Manual Therapy 26 (2016) 141–149

Contents lists available at ScienceDirect

Manual Therapy

journal homepage: www.elsevier.com/math

Original article

Manual therapy in joint and nerve structures combined with exercises in the treatment of recurrent ankle sprains: A randomized, controlled trial

Gustavo Plaza-Manzano [a, 1], Marta Vergara-Vila [b, c], Sandra Val-Otero [c], Cristina Rivera-Prieto [c], Daniel Pecos-Martin [c, 2], Tomás Gallego-Izquierdo [c, 2], Alejandro Ferragut-García [d, 3], Natalia Romero-Franco [d, *]

[a] Departamento de Medicina Física y Rehabilitación, Facultad de Medicina, Universidad Complutense de Madrid, Instituto de Investigación Sanitaria del Hospital Clínico San Carlos (IdISSC), Spain
[b] Community Health Centre Maria Wolff, Madrid, Spain
[c] Physiotherapy Department, University of Alcalá, E-28871, Madrid, Spain
[d] Physiotherapy and Nursery Department, University of the Balearic Islands, E-07122, Mallorca, Spain

ARTICLE INFO

Article history:
Received 29 March 2016
Received in revised form
6 July 2016
Accepted 22 August 2016

Keywords:
Manual therapy
Proprioception
Exercises
Ankle sprain

ABSTRACT

Background: Recurrent ankle sprains often involve residual symptoms for which subjects often perform proprioceptive or/and strengthening exercises. However, the effectiveness of mobilization to influence important nerve structures due to its anatomical distribution like tibial and peroneal nerves is unclear.
Objetives: To analyze the effects of proprioceptive/strengthening exercises versus the same exercises and manual therapy including mobilizations to influence joint and nerve structures in the management of recurrent ankle sprains.
Study design: A randomized single-blind controlled clinical trial.
Method: Fifty-six patients with recurrent ankle sprains and regular sports practice were randomly assigned to experimental or control group. The control group performed 4 weeks of proprioceptive/strengthening exercises; the experimental group performed 4 weeks of the same exercises combined with manual therapy (mobilizations to influence joint and nerve structures). Pain, self-reported functional ankle instability, pressure pain threshold (PPT), ankle muscle strength, and active range of motion (ROM) were evaluated in the ankle joint before, just after and one month after the interventions.
Results: The within-group differences revealed improvements in all of the variables in both groups throughout the time. Between-group differences revealed that the experimental group exhibited lower pain levels and self-reported functional ankle instability and higher PPT, ankle muscle strength and ROM values compared to the control group immediately after the interventions and one month later.
Conclusions: A protocol involving proprioceptive and strengthening exercises and manual therapy (mobilizations to influence joint and nerve structures) resulted in greater improvements in pain, self-reported functional joint stability, strength and ROM compared to exercises alone.

1. Introduction

Lateral ankle sprain is the most common musculoskeletal injury among the physically active population (Gribble et al., 2016b), as well as the most prevalent ankle sprain type (85% of all ankle sprains) (Doherty et al., 2014). Although the residual pain often occurs between 5 and 25% even three years later (van Rijn et al., 2008), the development of chronic ankle instability (CAI) means a significant global healthcare burden that is associated to this injury between 20 and 41% of all lateral ankle sprains(Hubbard and Hicks-

* Corresponding author.
E-mail addresses: gustavo@fisioterapiamanual.es (G. Plaza-Manzano), ver.vergara90@gmail.com (M. Vergara-Vila), Val.sandra@hotmail.com (S. Val-Otero), cris309cr@gmail.com (C. Rivera-Prieto), daniel.pecos@uah.es (D. Pecos-Martin), tomas.gallego@uah.es (T. Gallego-Izquierdo), alejandro_sft@yahoo.es (A. Ferragut-García), narf52@gmail.com (N. Romero-Franco).
[1] Fax: +34 913941518.
[2] Fax: +34 918855008.
[3] Fax: +34 971172810.

http://dx.doi.org/10.1016/j.math.2016.08.006
1356-689X/

Little, 2008). In this sense, the main primary manifestation is a "giving away" subjective feeling of the ankle joint that often ends up in the recurrence of the ankle sprain.

Along with the subjective instability, patients also exhibit reductions in the sense of the ankle joint position, the range of motion of the ankle, and the strength of the ankle eversion muscles that may also facilitate this recurrence and thus, the CAI (Sizer et al., 2003; Holmes and Delahunt, 2009; Munn et al., 2010; Han and Ricard, 2011). Considering this symptomatology, an exercise and manual therapy based approach is needed to manage the CAI patients.

Manual therapy approaches are often included to benefit the range of motion, the residual pain and the consequent quality of life of these patients. The joint mobilization techniques in regions such as the astragalus and talocrural joint are often included reporting increases in ankle dorsiflexion range of motion and postural control, which may help restore the functional stability (Hubbard et al., 2005; Truyols-Dominguez et al., 2013; Hoch et al., 2014; Cruz-Diaz et al., 2015).

Exercise therapy approach is also considered through proprioceptive and strengthening exercises to improve the main postural control strategies during body perturbations and decrease the recurrence of the ankle sprain. The balance-perturbation training in stable and unstable platforms, anticipatory postural adjustments and/or elastic tube exercises are often included reporting excellent results in terms of pain, range of motion, function, and postural control strategies even after an only training session (Han et al., 2009; Santos et al., 2016).

Despite the benefits from manual therapy and exercise approaches both as separated therapies and combined programs (Truyols-Dominguez et al., 2013; Lubbe et al., 2015; Cleland et al., 2013) residual symptoms and recurrence persisted after several weeks of treatment. In this regards, it is important to note that neural structures in the ankle like the tibial and peroneal nerves may play a role in the residual symptoms due to its possible affectation during the plantar flexion with inversion (PFI) ankle sprain mechanism (Hunt, 2003). In fact, Nitz et al. (1985) referred to a possible neural damage in a high percentage of patients with ankle sprain grade III that could prolong the rehabilitation process (Nitz et al., 1985). However, no studies to date have considered the treatment of these neural structures, remaining unknown its effectiveness on the CAI residual symptoms. We hypothesis that including specific manual therapy mobilizations to influence nerve structures during a program combining manual therapy and exercise approaches may results on higher benefits for CAI symptoms.

Based on the aforementioned arguments, this study aimed to analyze and compare the effects of proprioceptive and strengthening exercises versus the same protocol of exercises plus manual therapy which included mobilizations to influence joint and nerve structures, on the management of CAI symptoms.

2. Material and methods

The present research refers to a single-blinded, randomized study, with two groups. Level of pain, self-reported functional ankle instability, pressure pain threshold (PPT), muscle strength and active range of motion were considered as outcome measures. This study was guided by the CONSORT statement and included the CONSORT checklist of information/items to include when reporting a randomized trial.

2.1. Subjects

Fifty-six subjects (39 men, 17 women) aged 20–38 years (24.3 ± 2.5) with recurrent PFI ankle sprains voluntary participated in this study. Participants were randomly recruited from a sample of 70 subjects of the University Hospital of the city, referred by medical practitioners (who were Orthopaedists experts in the ankle joint) to Physiotherapy. Participants were recruited in May 2014 and the study took place from May 2014 to June 2014, in the University Hospital of the city.

The eligibility criteria were based on those endorsed by the International Ankle Consortium (Gribble et al., 2016a). Inclusion criteria: a) previous initial PFI ankle sprain graded I, II or III (I, stretching; II, partial rupture; III, complete rupture of the ligament) (Amundson, 1991) at least 12 months prior to the study beginning, diagnosed by a medical practitioner expert in the ankle joint associated with inflammatory symptoms such as swelling and pain with at least one interrupted day of desired physical activity; b) recurrence of previous PFI ankle sprains (at least one recurrence); c) had not sprained the affected ankle in the last three months; c) regular sports practice (recreational activity at least three times a week). Exclusion criteria: a) surgical treatments or b) previous fractures in either lower extremity; c) adjacent pathologies that disturbed joint integrity or function (i.e. sprains) and required ad least one interrupted day of desired physical activity.

The sample size calculation was performed considering the Visual Analogical Scale (VAS) as the primary outcome measurement. The effect size for the VAS was considered at 0.25. The correlation between repeated measures was assumed in 0.5. Considering three measures (pre, post and one month later) in two treatment groups, the sphericity correction was determined at 1. We estimated a sample size of 44 participants with a statistical power of 0.95 and level alpha of 0.05. Since we considered a 30% drop out rate, the necessary sample size was of 56 participants (28 in each intervention group). We employed the software Gpower v.3.0.18.

2.2. Ethical considerations

According to the standards of the Declaration of Helsinki, all subjects provided written informed consent before data collection. Approval was obtained from the ethical committee from the University of the city: M2013/031/20131120.

2.3. Procedures

All participants were randomly classified into the Experimental I Group ($n = 28$) or the Experimental II Group ($n = 28$). For the randomization process, an external clinical assistant randomized the intervention to each participant using computer-generated random numbers with the Epidat software v.3.1. (EPIDAT, 2014) Assessors and therapists were blind to the group assignment. Experimental I Group performed proprioceptive and strengthening exercises over 4 weeks (two times per week); Experimental II Group performed the same exercises and manual therapy over 4 weeks. Participants were not informed about the true objective of the study to avoid bias. Also, the participants did not know about the existence of another intervention group to avoid a major engagement because of the treatment. In this way, participants were blinded.

2.3.1. Proprioceptive and strengthening exercises

The protocol consisted of four sessions of six exercises that were repeated twice a week and progressed every week (Table 1). The participants were always supervised by two physiotherapists with at least six years of experience in Sports Physiotherapy and physically active populations with musculoskeletal injuries (mainly ankle joint injuries), while performing all the exercise program sessions based on previous studies, having been previously shown to be successful (Mattacola and Dwyer, 2002; McKeon and Hertel, 2008).