

Immediate Effects of Sensory-Targeted Ankle Rehabilitation Strategies on Balance and Range of Motion in Those with Chronic Ankle Instability

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INTRODUCTION

Chronic ankle instability (CAI) is an extremely common consequence of a lateral ankle sprain. CAI is attributed to a combination of mechanical and functional insufficiencies that significantly constrains the sensorimotor system's ability to cope with changing demands, resulting in repeated ankle sprains.¹ Traditional rehabilitation strategies for this condition focus on motor pathway impairments (i.e. strength, coordination) with very little emphasis on the potential to intervene through sensory pathways. Similarly, most research on CAI has focused only on maximizing motor output, ignoring the full spectrum of sensorimotor dysfunction associated with CAI. However, it has been demonstrated that the sensorimotor system dynamically shifts reliance on various sensory inputs depending on the demands placed on the system.² Potentially, sensory-targeted ankle rehabilitation strategies, including triceps surae stretching, plantar massage, or ankle joint mobilization, targeting 3 types of sensory pathways (musculotendinous, plantar cutaneous, and articular, respectively), has beneficial effects on objective measures of sensorimotor function including single limb balance measured through center of pressure (COP) excursions in those with CAI. However, we do not yet understand the unique contributions of these interventions.

PURPOSE

To evaluate the immediate effects of sensory-targeted rehabilitation strategies (STARS) on COP excursion velocity during a single limb balance task in those with CAI.

METHODS

Design: Multi-Center Randomized Controlled Trial

Setting: Research laboratory

Subjects

- 61 individuals with self-reported CAI were randomly assigned to four different STARS groups.
- CAI was defined as a history of at least 1 ankle sprain with 2 episodes of giving way in the last 6 months, <90% on the Foot and Ankle Ability Measure (FAAM) and <80% on the FAAM-Sport (FAAM-S) Scale.

Outcome Measures

All subjects performed 3 trials of single limb stance on a force plate with eyes closed for 10 seconds.³

AMTI Accusway force plate

Sampling Frequency: 50 Hz

CoP velocity was calculated for the mediolateral (CoPV-ML) and the anteroposterior (CoPV-AP) directions. During the trial, if a subject touched down or failed to maintain the target position (see figure below), the trial was stopped and repeated.



All subjects maintained single limb stance with eyes closed and arms across their chests..

Concealed Allocation

All subjects were tested prior to allocation to their respective STARS treatment groups. Group allocation was prepared by an independent investigator and sealed in an envelope to be opened after the pre-STARS testing.



All subjects received a 5 minute treatment upon completion of the pre-STARS outcome measures assessment.

Ankle Joint Mobilization: Two 2-minute bouts of Maitland Grade 3 Anterior-to-Posterior Mobilizations.³

Plantar Massage: Two 2-minute bouts of foot massage that combined petrissage and effleurage.

Triceps Surae Stretching: Six 30-second stretches in maximum dorsiflexion with the knee slightly bent to emphasize stretch of the soleus.

Control: 5 minutes of quiet resting in a seated position.

Upon completion of the treatment, all STARS outcome measures were reassessed immediately.

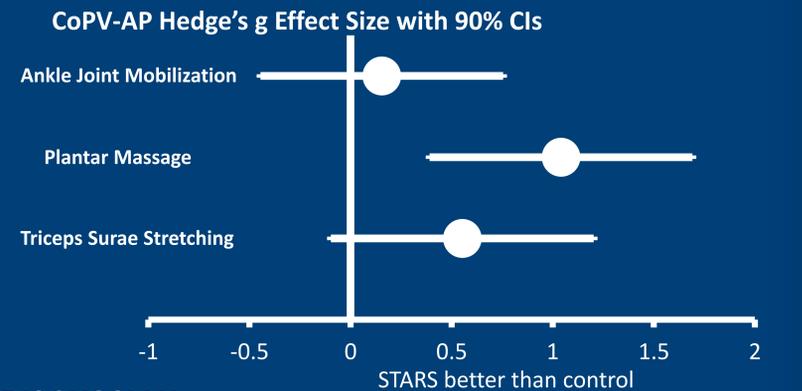
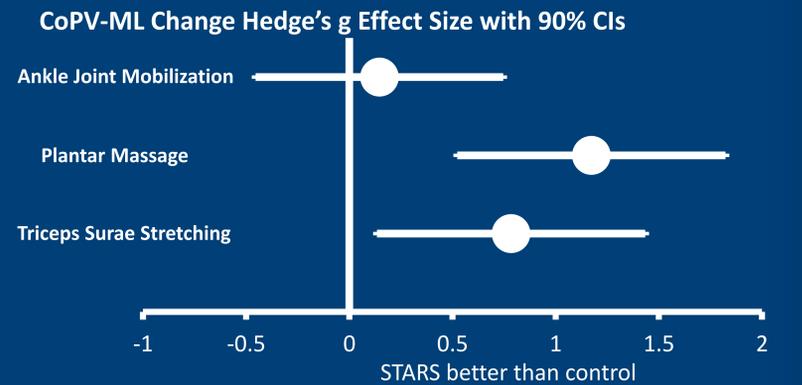
Statistical Analysis

Change scores from post- to pre-STARS were generated. The post- to pre- change scores of the 3 STARS groups were compared to the CON independent t-tests ($p \leq 0.10$). Hedge's g effect sizes with 90% confidence intervals were also generated for the changes between the treatment groups and controls.

RESULTS

	CoPV-ML Change (cm/s)	CoPV-AP Change (cm/s)
Ankle Joint Mobilization	0.4±1.8	0.4±2.0
Plantar Massage	-0.6±0.8	-0.6±1.0
Triceps Surae Stretching	-0.4±1.2	-0.3 ±1.9
Control	0.6±1.0	0.6±1.2

A negative value indicates a beneficial change (reduction in CoP velocity).



DISCUSSION

The STARS that appears to be most effective for enhancing single limb balance as measured by CoP velocity in both the ML and AP directions immediately after one treatment is plantar massage.

Triceps surae stretching had a substantial effect on balance, but only in the ML direction. However, the magnitude of change was not as great as the effect of plantar massage.

Joint mobilization offered no immediate beneficial effect on balance.

While each STARS offers unique contributions to rehabilitation for those with CAI,⁴ stimulating the plantar afferents through plantar massage has the most apparent immediate beneficial effect on balance for those with CAI.

REFERENCES

1. Wikstrom EA, Hubbard-Turner T, McKeon PO. Understanding and Treating Lateral Ankle Sprains and their Consequences : A Constraints-Based Approach. *Sports Med.* Apr 12 2013.
2. McKeon PO, Stein AJ, Ingersoll CD, Hertel J. Altered plantar-receptor stimulation impairs postural control in those with chronic ankle instability. *J Sport Rehabil.* Feb 2012;21(1):1-6.
3. Hoch MC, McKeon PO. Joint mobilization improves spatiotemporal postural control and range of motion in those with chronic ankle instability. *J Orthop Res.* Mar 2011;29(3):326-332.
4. McKeon PO, Wikstrom EA. The effect of sensory-targeted ankle rehabilitation strategies on balance and range of motion in those with chronic ankle instability: A preliminary study. *Med Sci Sport Ex* 2013;45(55):5706-7

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