

Research article

Comparison of the Effects of Local Cryotherapy and Passive Cross-body Stretch on Extensibility in Subjects with Posterior Shoulder Tightness

Kyue-nam Park¹, Oh-yun Kwon¹✉, Jong-hyuck Weon², Sung-dae Choung³ and Si-hyun Kim³

¹Department of Physical Therapy, Kinetic Ergocise Based on Movement Analysis Laboratory, College of Health Science, Yonsei University, Wonju, South Korea; ²Department of Physical Therapy, College of Tourism & Health, Joongbu University, Chungnam, South Korea; ³Department of Physical Therapy, Graduate School, Yonsei University, Wonju, South Korea.

Abstract

The objective was to compare the immediate effects of local cryotherapy (LC) and passive cross-body stretch on the extensibility of the posterior shoulder muscle in individuals with posterior shoulder tightness. Eighty-seven healthy subjects with a between-shoulder difference in internal rotation (IR) range of motion (ROM) greater than 10° were randomly divided into three groups: LC group, stretching group, and control group (n = 29 in each group). Subjects in the LC group received LC on infraspinatus and posterior deltoid muscles and subjects in the stretching group performed passive cross-body stretch. Stretch sensation was measured at the end range of passive IR and horizontal adduction (HA) using numerical rating scale, and the pressure pain threshold (PPT) at the infraspinatus and posterior deltoid muscles was measured using pressure algometry. Passive and active ROM of IR and HA of the glenohumeral joint were measured using an inclinometer. All measurements were performed at pre-intervention, post-intervention, and 10-min follow-up. Stretch sensation was significantly decreased and PPT was significantly increased in the LC and stretching groups at post-intervention, and these effects were maintained at 10-min follow-up, compared to the control group. Both the LC group and stretching group had a significantly greater increase in passive and active ROM of IR and HA, compared to the control group at post-intervention and 10-min follow-up. However, there were no significant differences in stretch sensation, PPT, or ROM of IR and HA between the LC group and stretching group. LC can be used to decrease the stretch sensation and increase PPT and ROM of IR and HA as much as a stretching exercise. LC could be an alternative method for increasing the restricted ROM of glenohumeral IR and HA for individuals with posterior shoulder tightness, especially for patients and sports players who have severe stretching discomfort.

Key words: Cryotherapy, muscle stretching exercise, shoulder.

Introduction

Posterior shoulder tightness is a common cause of shoulder impingement syndrome, labral lesions, and rotator cuff tears in clinical rehabilitation and sport activities (Ludewig and Cook, 2002; Tyler et al., 2000; Wilk et al., 2002; 2005). Posterior shoulder tightness is often assessed by measuring the range of motion (ROM) of glenohumeral internal rotation (IR) and horizontal adduction (HA) (Bach and Goldberg, 2006; McClure et al., 2007). A restricted ROM of IR and HA is caused by tightness

of posterior muscles (i.e., infraspinatus and posterior deltoid) and the posterior capsule (Borsa et al., 2005; Poser and Casonato, 2008; Yang et al., 2012). Passive cross-body stretch is an effective method for stretching these areas (McClure et al., 2007).

Short-term (3- to 8- week) stretching program increases ROM by changing mechanical properties, such as increasing the length of stretched muscle, inducing elongating connective tissue, and increasing the number of sarcomeres in series (McNair et al., 2001; Taylor et al., 1995; Reid and McNair, 2004). However, although ROM increases after single stretching session, increased muscle length is transient and some studies have demonstrated that muscle stiffness (passive torque/ angle curve) do not change significantly (Law et al., 2009; Ben and Harvey, 2010; Björklund et al., 2001). Increased muscle extensibility after stretching is due to sensory modification, rather than increased muscle length, an idea referred to as sensory theory (Nelson and Bandy, 2004; Weppeler and Magnusson, 2010). Namely, stretching can increase the stretch tolerance at the terminal position of the stretch, resulting in increased muscle extensibility and ROM (Folpp et al., 2006; de Weijer et al., 2003; Weppeler and Magnusson, 2010).

A previous study speculated that local cryotherapy (LC) may help endure the uncomfortable stretch sensation, felt at the final position of the stretch (Brodowicz et al., 1996). Stretching the hamstring with ice on it more effectively improved supine hamstring flexibility than both stretching alone and stretching with heat (Brodowicz et al., 1996). In addition, whole body cryotherapy effectively increases the active ROM of glenohumeral flexion, abduction, external rotation, and IR in patients with adhesive shoulder capsulitis (Ma et al., 2013).

To date, no studies have investigated the effects of LC on posterior shoulder muscles for the improvement of ROM of IR and HA, through modification of the stretch sensation at the end range of passive IR and HA. Thus, in this study, we investigated the effects of LC on the stretch sensation and on the ROM of glenohumeral IR and HA, comparing it to passive cross-body stretch and no stretching. We also investigated the lasting effects of LC and stretching (separately) at a 10-min follow-up assessment. We hypothesized that LC would decrease the uncomfortable stretch sensation, resulting in an increased ROM of IR and HA and have a lasting effect, similar to stretching.