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## ORIGINAL ARTICLE

### EFFECTS OF CRYOTHERAPY ON INTRINSIC MUSCLES STRENGTH OF HAND USING MODIFIED SPHYGMOMANOMETER

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### Abstract

**Background and purpose:** The purpose of the study is effects of cryotherapy on the intrinsic muscle strength of the hand using modified sphygmomanometer. Therapeutic use of ice has clinical applications both in rehabilitation and other areas of medicine. Cryotherapy has been show to decrease increase and not impact torque production which requies isometric strength of intrinsic and extrinsic muscles of hand. Till date few studies have been conducted to see the carry over effect of cryotherapy on intrinsic muscle. **Objective of the study:** The objective of the study was to find out the effectiveness of cryotherapy on intrinsic muscle strength using modified sphygmomanometer. **Methodology:** 50 subjects with age group 17-23 were participated in this study. This study clinically implied to find out the immediate and carry over effect of cryotherapy on intrinsic muscle strength of hand using modified sphygmomanometer . **Result:** There is significant increase in intrinsic muscle strength immediately after the cryotherapy application. There is significant decrease in intrinsic muscle strength after 15-30 minutes of ice immersion. After 30-45 minutes it continuously decreased of hand strength. **Conclusion:** The study concluded that muscle strength is increased at immediately after immersion of 100-150 cold water.

**Keywords:** Cryotherapy, Modified Sphygmomanometer, Muscle Strength, Intrinsic Muscles.

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## INTRODUCTION

Cryotherapy is the local or general use of low temperature in medical therapy. The term cryotherapy comes from the Greek "Cryo" meaning "cold" and "therapy" meaning "cure" cryotherapy has been used as early as the 17th century. Its goal is to decrease inflammation, decrease pain and spasm promote the constriction of the vessels. Other therapies that use the term are whole body cryotherapy and ice pack therapy.

The intrinsic muscles are Thenar-opponenspollicis, flexor pollicis brevis, abductor pollicis brevis, adductor pollicis. Hypothenar-abductor digitiminimi, flexor digitiminimi brevis, opponens digitiminimi, Palmaris brevis. Intermediate – extensor digitorum brevis minimus, lumbricals, dorsalinterossei, palmarinterssoi. Strength of the muscle increase on application of cold.

### Background and need of the study

Intrinsic muscle strength is very much needed in functional activities of daily life. Although power grip traditionally has been thought of as an extrinsic activity, recent studies have indicated considerable interosseous muscle activity. The interossei are considered to be functioning as metacarpophalangeal flexors, abductors and adductors in cylindrical grip. In strong grip the magnitude of force of interossei in MCP flexion has been found to be nearly equal to that of the extrinsic flexors.

In previous studies, cryotherapy had proved to decrease oxidative stress which has negative effect on muscle strength. So this

study aims at finding the effectiveness of cryotherapy on intrinsic muscle strength.

### Aim and objective of the study

The aim of the study is to find out the effectiveness of cryotherapy on intrinsic muscle strength using modified sphygmomanometer.

**Hypothesis:** H0 - There is no relationship between cryotherapy application and the intrinsic muscle strength of hand. H1 - There is relationship between cryotherapy application and intrinsic muscle strength of hand.

## METHODOLOGY

Study Setting: Department of physiotherapy, Vels University, Thalambur, Chennai.

Study Duration: Single time study

Sample Size: 50 subjects both male and female

Inclusion Criteria:

Subjects with normal sensation in hands were selected. Participants of age group 17-23 were included for this study.

Exclusion Criteria:

Any open wound, recent fracture and acute injury were excluded from the study. Subjects with previous history of cold hypersensitivity were also excluded.

Outcome Measure: Hand grip strength

Materials Used:

Modified sphygmomanometer

**Procedure**

50 volunteer subjects fulfilling the inclusion and exclusion criteria was taken into the study. The study was clearly explained and written consent was obtained from all participants.

As the pretest assessment, the hand grip strength of the dominant hand of the participants was measured using modified sphygmomanometer. Then they was asked to immerse their hand in cold water of temperature ranging between 10°-15°c. the temperature was monitoted using thermometer.

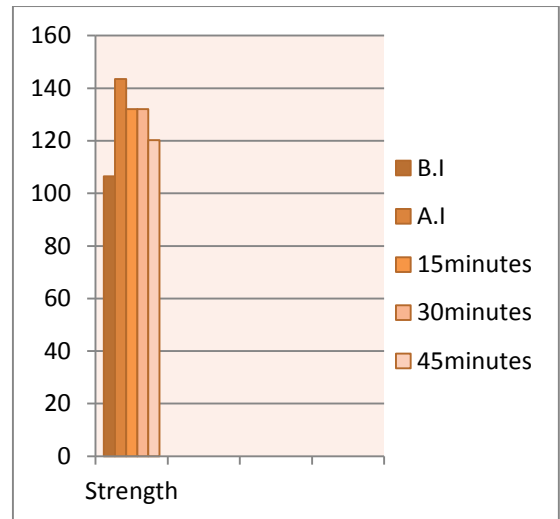
The hand grip assessed again after 15minutes, 30 minutes, 45 minutes of cryotherapy cessation using modified sphygmomanometer. The hand grip was measured with shoulder in adducted neutrally rotated, forearm in neutral position and wrist slightly extended (0-30°) and elbow in 90°. The sphygmomanometer was inflated to 20mmHg and then the values are taken.

**RESULT**

Intrinsic muscle strength of hand was measured before and after ice immersion. The study found there is difference it effect of intrinsic muscle strength before and after ice immersion .

Groups	Means
Before immersion	106.2mm hg
Immediately after immersion	143.5mm hg
15 Minutes after immersion	132mm hg
30 Minutes after immersion	132mm hg
45 Minutes after immersion	120.2mm hg

**Table 1:** Intrinsic muscle strength of hand, before and after ice immersion



**Figure 1:** B.I-Before immersion, A.I-After immersion, 15minutes- 15 minutes after immersion, 30minutes- 30 minutes after immersion and after 45 minutes immersion.

There is significant increase in intrinsic muscle strength immediately after the cryotherapy application. There is also a significant decrease is intrinsic muscle strength after 15-30 minutes of ice immersion. After 30-45 minutes it continuously decreased of hand strength.

## DISCUSSION

Halvorson and Kowal has explained the effect of cold on muscle spindle, the myotatic reflex, the neuronal discharge, blood supply and sensitivity of the muscle. The reduction in intramuscular tissue temperature impeded the neuronal discharge, even if stimulation from the spindle action leads the reflex arc, the neuronal message for increased muscle excitability, may be inhibited due to significant decrease in the motor and plate's potential<sup>1,2,3,4,5,6</sup> these Mecomber and Herman clinical validated findings by noting a decrease in the amplitude of action potentials, twitch contraction and nerve conduction time following maximal tendon taps of precooled Achilles tendons.

Conflicting result regarding the effects of cold on isometric strength have been reported by investigator<sup>7,8,9,10,11</sup> muscle contraction speed and force generating capacity or reduce by cold. Davies and Young noted that when the intramuscular tissue temperature of the triceps surae was reduced by a cold immersion<sup>12</sup>. The positive dependences of the velocity of adenosine triphosphate (ATP) splitting on muscle temperature may also be a factor in the decreased maximal muscle activity. Ferretti explains that the fraction of active muscle mass at any given time instant could increase in the cold, mass is constant and limited<sup>16</sup>. Therefore cold immersion has variable effect on isometric muscle strength. Thus compensating for the reduced ATP splitting rate, this means that in the aerobic ATP resynthesis in the cold may be carried out at slower rate by a greater activated muscle mass. This compensation cannot be operational when maximal power is attained

,for in this case instantaneously activated muscle.

Result of this study show variable effect on isometric muscle strength of hand after immersion in cryotherapy. After immersion of hand for 15 minutes in cold both of temperature 10<sup>0</sup>-15<sup>0</sup>, the isometric muscle strength significantly increased.

## CONCLUSION

The study concludes that muscle strength is increased immediately after immersion in 10<sup>0</sup>-15<sup>0</sup> cold water

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