in Older Adults with Symptomatic Knee Osteoarthritis

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Summary

This study aimed to evaluate changes in gait mechanics in older adults with symptomatic knee osteoarthritis (KOA) after a single session of ischemic preconditioning (IC) or sham treatment. IC (225mmHg) and sham (25mmHg) treatment were administered on the involved thigh, defined as the most symptomatic limb, for 5-minutes of inflation and 5-minutes of reperfusion for 50-minutes. The IC group demonstrated reduced knee valgus and external rotation, and increased trunk lateral flexion, extension moment, and rotation moment compared to the sham group, suggesting improvements in the screw-home mechanism after a novel, passive treatment.

Introduction

Knee osteoarthritis (KOA) is a leading cause of disability and affects over 650 million adults over the age of 40 worldwide [1]. Although altered gait mechanics are synonymous with KOA and its progression, few treatments outside of physical activity have shown to change gait mechanics. Therefore, the purpose of this study was to evaluate changes in gait mechanics after a single session of ischemic preconditioning (IC) in older adults with symptomatic KOA.

Methods

Thirty older adults with symptomatic KOA (12F/18M, 62.8±8.6 years, 95.6±28.6 kg, 170.9±18.5 cm) walked on a split-belt treadmill with 3D motion capture at a self-selected speed before and immediately after a single session of IC (n=14) or sham (n=16) treatment. IC and sham treatment, administered on the involved thigh, consisted of 5 minutes of inflation (225mmHg for IC and 25mmHg for sham) followed by 5 minutes of reperfusion, for 5 cycles (50 minutes). The involved limb was defined as the knee with greatest KOA symptoms.

Triplanar knee, hip, and trunk kinematics and kinetics were measured on the involved side during the 6-minute walk test. Kinematic data were reduced to 101 points from heel strike (>20N) to ipsilateral heel strike to represent 0-100% of the gait cycle and kinetic data were reduced to 101 points from heel strike to ipsilateral toe off (<20N) to represent 0-100% of stance phase and normalized to mass (Nm/kg). Change scores were calculated by subtracting pre-gait from post-gait for each 1% with 90% confidence intervals. Differences in change scores between groups were considered significant if the 90% confidence intervals did not overlap for three or more consecutive points and were reported as mean differences (MD) ± standard deviation.

Results and Discussion

The IC group demonstrated reduced knee valgus during early stance ($2.0\pm0.3^\circ$) and swing ($4.2\pm1.39^\circ$), and less knee

external rotation ($1.2\pm0.09^\circ$) during terminal stance. During mid-stance, the IC group demonstrated increased trunk lateral flexion ($1.8\pm0.36^\circ$) towards the involved side, increased trunk extension moment ($0.15\pm0.01\text{Nm/kg}$), and reduced trunk rotation moment ($0.02\pm0.004\text{Nm/kg}$) towards the involved side compared to sham (Figure 1). There were no other changes in gait after a single session of IC.

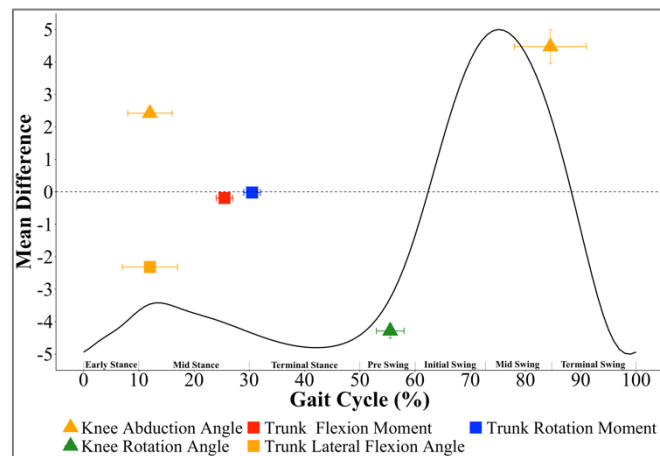


Figure 1: Mean differences for significant differences in gait kinematics (°) and kinetics (Nm/kg) change scores between IC and sham groups. Vertical error bars represent pooled standard deviations for mean differences and horizontal error bars represent duration across the gait cycle where 90% confidence intervals did not overlap.

These gait alterations, largely in the frontal and transverse planes, suggest that a single session of IC can improve the screw-home mechanism that is often dysfunctional in older adults with KOA [2]. These gait alterations could be due of improved quadriceps and hip abductor strength after IC [3]. Thus, IC should continue to be investigated as a novel, passive clinical intervention to improve function in KOA.

Conclusions

A single session of IC alters gait in older adults with symptomatic KOA, suggesting the use of IC treatment may lead to improved gait in individuals with KOA.

Acknowledgments

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References

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