Journal of Bodywork & Movement Therapies xxx (2017) 1–5

Contents lists available at ScienceDirect

Journal of Bodywork & Movement Therapies

journal homepage: www.elsevier.com/jbmt

Comparative randomized clinical trial

The effects of cryotherapy versus cryostretching on clinical and functional outcomes in athletes with acute hamstring strain

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ARTICLE INFO

Article history:
Received 14 February 2017
Received in revised form
22 July 2017
Accepted 26 July 2017

Keywords:
Ice
Stretch
Soft tissue injury
Range of motion
Pain
Function

ABSTRACT

Purpose: Hamstring strain is a common sport injury that results in pain and functional limitation. Despite its high frequency in active populations, there is no agreement regarding the best method used for early intervention of hamstring strain. The aim of the present study was to compare the effects of cryotherapy and cryostretching on clinical and functional outcomes in athletes with acute hamstring strain.

Materials and methods: Thirty seven elite athletes with an acute grade I or II hamstring strain were randomly assigned to either cryotherapy (n = 19) or cryostretching (n = 18) group, receiving 5 sessions of supervised treatment plus home-based intervention monitored by the therapist. Pre-treatment to post-treatment changes in pain, active and passive knee extension range of motion and functional status were compared between the two groups.

Results: Compared to cryotherapy, cryostretching resulted in larger improvement of function and passive knee extension range of motion. Changes in active knee extension range of motion and pain severity were not significantly different between the two groups.

Conclusion: A rehabilitation protocol involving gentle stretching following cryotherapy is more effective than cryotherapy alone in the improvement of function and passive knee range of motion in patients with grade I and II hamstring strain.

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1. Introduction

Hamstring strain is the most common muscle strain among competitive athletes (Dadebo et al., 2004). This injury occurs in sports that require extensive lengthening of hamstring, such as running, jumping and kicking (Heiderscheit et al., 2010; Sherry, 2012). Due to slow healing rate, hamstring strain has a long recovery time leading to absence from competition (Drezner, 2003; Kerkhoffs et al., 2013; Sherry et al., 2015). Delayed healing process leads to persistence of pain, functional limitation and re-injury (Malliaropoulos et al., 2004). Despite high incidence of hamstring strain, there is still no consensus on the best method used for early intervention (Reurink et al., 2012).

Cryotherapy has been suggested as an effective and simple therapeutic modality for pain management after acute injuries (Bleakley et al., 2004; Point et al., 2017). Inhibitory effects of cold on pain and muscle spindle depolarization results in reduction of muscle spasm and thereby improving muscle relaxation (Algafly and George, 2007; Rancour et al., 2010). This increases patients' capacity to perform pain-free exercise (Heinrichs, 2004). Cryotherapy accelerates the course of treatment by decreasing metabolic rate and resultant hypoxic injuries of the tissue and postponing hematoma formation (Heinrichs, 2004; Malanga et al., 2015). Despite lack of evidence of an effect of cryotherapy on muscle strain, the use of ice in clinical practice has been advocated.

Therapeutic effects of cold application can be enhanced if it combines with stretching, known as cryostretching (Heinrichs, 2004). Stretching as one mode of stress delivery can accelerate fibroblastic activity and stimulate expression of several growth factors involved in regeneration of the injured muscle (Jarvinen

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http://dx.doi.org/10.1016/j.jbmt.2017.08.007
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Please cite this article in press as: Sefiddashti, L., et al., The effects of cryotherapy versus cryostretching on clinical and functional outcomes in athletes with acute hamstring strain, Journal of Bodywork & Movement Therapies (2017), http://dx.doi.org/10.1016/j.jbmt.2017.08.007

et al., 2005; Malliaropoulos et al., 2004). Gentle stretching can help to restore tensile strength of the healing tissue by inducing more rapid growth of capillary blood vessels and more parallel orientation of muscle fibers (Jarvinen et al., 2005). Besides the histological changes, biomechanical strength of the injured muscle returns more quickly to the level of un-injured muscle following stretching (Jarvinen et al., 2005). Stretching shifts the angle-torque relationship and helps to restore the strength of the injured muscle (McHugh and Cosgrave, 2010). It is also believed that stretching helps to optimize healing by improving elasticity and valence of the injured muscle, preventing muscle atrophy and loss of extensibility (Jarvinen et al., 2005).

Given these findings, we assume that the combined effects of stretch and cold application are greater than the effects of cold application alone. Although the effect of cooling and cryostretching on flexibility of hamstring has already been examined in healthy adults (Gkrilias et al., 2017), the effectiveness of incorporating stretching exercise with cryotherapy has not been investigated before in athletes with acute muscle strain. Therefore, the aim of this study was to compare the short-term effects of cryostretching and cryotherapy on pain, range of motion and functional status in athletes with acute hamstring strain. We hypothesized more improvement of pain, range of motion and function following hamstring strain in cryostretching group compared to cryotherapy group.

2. Material and methods

2.1. Participants

From April 2014 until June 2015, thirty seven athletes with acute hamstring strain volunteered to participate in this study (Fig. 1). Participants were recruited from physician practices, physical therapy centers and National Olympic Academy of Iran. All athletes had taken part in sport activity for at least two years, three times per week for a minimum of 2 h each time. Participants within age range of 18–40 years from both genders were included in the present study. They were diagnosed by a sport medicine physician. All participants had grade I or II strain that induced pain during resisted prone knee flexion and passive straight leg raise test (Guillodo et al., 2014; Sherry and Best, 2004). Participants had no hip flexor muscle shortness (diagnosed by Thomas test), hypersensitivity or cold intolerance, complete muscle disruption, history of lower limb fracture, previous lower limb injury that required surgery or other kind of treatment within the past 6 months and history of malignant disease or radiculopathy (positive active slump test (Heiderscheit et al., 2010)). Participants who had experienced hamstring strain within the preceding 48 h were eligible to take part in this study. Each participant signed an informed consent form approved by ethics committee of Tehran University of Medical Sciences.

2.2. Design

This study was a randomized clinical trial in which athletes were randomly assigned to the cryotherapy (n = 19; female/male: 8/11) or cryostretching (n = 18; female/male: 8/10) group. Randomization was performed using random number table. Nineteen cards printed with odd number and nineteen cards printed with even number were created. Each card was placed inside an envelope. Following baseline assessment, athletes were asked to select one of the two envelopes indicating group assignment. One of the investigators (LS) carried out subject recruitment, delivered treatments, and performed all pre-treatment and post-treatment assessments.

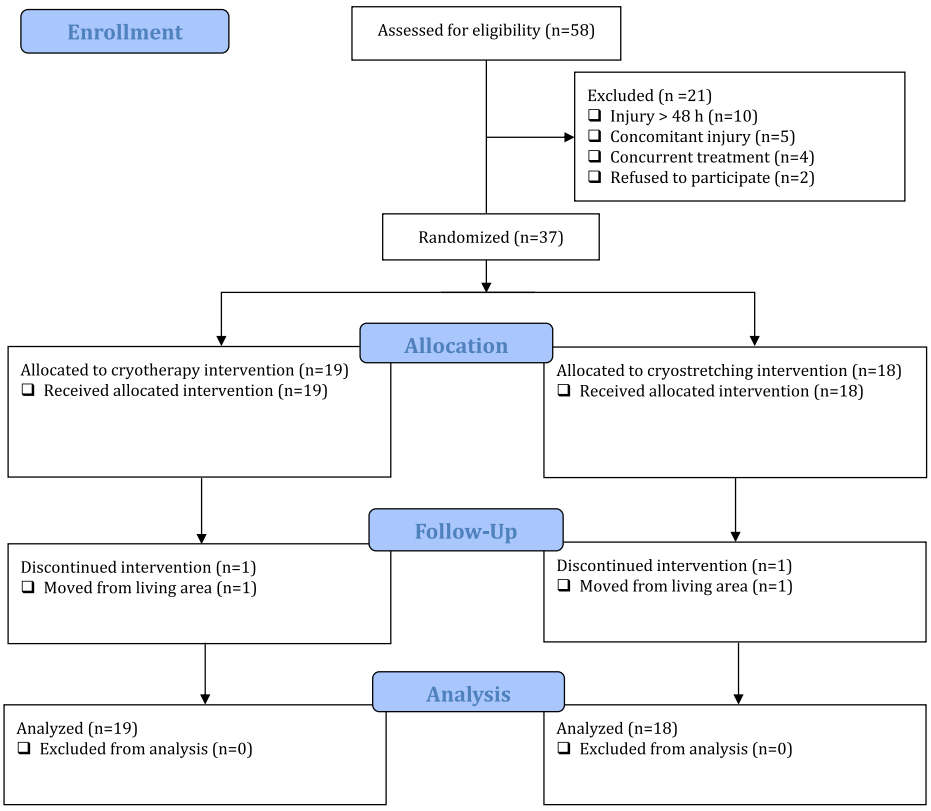

Fig. 1. Consort diagram showing the flow of participants through the study.

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