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## ORIGINAL ARTICLE

### EFFECT OF CRYOTHERAPY ON JOINT POSITION SENSE – AN EXPERIMENTAL STUDY

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Dr. Tilak Francis T G, MPT<sup>1</sup> and Deepika S<sup>2</sup>

Corresponding Author:

<sup>1</sup>Associate professor, school of physiotherapy, vels university, Chennai, India. Mail id: [tilak.sp@velsuniv.ac.in](mailto:tilak.sp@velsuniv.ac.in)

Co author:

<sup>2</sup>BPT Internee student, Vels university, Chennai, India.

### Abstract

**Back Ground of the Study:** The slowing of nerve conduction is commonly a desired effect of cryotherapy, the use of cryotherapy in DOMS (delayed onset of muscle soreness) remains questionable. The aim of this study was to present data on DOMS induced position sense of healthy ankle after cryotherapy to clarify the effectiveness and safety of this therapy. Delayed onset of muscle soreness is defined as the sensation of discomfort or pain in the skeletal muscles following physical activity, usually eccentric to which an individual is not accustomed. Although muscle soreness usually occurs on less physically trained individuals, most people including athletes can experience this soreness.

**Methodology:** The subjects were allocated in to two groups, 10 in each group. After inducing DOMS, subjects in group A were assessed for joint position sense every day for 3 consecutive days and subjects in group B were given cryotherapy with elastogel cold wrap and assessed for the same as of group A. Mean difference between groups of pre and post test scores were analysed to find the outcome.

**Result:** This study found that there is a significant difference in mean values of scores in joint position sense when compared between the group A and B after applying elasto-gel cold wrap. **Conclusion:** This study concluded that elasto gel cold wrap application is more effective after DOMS, which improves the joint position sense thereby decreasing the undue effect of DOMS.

**Keywords:** Delayed onset of muscle soreness, joint position sense, elasto-gel cold wrap.

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## INTRODUCTION

The term cryotherapy refers to decreasing of the tissue temperature by the removal of heat from the body to achieve a therapeutic benefit. Despite this conceptual simplicity, controversy and confusion exist within clinical practice and published literature over the therapeutic benefits and application protocols of cold therapy. Cryotherapy or icing and or submersion of the foot and ankle in cold water, is a well known treatment method for both acute and chronic athletic injuries because it reduce pain, inflammation and muscle spasm. Also, cryotherapy influences neuro muscular properties including conduction velocity of nerve and muscle contraction. In fact, results from previous research suggest a linear relationship between the rate of muscle spindle discharge and muscle temperature<sup>1</sup>. This is important, because any change in afferent signal can in return lead to motor response modification.

The proprioceptive effects of cryotherapy may be explained neurophysiological by reference to the reduction of nerve conduction velocity and the eventual blocking of conduction. Although the slowing of nerve conduction is commonly a desired effect of cryotherapy, it may not be desirable before exercise training. Cryotherapy before exercise may result in inadequate peripheral feedback on the position sense and may change biomechanics properties of the ankle joint<sup>2</sup>. Afferent input from the dynamic stabilizer muscles surrounding the ankle joint may play an important role in the prevention of ankle sprains. It can be assumed that, if neural and muscular response is minimized by the treatment, ankle injury may occur when exercise is resumed.

For cryotherapy, Elasto gel cold wrap stay for 20 to 40 minutes after two or more hours in the freezer. The cool temperature treats

acute pain from new injuries, post trauma or surgical procedures. This method of cold therapy also aids in reducing swelling and inflammation for many areas the body.

Proprioception is vital in coordinating body parts and controlling muscles to activate movements. Swenson<sup>11</sup> defined proprioception as afferent information travelling to the central nervous system in 1906. Which encompasses number different components including kinesthesia, somatosensation, balance, reflexive joint stability and joint position sense? More recently, the term proprioception has evolved into including measures of joint position sense, threshold of detection of passive movement and force reproduction. Proprioceptive control may differ depending on the joint tested. However, exact mechanism of proprioceptive control remains unclear. Angular measurements have been used by researchers to assess joint position sense as one of the sub modalities of proprioception. Joint position sense measures the individual's ability to perceive the position of a joint with his or her vision occluded and minimal exteroceptive cues. In Clinical setting, joint position sense is often referred to as proprioception.

Delayed onset muscle soreness (DOMS) also termed as muscle fever, is the pain and stiffness of the muscles felt several hours to days after unaccustomed or excessive exercise<sup>3</sup>. Delayed onset muscle soreness is one symptom of exercise-induced muscle damage. The soreness is felt as dull aching pain in the involved muscle, often in combination with tenderness and stiffness. The pain is typically perceived only when the muscle is lengthened, contracted or put under pressure, not when it is at rest. Although there is variance among exercises and individuals, the soreness usually increases in intensity in the first 24 hours after exercise. It

peaks from 24 to 72 hours, then subsides and disappears up to 7 days after exercise. The soreness is caused by eccentric exercise that is exercise consisting of eccentric contraction of the muscles<sup>4</sup>.

Goniometer is an instrument that either measures an angle or allows an object to be rotated to an accurate angular position. The term Goniometer is derived from two Greek words, Gonio meaning angle and metron meaning measure. The first description of a goniometer derived from the Astrolabe, was apparently in 1538 by Gemma Friseur. According to previous studies, the various instruments that measure joint position are reliable. The ankle joint was selected for the assessment of proprioception in this study because of its predominant role in postural control<sup>5</sup>.

#### **Aim of the study**

The aim of this study was to present data on the delayed onset muscle soreness (DOMS) induced position sense of healthy ankle after cryotherapy to clarify the effectiveness and safety of this therapy.

#### **Background of the Study**

Delayed onset muscle soreness is defined as the perception of discomfort or pain in the skeletal muscles following exercise activity. Although muscle soreness usually occurs on less physically trained individuals, most people including athletes can experience this soreness well.

The mechanism involved in delayed onset muscle soreness (DOMS) are still being studied and refined. Understanding of delayed onset muscle soreness can perhaps learn to deal with the effect of muscle fiber damage.

#### **Need for the study**

Most of us would have experienced muscle soreness and stiffness in the exercised muscles and joints. This study is to find the effect of cryotherapy on induced delayed onset muscle soreness.

#### **Objective**

To find the effectiveness of elasto-gel cold wrap in normal joint position sense on induced delayed onset of muscle soreness (DOMS).

#### **Hypothesis**

**Null hypothesis:** There is no significant difference with the effect of cryotherapy on delayed onset muscle soreness induced ankle joint position sense.

**Alternate hypothesis:** There is a significant difference with the effect of cryotherapy on delayed onset muscle soreness induced ankle joint position sense.

#### **METHODOLOGY**

**Sample:** Subjects for the study were selected from students of Vels University, school of physiotherapy, Thalambur. All the subjects will be considered for the study after they sign an approved consent form.

**Sampling Method:** All the 20 subjects will be selected on the basis of convenient Sampling method.

**Study Design:** This study is a comparative experimental design including the analysis of two different groups with pre and post-test measures.

**Methods of Data Collection:** 20 healthy individuals are selected after full filling the inclusion criteria.

**Inclusion criteria:** Male and female healthy subjects, Age group between 18-20 years.

**Exclusion criteria:** Known neurological and musculoskeletal disorders, Recent fracture or other orthopedic problem involving lower limb.

**Materials used:** Elasto-gel cold wrap, Universal goniometer, Figure 1 and 2 .



**Figure 1** Elasto-gel cold wrap



**Figure 2** Goniometer

### Procedure:

20 healthy subjects will be selected based on inclusion and exclusion criteria. They were divided into two groups namely, Group-A, Group-B. The primary data will be collected from the subjects of all the two groups. The data were respectively entered into specific data collection forms.

The subjects were tested for joint position sense before and after inducing DOMS. The pre-test and post-test values of each person are recorded in the scoring sheet. After 3 days of follow up using the Elasto-gel cold wrap for

every 2 hours per day the individuals are tested for joint position sense for Plantar-flexion and Dorsi-flexion in each day, Figure 3.

### Group-A (Control Group)

The participants were measured for ankle joint position sense by asking them to close their eyes and identify the static position of the joint range after the activity has been performed. This was demonstrated to them with eyes open. After this, the participants are induced with delayed onset muscle soreness and again joint position sense was identified using universal goniometer. They were recorded in the scoring sheet. These participants were left without giving any treatment and their joint position sense for plantar-flexion and dorsi-flexion were measured in the three consecutive days.

### Group-B (Experimental Group)

The participants were induced with delayed onset muscle soreness. Their joint position sense was checked using Universal goniometer after inducing delayed onset muscle soreness. The Elasto-gel cold wrap is applied immediately and also following every two hours in a day after inducing the delayed onset muscle soreness. This procedure is followed-up for the next consecutive two days and their joint position sense is measured for Plantar-flexion and Dorsi-flexion on each day and recorded in the scoring sheet respectively, Figure 4.



**Figure 3** Goniometer measurements for Ankle Joint



Figure 4 Application of elasto-gel cold wrap

**RESULT**

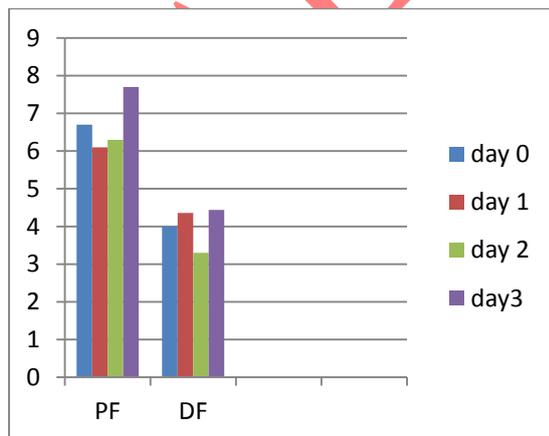
**Joint Position Sense: Group A (Control)**

|             | Day 0 | Day 1 | Day 2 | Day 3 |
|-------------|-------|-------|-------|-------|
| <b>Mean</b> | 6.7   | 6.1   | 6.3   | 7.7   |

Table 1 Plantar Flexion

|             | Day 0 | Day 1 | Day 2 | Day 3 |
|-------------|-------|-------|-------|-------|
| <b>Mean</b> | 4     | 4.36  | 3.3   | 4.44  |

Table 2 Dorsiflexion



Graph 1 Group-A (Control) PF- Plantar Flexion, DF- Dorsi Flexion

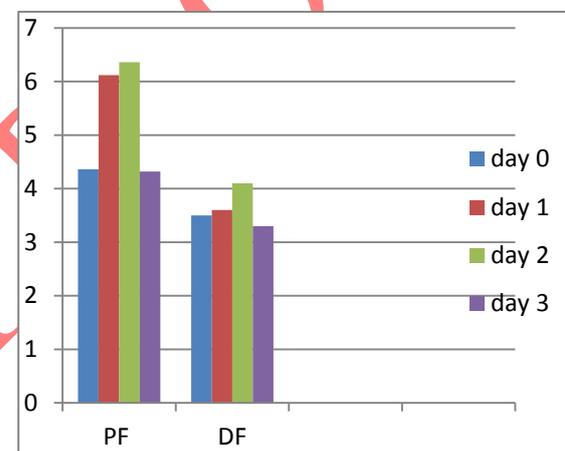
**Joint position sense: Group B (Experimental)**

|             | Day 0 | Day 1 | Day 2 | Day 3 |
|-------------|-------|-------|-------|-------|
| <b>Mean</b> | 4.36  | 6.12  | 6.36  | 4.32  |

Table 3 Plantar flexion

|             | Day 0 | Day 1 | Day 2 | Day 3 |
|-------------|-------|-------|-------|-------|
| <b>Mean</b> | 3.5   | 3.6   | 4.1   | 3.3   |

Table 4 Dorsiflexion



Graph 2 Group-B (Experimental), PF-Plantar Flexion, DF- Dorsi Flexion

This study found that there is a significant difference in mean values of scores in joint position sense when compared between group A and B after applying Elasto-gel cold wrap.

**DISCUSSION**

The purpose of this study is to find the effectiveness of Elasto-gel cold wrap to that of the ankle joint position sense on induced delayed-onset muscle soreness. The study was to present data on the delayed onset muscle soreness induced joint position sense of healthy ankle after cryotherapy to clarify

the effectiveness and safety of this therapy. Joint position sense has been defined as the awareness of the position of a joint in space, and the term is used interchangeably as synonym for proprioception with in the literature<sup>6</sup>. This is primarily because proprioception includes a number of different components, such as kinesthesia, somato-sensation, balance, reflexive joint stability and joint position sense. Some authors found cryotherapy had no effects on joint position sense, whereas three other found joint position sense was reduced after cryotherapy<sup>7</sup>.

Blaeakley et al, (2004) said that application of ice can prevent the muscle spasm by its temperature reduction on tissue and increases the capability of the muscle to release endorphins thereby decreasing the pain<sup>8</sup>. Bailey et al (2007) found that ice application has analgesic properties that aids to remove pain from the muscle but it cannot remove any exercise induced waste accumulation associated with muscle damage<sup>9, 10</sup>. Cheung et al (2003) states that the application cryotherapy reduces only the swelling while joint function and range of motion where unaffected in case of DOMS.

Roya khan Mohammadi, et al, states that application of cryotherapy for duration of 15 min does not cause harm to the joint position sense has it reduce the proprioception<sup>11</sup>. The present study concludes that the joint position sense reduced in the experimental group during day 0 & day 3 after applying Elasto gel cold wrap in comparison to 1<sup>st</sup> day and 2<sup>nd</sup> day, while in control group the joint position sense is increased in day 0 & 3<sup>rd</sup> day compared to that of 1<sup>st</sup> and 2<sup>nd</sup> day. The study reveals the importance of Elasto gel cold wrap in reducing ill effects of DOMS and restore normality of joint position sense. Elasto gel cold wrap thereby helps in improve the range of motion.

## CONCLUSION

This study concludes that Elasto gel cold wrap application is effective after DOMS, which improves the joint position sense thereby decreasing the undue effect of DOMS.

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