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The effect of two mobilization techniques on dorsiflexion in people with chronic ankle instability

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ABSTRACT

Objective: To compare the effect of two manual therapy techniques, mobilization with movement (WB-MWM) and talocrural manipulation (HVLA), for the improvement of ankle dorsiflexion in people with chronic ankle instability (CAI) over 48 h.
Design: Randomized controlled clinical trial.
Setting: University research laboratory.
Participants: Fifty-two participants (mean ± SD age, 20.7 ± 3.4 years) with CAI were randomized to WB-MWM ($n = 18$), HVLA ($n = 19$) or placebo group ($n = 15$).
Main Outcome Measures: Weight-bearing ankle dorsiflexion measured with the weight-bearing lunge. Measurements were obtained prior to intervention, immediately after intervention, and 10 min, 24 h and 48 h post-intervention.
Results: There was a significant effect × time ($F_{4,192} = 20.65$; $P < 0.001$) and a significant time × group interactions ($F_{8,192} = 6.34$; $P < 0.001$). *Post hoc* analysis showed a significant increase of ankle dorsiflexion in both WB-MWM and HVLA groups with respect to the placebo group with no differences between both active treatment groups.
Conclusion: A single application of WB-MWM or HVLA manual technique improves ankle dorsiflexion in people with CAI, and the effects persist for at least two days. Both techniques have similar effectiveness for improving ankle dorsiflexion although WB-MWM demonstrated greater effect sizes.

1. Introduction

Ankle sprains are the most common injury incurred during sports activities (Collins, Teys, & Vicenzino, 2004; Morrison & Kaminski, 2007) and it has been reported that during the period from 2005 to 2006 ankle sprains accounted for 22.6% of all sports injuries in adolescent high school athletes (Nelson, Collins, Yard, Fields, & Comstock, 2007). It is estimated that between 20% and 40% of ankle sprains will result in chronic ankle instability (CAI) with up to 70% reported in specific sports such as basketball (Valderrabano, Wiewiorski, Frigg, Hintermann, & Leumann, 2007; Valderrabano et al., 2006). CAI is defined as a set of residual symptoms that can occur after an initial ankle sprain and include chronic pain, episodes of giving way, recurrent sprains, and swelling (Delahunt et al., 2010; Ross, Guskiewicz, Gross, & Yu, 2008). CAI may not only limit activity, but also may lead to an increased risk of osteoarthritis and articular degeneration at the ankle (Hubbard, Hertel, & Sherbondy, 2006; Valderrabano, Hintermann, Horisberger, & Fung, 2006).

A deficit in dorsiflexion is common after an acute or subacute ankle sprain (Collins et al., 2004) as well as in subjects with CAI (Drewes, McKeon, Kerrigan, & Hertel, 2009; Hoch et al., 2012). The restriction of this movement affects daily activities such as walking, running, stair-climbing and squatting (Bennell, Talbot, Wajswelner, Techovanich, & Kelly, 1998; Green, Refshauge, Crosbie, & Adams, 2001) and although the factors that predispose to reinjury of the ankle are not conclusively evidence based, a deficit in dorsiflexion has been shown to be associated with the recurrence of ankle sprains in some studies (Baker, Beynnon, & Renstrom, 1997; Bennell et al., 1998; Pope, Herbert, & Kirwan, 1998; Vicenzino, Branjerdporn, Teys, & Jordan, 2006). Altered arthrokinematics is a mechanical deficiency outlined in the Hertel (2002) paradigm of insufficiencies and thought to contribute to CAI. Pope et al. (1998) reported that a restriction in ankle dorsiflexion increased the risk

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of incurring an ankle sprain in 1093 Australian Army recruits (likelihood ratio = 7.65; $P = 0.006$).

Manual therapy is frequently used by physical therapists after injury to improve range of motion, alleviate pain, and facilitate return to function (Green et al., 2001; Vicenzino et al., 2006). There are several manual therapy techniques used to restore dorsiflexion with the most common being an antero-posterior (AP) passive accessory joint mobilization of the talus on the tibia (De Souza, Venturini, Teixeira, Chagas, & De Resende, 2008; Green et al., 2001; Venturini et al., 2007), a high-velocity thrust manipulation of the talocrural joint (Andersen, Fryer, & McLaughlin, 2003; Dananberg, Shearstone, & Guilliano, 2000; Fryer, Mudge, & McLaughlin, 2002; Nield, Davis, Latimer, Maher, & Adams, 1993) and a mobilization with movement (MWM) as described by Mulligan (Collins et al., 2004; Mulligan, 1999; O'Brien & Vicenzino, 1998; Vicenzino et al., 2006). Suggested bases for the therapeutic mechanism of mobilization or manipulation techniques used for the restoration of ankle dorsiflexion is a suspected positional fault in the distal fibula (Hubbard et al., 2006) and a limitation in posterior glide of the talus observed after an ankle sprain (Denegar, Hertel, & Fonseca, 2002; Vicenzino et al., 2006). The latter technique is suggested to facilitate the restoration of normal arthrokinematics of the talocrural joint, improving the positioning of its rotational center and its articular congruence (Beazell et al., 2012; Venturini et al., 2007).

The efficacy of the manipulation and mobilization for the improvement of ankle dorsiflexion has been widely investigated in previous studies (Andersen et al., 2003; Beazell et al., 2009, 2012; Collins et al., 2004; De Souza et al., 2008; Delahunt, Cusack, Wilson, & Docherty, 2013; Fryer et al., 2002; Green et al., 2001; Hoch & McKeon, 2011; Hoch et al., 2012; O'Brien & Vicenzino, 1998; Venturini et al., 2007; Vicenzino et al., 2006), with some studies demonstrating a positive effect (Collins et al., 2004; Green et al., 2001; O'Brien & Vicenzino, 1998; Pellow & Brantingham, 2001; Venturini et al., 2007; Vicenzino et al., 2006) and some studies demonstrating a negative effect in both asymptomatic (Andersen et al., 2003; Fryer et al., 2002; Nield et al., 1993) and CAI subjects (Beazell et al., 2009, 2012). However, to date there are limited studies on the comparative effect of mobilization techniques versus manipulation. Therefore, the aim of this study was to compare the effect of two manual techniques, MWM and talocrural manipulation, for the improvement of ankle dorsiflexion in people with CAI over a 48 h period.

2. Methods

2.1. Participants

Fifty-two participants (31 males, 21 females) aged from 15 to 36 years old (mean ± SD: 20.7 ± 3.4 years) with CAI volunteered and qualified for participation (Fig. 1 and Table 1). Inclusion criteria were: a past history of at least one unilateral ankle sprain which needed weight-bearing rest (Caulfried & Garrett, 2004; Dayakidis & Boudolos, 2006; Delahunt, Monaghan, & Caulfried, 2006, 2007); current episodes of ankle instability in the form of giving way, pain and/or subjective decrease of function; less than 24 points in the Spanish version of the Cumberland Ankle Instability Tool (CAIT-Sv) (Rodríguez-Fernández, 2013) to ensure the existence of CAI (De Noronha, Refshauge, Kilbreath, & Crosbie, 2007; Delahunt, O'Driscoll, & Moran, 2008).

The CAIT-Sv is the Spanish cross-cultural adaptation of the Cumberland Ankle Instability Tool (CAIT). Both scales are considered valid for the discrimination of subjects with CAI. CAIT is a self-reported questionnaire for ankle instability. It consists of 9 items about pain, stability in different situations and the response to typical ankle sprains. The maximum score is 30, which corresponds with the best ankle stability. CAIT has a sensibility and a specificity of 82.9% and 74.7% respectively for a cut point of 27.5 (Hiller, Refshauge, Bundy, Herber, & Kilbreath, 2006). The CAIT-Sv showed adequate values of internal consistency, construct validity, reliability, floor and ceiling effects and responsiveness (Rodríguez-Fernández, 2013).

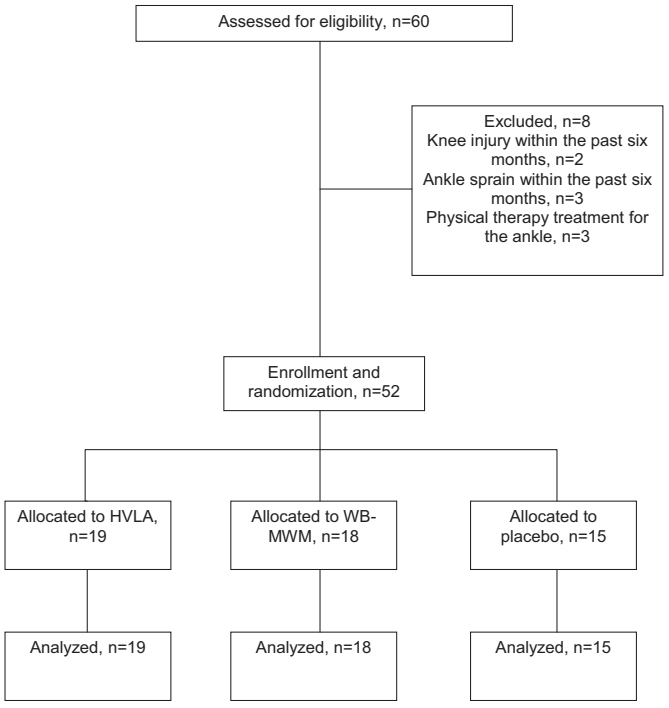

Fig. 1. Consort flow chart. HVLA: High velocity and low amplitude manipulation; WB-MWM: Weight-bearing mobilization with movement.

Exclusion criteria were lower extremity injury or surgery within the past six months or physical therapy treatment of the lower extremities at the time of the study. Participants were recruited as a sample of convenience from a university community and soccer

Table 1
Participants demographics.

	HVLA group ($n = 19$)	MWM group ($n = 18$)	Placebo group ($n = 15$)	P value
Age (years)	20.6 ± 2.5	21.1 ± 5	20.3 ± 1.4	0.82
Height, m	1.77 ± 0.1	1.76 ± 0.1	1.74 ± 0.12	0.67
Weight, kg	72.7 ± 11.4	69.04 ± 15.4	70.6 ± 15.1	0.73
BMI	23.1 ± 2.4	22.2 ± 3.4	23.1 ± 2.3	0.55
CAIT-Sv	19 ± 2.9	18.2 ± 4.97	20.3 ± 1.4	0.25
Number of sprains	2.6 ± 1.3	3.11 ± 1.6	2.7 ± 1.05	0.50
Last ankle sprain, years	3.1 ± 2.3	2.7 ± 2.94	1.8 ± 1.01	0.27
Male/female	13/6	9/9	9/6	0.56
Sport practice, yes/no	14/5	13/5	10/5	0.93
MAI/FAI	4/15	7/11	4/11	0.51
Dominance, right/left	18/1	15/3	14/1	0.51

HVLA: High velocity and low amplitude manipulation; MWM: Mobilization with movement; BMI: Body mass index; CAIT-Sv: Cumberland Ankle Instability Tool (Spanish Version); MAI: Mechanical ankle instability; FAI: Functional ankle instability. Values are presented as mean ± SD for quantitative data and number of participants for qualitative data. Comparison was made with one-way ANOVA for quantitative data and with chi-square for qualitative data. There was no significant difference between groups.