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Original article

Hypoalgesic effect of a passive accessory mobilisation technique in patients with lateral ankle pain

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ABSTRACT

A randomised, double blind, repeated measures study was conducted to investigate the initial effects of an accessory mobilisation technique applied to the ankle joint in 13 patients with a unilateral sub-acute ankle supination injury. Ankle dorsiflexion range of motion, pressure pain threshold, visual analogue scale rating of pain during functional activity and ankle functional scores were assessed before and after application of treatment, manual contact control and no contact control conditions. There were significant improvements in ankle dorsiflexion range of motion ($p = 0.000$) and pressure pain threshold ($p = 0.000$) during the treatment condition. However no significant effects were observed for the other measures. These findings demonstrate that mobilisation of the ankle joint can produce an initial hypoalgesic effect and an improvement in ankle dorsiflexion range of motion.

1. Introduction

Supination ankle sprain injuries are common with sporting activities that require jumping, running (Bahr et al., 1994) or rapid changes in direction (Brukner and Khan, 2001). Swelling, haematoma and painful ankle movement (especially dorsiflexion and plantar flexion-inversion) are common complaints after an acute supination injury. The decreased ability to dorsiflex the ankle can result in a functional deficit (Safran et al., 1999a; Brukner and Khan, 2001) and is an indication of injury severity (Reid, 1992).

Conservative management in the form of functional rehabilitation is widely recommended; this may include the use of joint mobilisation (Reid, 1992; Rundle, 1995; Safran et al., 1999b; Brukner and Khan, 2001).

There are different types of mobilisation techniques including Maitland's physiological and accessory movement techniques (Maitland, 1991) and Mulligan's mobilisation with movement (MWM) techniques (Mulligan, 1995), which are widely employed by physiotherapists to reduce pain and improve range of motion in peripheral joints.

Whilst some research has been reported on the use of mobilisation with movement techniques in the upper limb (Vicenzino et al., 2001; Paungmali et al., 2003), limited research is available in relation to the effects of peripheral joint mobilisation techniques in the lower limb. There is also limited research investigating the effects of joint mobilisation techniques as opposed to mobilisation with movement techniques. Moss et al. (2007) showed that an accessory mobilisation technique applied to the tibio-femoral joint in patients with knee osteoarthritis produced a significant increase in pressure pain threshold and improvements in function. Sluka and Wright (2001) showed that a similar mobilisation of the rat knee joint reversed the hyperalgesia produced by injection of capsaicin into the ipsilateral ankle joint. Using this model, Skyba et al. (2003) demonstrated that the antihyperalgesic effect of joint mobilisation is mediated by the release or serotonin and nor adrenalin acting to inhibit pain projection neurons in the spinal cord.

Collins et al. (2004) evaluated the effect of a weight bearing MWM technique designed to improve ankle dorsiflexion range of motion in a group of subjects with sub-acute ankle sprain. Interestingly, the authors were able to demonstrate a significant improvement in ankle dorsiflexion range of motion but no hypoalgesic effect on pressure pain threshold (PPT) despite the fact that subjects exhibited reduced PPT in the affected ankle compared to the contralateral ankle. It has also been shown that both weight bearing and non-weight bearing MWM techniques have similar effects and can produce significant improvements in ankle dorsiflexion range of motion (Vicenzino et al., 2006). This lack of a hypoalgesic effect appears to contrast with the effects of joint mobilisation techniques.

There is a clear need for further research to investigate the effects of peripheral joint mobilisation techniques. In particular there is a need to evaluate the ability of joint mobilisation techniques to

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produce a demonstrable hypoalgesic effect. This study investigated the effects of a passive accessory mobilisation designed to increase ankle dorsiflexion range of motion in patients with lateral ankle sprain. Changes in pressure pain threshold, ankle range of motion and performance on a battery of functional tests were assessed.

2. Methods

2.1. Research design

A randomised, controlled, double blind within-subject repeated measures study was conducted to evaluate changes in PPT, ankle dorsiflexion range of movement and ankle functional scores immediately following the application of an accessory joint mobilisation technique to the ankle joint.

The study was approved by the Human Research Ethics Committee at Curtin University of Technology.

2.2. Subjects

Subjects were recruited voluntarily through advertisements placed in University campuses, sports venues and clubs, local community newspapers and from referral by sports trainers and physiotherapists from metropolitan and suburban areas in Perth, Western Australia. Subjects were screened for the mechanism of ankle injury and the duration of the current complaint and were scheduled to participate in the study if they met the selection criteria.

A total of 13 subjects (10 males and 3 females; Age 29.5 years, range 20–49 years; duration of injury 5 weeks, range 2–10 weeks) with a recent supination sprain of the ankle participated in the study. Five potential subjects were excluded before the commencement of the study. Two subjects had a moderate amount of medial ankle pain, 2 subjects had knee pathologies that can affect functional performance and 1 subject had a previous history of ankle fracture.

Six subjects sustained their injury while playing soccer, 2 subjects each playing netball and walking downstairs; and 1 subject each playing hockey, badminton and basketball. Three subjects received medical treatment at the Emergency Department with X-rays of the ankle taken while the others reported self management for their ankle injuries. All subjects complained of lateral ankle pain that affected or prevented them from running, squatting and jumping. Two subjects also reported gradual onset of lateral ankle pain and swelling after prolonged walking.

2.2.1. Inclusion and exclusion criteria

The criteria for inclusion in this study were (i) Grade 2 sub-acute ankle supination injury, (ii) injury should have occurred between 2 and 10 weeks prior to commencement of the study, (iii) subjective assessment required all subjects to have persistent lateral ankle pain while performing functional activities but still be able to fully weightbear and (iv) a difference of at least 20% in ankle dorsiflexion range of motion and PPT between the injured and non-injured ankle at the initial assessment.

A pre-study clinical examination was performed by the primary researcher prior to commencement of the first study session to ensure that all subjects met the selection criteria. This included obtaining a thorough history of the ankle injury, the initial management, their main complaints and aggravating factors for ankle pain. Areas of swelling and tenderness around the lateral ankle region were noted. Physical examination of active and passive ankle range of motion, passive joint movement, manual muscle testing and palpation of the ankle joint and lower leg were performed. Anterior drawer test of the talus, inversion stress test and the inversion-plantar flexion stress test were conducted to determine the severity of the ankle injury. Further tests were performed to determine a differential diagnosis if required.

Subjects with a suspected fracture, intra-articular swelling, medial ankle sprain, mid-foot injuries, syndesmotic sprains or injuries affecting other lower limb structures detected during the pre-study examination were excluded from the study. As noted above, five subjects were excluded before the commencement of the study.

2.3. Experimental protocol

The study was conducted in the pain research laboratory in the School of Physiotherapy, Curtin University of Technology. All subjects attended 3 study sessions scheduled at least 48 h apart. Each session consisted of an experimental condition implemented by an experienced physiotherapist and pre and post intervention measurement conducted by a blinded researcher.

2.4. Interventions

The intervention conditions consisted of a treatment condition (ankle joint mobilisation), a manual contact control condition, and a no contact control condition. All subjects received the 3 experimental conditions in randomised order over 3 different study sessions at least 48 h apart. All experimental conditions were provided by an experienced physiotherapist with a post-graduate qualification in manual therapy.

The treatment condition used in this study was Maitland's passive accessory mobilisation of the talus on the distal tibia and fibula. This involved the manual application of a repetitive gentle oscillation of the talus in an anterior–posterior direction. The therapist used one hand to stabilize the subjects' distal tibia and fibula while grasping around the anterior surface of the talus with the other hand and providing a firm but gentle oscillation (Maitland, 1991). The position of the subject was modified such that the subjects were in long sitting with a folded towel placed under the injured leg. The knee was maintained in slight flexion. The mobilisation technique was performed for 1 min and was repeated three times with a 30 s rest interval between applications. The force used for this mobilisation technique was firm enough to provide a gliding movement of the talus against the end of range of the joint but gentle enough to avoid pain re-production.

During the manual contact control condition the therapist and subject were in the same position as the treatment condition with similar manual contact on the ankle joint, however the talus was translated to the end of available range and that position was sustained. The duration of hand contact on the ankle was the same as the treatment condition.

The no contact control condition involved the same positioning of the subject as described in the treatment condition but there was no physical contact between therapist and subject. This condition was maintained for the same period of time as the treatment condition.

2.5. Outcome measures

Outcome measures were obtained prior to and immediately after each intervention for the injured ankle. Measurements of the non-injured ankle were conducted only prior to the first study session to obtain values for comparison. These measures included ankle dorsiflexion range of movement, pressure pain threshold and ankle functional performance.

2.5.1. Ankle dorsiflexion index

Ankle dorsiflexion measurements were performed using the weight bearing lunge position. This technique is easily performed,