

ABSTRACT

Chronic ankle instability (CAI) patients often exhibit altered walking mechanics, due to strength and proprioceptive deficits associated with CAI. Reduced strength and proprioception function may alter walking energetic patterns, by reducing energy absorption and generation capability. It is unclear whether strength and proprioceptive training can affect walking energetics for CAI patients. **PURPOSE:** To examine the effect of a 6-week ankle and hip rehab program on ankle, knee, and hip joint energetic patterns during walking in CAI patients. **METHODS:** 15 CAI patients (23 ± 2 yrs, 178 ± 8 cm, 76 ± 9 kg, 83 ± 7% FAAM ADL, 56 ± 10% FAAM Sports, 3.6 ± 1.1 MAII, 4.7 ± 2.0 ankle sprains) performed ankle and hip strength and proprioceptive exercises (i.e., theraband, wobble board, etc.) 3 times per week, for 6 weeks (rehab group). 14 CAI patients (22 ± 2 yrs, 177 ± 9 cm, 75 ± 12 kg, 81 ± 9% FAAM ADL, 56 ± 12% FAAM Sports, 3.4 ± 1.2 MAII, 5.9 ± 3.3 sprains) performed no rehab exercises (control group). We measured ankle, knee, and hip joint power during walking for all patients before and after 6 week duration. Functional statistics ($\alpha = 0.05$) were used to evaluate the influence of the rehab exercises on joint power for both groups across the entire stance phase of walking. **RESULTS:** The rehab intervention resulted in up to 0.07 W/kg more positive ankle power (concentric) between 19 and 26% of stance and up to 0.06 W/kg more positive knee power (concentric) between 40 and 48% of stance. No changes were detected in hip joint power during the stance phase of walking. **CONCLUSION:** Strength and proprioceptive training resulted in an improved gait energetic efficiency via increased ankle and knee power generation during mid-stance. As greater muscular strength can lead to an increase in power absorption and generation, the intervention focusing on strength could be beneficial in improving walking energetics in a CAI population.

INTRODUCTION

- Up to 40% of individuals who suffer a lateral ankle sprain go on to suffer from chronic ankle instability (CAI), which is partly manifest by decreased static and dynamic joint stability [1, 2].
- CAI patients typically display abnormal neuromuscular function [3] that likely affects walking energetics (i.e., energy absorption and generation).
- It is unclear whether strength and proprioceptive training can improve walking energetics for CAI patients.
- The **purpose** of this project was to determine whether a 6-week ankle and hip rehab program (strength and proprioceptive training exercises) can improve ankle and knee mechanical power patterns, during walking, in CAI patients.

METHODS

- 29 CAI patients were divided into a control (n = 15) and a rehab group (n = 14; Table 1).
- The rehab group completed a 6-week rehab program (3 × per week) involving exercises shown in Figure 1.

- Gait analyses were performed before and after the rehab program: high-speed videography, ground reaction force measurement, and standard 3D inverse dynamics calculations.
- A functional approach was used to compare sagittal-plane ankle, knee, and hip joint power, before and after the rehab program, across the entire gait cycle.

Table 1: Subject demographics, for the control and rehab groups.

Group	Subjects	Age (years)	Height (cm)	Weight (kg)	FAAM ADL	FAAM Sports	Ankle Sprains
Control	15 (12M;3F)	23 ± 2	178 ± 8	76 ± 9	83 ± 7	56 ± 10	4.7 ± 2.0
Rehab	14 (10M;4F)	22 ± 2	177 ± 9	75 ± 12	81 ± 9	56 ± 12	5.9 ± 3.3



Figure 1: Exercises performed by the rehab group, 3 times per week, for 6 weeks.

RESULTS

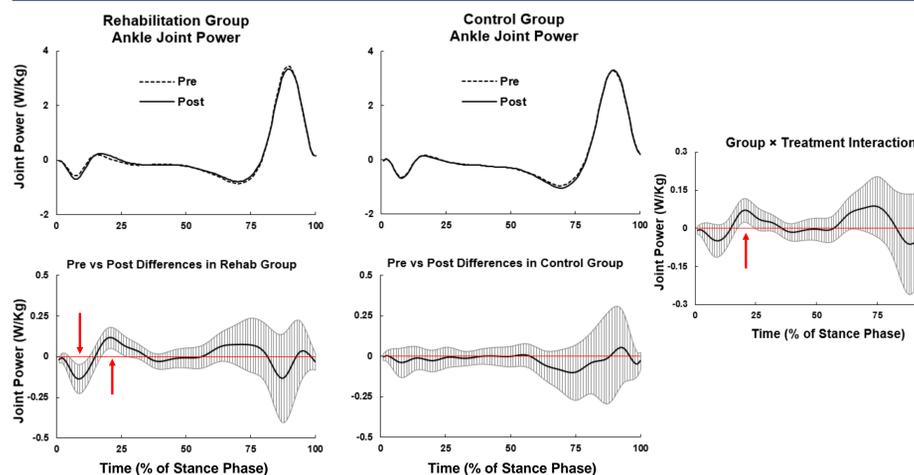


Figure 2: Ankle power during the stance phase of walking. The significant group × treatment interaction (indicated, in the subplot on the right, where the confidence intervals do not overlap zero) shows that the rehab program increased (up to 0.07 W/kg) positive ankle power, between 19 and 26% of the stance phase.

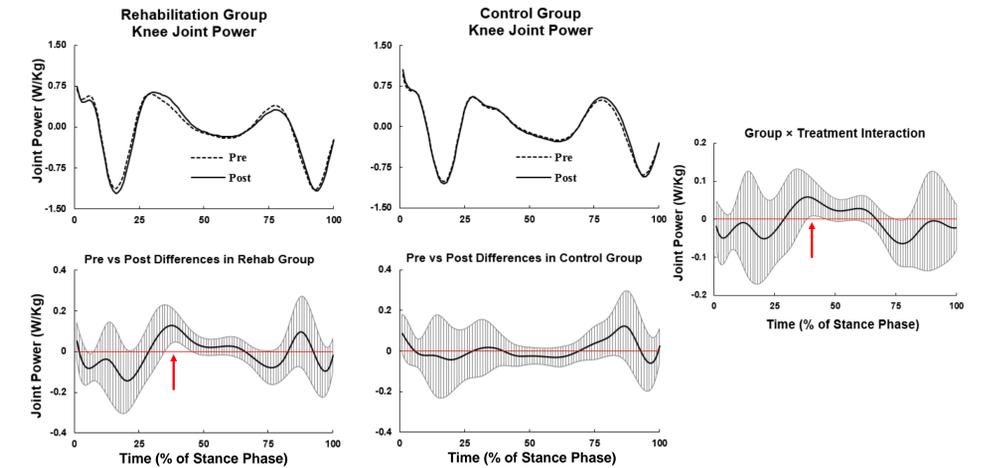


Figure 3: Knee power during walking. The significant group × treatment interaction (indicated in the right subplot, where the confidence intervals do not cross zero) shows the rehab program increased (up to 0.06 W/kg) positive knee power, between 40 and 48% of stance.

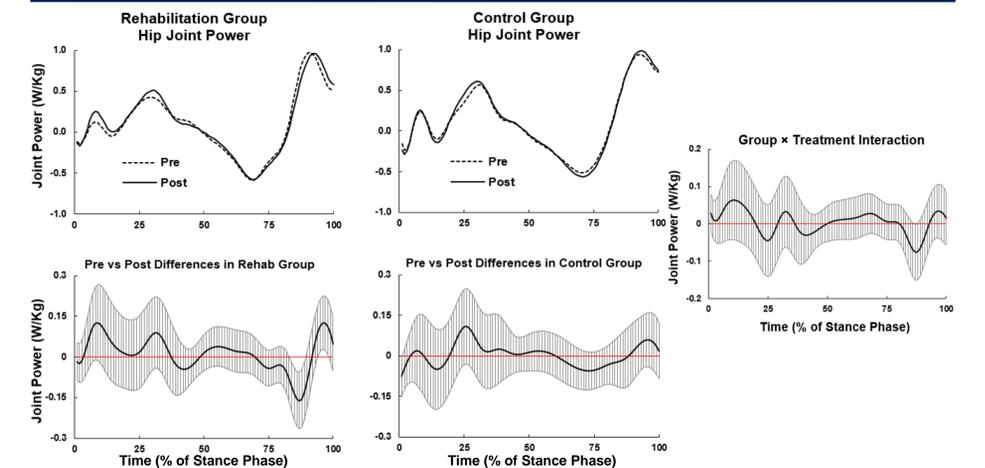


Figure 4: The rehab program did not alter hip power, during the stance phase of walking, indicated by the absence of statistical differences.

CONCLUSION

- Strength and proprioceptive training improves walking energetics via increased ankle and knee power generation, during the mid-stance phase of gait.
- Greater muscular strength can improve energy generation capability; consequently, the present rehab program should improve walking mechanics for CAI patients.

REFERENCES

1. Itay S et al., *Orthop Rev.* 1982,11(5), 73-76.
2. Vaes PH et al., *Am J Sports Med.* 1998, 26(5), 692-702.
3. Hertel J. *Clin Sports Med.* 2008, 27(3), 353-70.