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Original article

The effects of caudal mobilisation with movement (MWM) and caudal self-mobilisation with movement (SMWM) in relation to restricted internal rotation in the hip: A randomised control pilot study

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ABSTRACT

Background: A loss of internal rotation (IR) of the hip is associated with hip pathology. Improving IR may improve hip range of motion (ROM) or prevent hip pathology.
Objectives: The purpose of this study was to compare the immediate effects of caudal mobilisation with movement (MWM) and caudal self-mobilisation with movement (SMWM) on young healthy male subjects with reduced IR of the hip.
Design: A randomised controlled trial was performed. Twenty-Two subjects were randomised into a MWM group (n = 6), SMWM group (n = 8) or a control group (n = 8).
Method: The primary outcome measures included the functional internal rotation test (FIRT) for the hip and the passive seated internal rotation test (SIRT) for the hip. Outcomes were captured at baseline and immediately after one treatment of MWMs, SMWMs or control.
Results: A two-way analysis of variance (ANOVA), group × time interaction was conducted. The ANOVA revealed the only significant improvement was in the MWM group for the FIRT ($p = 0.01$), over the control group. Subjects with reduced IR of the hip who receive a single session of MWMs exhibited significantly improved functional IR of their hip than the control group.
Conclusions: From the data presented, it can be suggested that caudal MWMs of the hip appear to have a positive effect on functional IR of healthy young hips. This may be due to addressing the positional fault theory or the arthrogenic muscular inhibition theory. SMWMs may be effective in augmenting treatments for patients waiting for hip operations.

1. Introduction

Hip and groin injuries amongst professional English soccer players account for 12.0% of injures (Hawkins et al., 2001). Diagnosing hip pain in young adults continues to be a challenge and is most common in males (Casartelli et al., 2011). Boykin et al. (2013) suggests soft tissue injuries are believed to predispose patients to adaptive bony changes of the hip such as femoral acetabular impingement (FAI). Limited hip ROM is believed to be a predisposing factor in lower limb and trunk pain (Barbee Ellison et al., 1990; Almeida et al., 2012). Restriction in hip flexion and or internal rotation (IR) is strongly associated with FAI (Boykin et al., 2013). Patents with osteoarthritis (OA) often present with altered pelvic-femur alignment (Grimaldi et al., 2009). Hip and groin pain/positive impingement tests are a common finding in young active males which may be a precursor to osteoarthritis (Nogier et al., 2010). Freeman et al. (2013) suggests that the phenomenon of arthrogenic muscular inhibition (AMI) of the glutaeus maximus is present in hip pathology. AMI is believed to inhibit muscle activation at the site of acute injury as a defence reflex, but may itself lead to a chronic cause of re-injury. Experimentally induced effusion of the hip joint has been shown to inhibit glutaeus maximus activation (Freeman et al., 2013). Poor proprioceptive awareness of the hip may inhibit the glutaeus maximus muscle which is a major component of propulsion and stability (Yerys et al., 2002).

The proposed mechanism behind MWMs is the positional fault hypothesis (Abbott, 2001). MWMs involve an accessory glide in conjunction with a physiological movement, performed by the therapist or patient. MWMs should be performed pain free and the effects should be long lasting (Hing and Mulligan, 2011). Small adjustments, "*tweakology*", can be used to maximise the effect of MWMs (Hing et al., 2008). Kachingwe et al. (2009) suggests that MWMs should be performed in the position that causes the most agitation. The anterior impingement test (AIT) as described by

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Ratzlaff et al. (2013) incorporates adding adduction, and then IR, to a hip flexed to 90.0°. Often MWMs are performed in functional weight bearing positions (McDowell et al., 2014). The prevalence of OA of the hip is becoming a considerable problem for modern society especially as the incidence of OA of the hip increases with the ageing population (Grimaldi et al., 2009). It has been recognised that self-management is an important aspect to patient management in hip pathology clinical presentations (Cowan et al., 2010). Self-Management is an important consideration, in an Irish context, due to waiting lists in the free public sector (French, 2007). In the United Kingdom, the National Health System continues to have long waiting lists for surgical management for patients presenting with end stage hip pathology. Therefore self-management of these patients is crucial to minimise healthcare cost associated with surgical wait lists. Caudal self-mobilisation with movement may offer an alternative pain management strategy to exercise and pharmacology.

The body of research in to MWMs is in relation to the immediate effect of MWMs (Teys et al., 2008; Katchingwe et al., 2009). Hing and Mulligan (2011) state that the effect of MWMs are long lasting. However the research in to establishing the time frame of the benefits of MWM are sparse, the literature would suggest that if there is an instantaneous improvement the benefits of MWM can last up to 3 months (Doner et al., 2013; Teys et al., 2013). This is especially pertinent if there is an effective way to supplement MWM treatments with SMWMs.

This is the first randomised study that investigates the effects of MWMs in relation to the hip joint (Hing et al., 2009). Wright and Hegedus (2012) reported the use of home mobilisations using a heavy elastic resistance band. Using a resistance band would allow the subject to maintain an accessory glide throughout the SMWM which is a crucial aspect of the MWM concept (Teys et al., 2013). Many of the recent investigations involving MWMs (Katchingwe et al., 2009; Doner et al., 2013; Teys et al., 2008, 2013) are associated with the shoulder joint and show promising results. There are no studies to date that investigate the use of home exercises to replicate MWM. However, there are positive effects of using taping to augment MWMs (Djordjevic et al., 2012; Teys et al., 2013; Yoon et al., 2014). The use of home exercises may improve self-management which is a key goal to rehabilitation (French, 2007; Cowan et al., 2010).

This pilot study aims to assess whether MWMs and SMWMs can be implemented into the management of hip pain in young males to improve hip internal rotation. Thus it was hypothesised that a caudal MWM with adduction as the movement would increase IR ROM in a healthy restricted hip. Also that SMWMs would be as effective as therapist induced MWMs.

2. Methodology

2.1. Study design

The Study was a parallel-group single blind randomized pilot study (Fig. 1). Patients were blinded to the treatment technique received. The randomisation schedule was prepared using random function in Excel® 2010 (*Microsoft Corp*., Redmond, Washington, USA) for windows® 7 (*Microsoft Corp*., Redmond, Washington, USA). Subjects were randomly assigned into the order in which the outcome measures would be recorded thus avoiding any sequencing effect using random function in Excel® 2010 for windows® 7. Ethical approval was sought in line with Institute of Technology Carlow's Ethics Board. Subjects completed an informed consent form.

2.2. Subject selection

Forty-six male subjects aged 20 ± 1.80 were recruited using convenience sampling for this pilot study between September 2014 and December 2014. The recruitment pool consisted of volunteers from Science and Health Department and Sports Development Courses at Institute of Technology Carlow. Subjects were included in the pilot study provided that they participated in multidirectional sports. Hip and groin injuries have a high prevalence in young active males who participation in multidirectional sport such as soccer (Boykin et al., 2013). Subjects also had to have had an IR ROM in the hip of 30.0° or less in prone. Burns et al. (2011) used IR of less than 30.0° as an inclusion criterion in a study in hip mobilisation.

Subjects were excluded (n = 6) from the study if they reported having had a lower extremity injury in the past six months; having undergone surgery on the hip in the past year; having being diagnosed with rheumatoid arthritis, osteoarthritis or any neurological conditions. Subjects were also excluded if they had a positive AIT (Fig. 2) as described by Ratzlaff et al. (2013). The AIT is performed in supine. The tested leg was passively brought into 90.0° of flexion, fully adducted, and internally rotated. The test was considered positive if any of the movements elicit pain. Twenty-Two eligible subjects presented to the Institute of Technology Carlow's Physiology Laboratory for assessment of baseline measures, having abstained from vigorous activity for 24 h prior to initial testing. Subjects presented themselves no more than seven days after baseline testing, again having abstained from vigorous activity for 24 h for pre-test measurements. Post-Test measures were completed immediately after the interventions.

2.3. Interventions

2.3.1. MWM Group

The subject was set up in four-point-kneeling on a plinth. To ensure the subject's hips stayed in 90.0° of flexion the tester positioned their hands on the subject's greater trochanters. All MWMs were administered by a single undergraduate with 1 year clinical experience. The MWM was performed with a caudal glide to the femur applied with a Mulligan® mobilisation belt (*Mulligan Products and Tape*, Vught, the Netherlands) modified from Hing and Mulligan (2011). The mobilisation belt was positioned as proximally on the femur as was comfortable for the subject. The subject was instructed to inform the tester if there was any pain or discomfort, thus allowing for minor adjustments (Hing et al., 2008). MWM's should be performed with sufficient over pressure to effect the joint. The MWM must also be performed pain free, requiring communication between subject and tester (Abbott, 2001). To produce adduction the subject leaned their hips ipsilaterally to the affected side (Fig. 3).

2.3.2. SMWM Group

All SMWMs were supervised by the same undergraduate student with 1 year clinical experience. For the SMWMs, the subjects were in four-point-kneeling on the floor. The tester gave verbal feedback to the subject to ensure the subject's hips maintained 90.0° of flexion. A caudal glide was produced with a level 3 Crossmaxx® elasticated resistance band (*Lifemaxx Fitness Accessories*, Rotterdam, the Netherlands) which was tethered to a secure vertical beam of a squat rack. The resistance band was comfortably positioned as proximally on the femur as possible. The subject was instructed to inform the tester if there was any pain or discomfort, minor adjustments were made to ensure pain free movement. The subject leaned towards the affected leg to produce adduction. There is no literature in relation to using resistance bands to replicate MWMs, Reiman and Matheson (2013), however, offer clinical suggestions for self-mobilisations that could be easily adapted to simulate MWMs (Fig. 4).