

Original Article

EFFECTIVENESS OF ICE PACK VERSUS COLD WATER IMMERSION ON STATIC AND DYNAMIC BALANCE IN ANKLE SPRAIN

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ABSTRACT

Background: Cryotherapy is commonly used in physical therapy with many known benefits; however several investigations reported decreased functional performance, there is lack of evidence detailing the effects of Cryotherapy in ankle sprain individuals. Therefore, the purpose of the present study is to know the effectiveness of ice pack versus cold water immersion on static and dynamic balance in ankle sprain.

Materials and Methods: 30 subjects with ankle sprain were participated and randomly divided into two groups 15 each. Group A received ice pack application, group B cold water immersion for 20 minutes duration of 10 days. Static balance (balance error scoring system), dynamic balance (star excursion balance test) were recorded before and after the interventions, were analyzed by using students 't' test.

Results: The static balance for both the groups showed a decrease number of errors in tandem stance and double limb stance after ice pack application, Whereas there is no difference found in single limb stance. Dynamic balance increased in ice pack application compared to ice water immersion.

Conclusion: Results after 10 days showed marked variation suggesting better improvements in both static and dynamic balance by ice pack application than cold water immersion for ankle sprain athletes.

KEY WORDS: Ice Pack, Cold water immersion, Static Balance, Dynamic Balance, Ankle Sprain.

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INTRODUCTION

Ankle sprain is the most common sports injury [1-5], accounting for 10 % to 15%⁶ of sport related injuries, and is responsible for 7% to 10% of all emergency room visits [7]. Injury to the foot or ankle causes athletes to limit their abilities to run, jump, kick and change directions. The treatment and rehabilitation of these injuries are crucial in returning athletes to full participation at full functioning. When managing injuries for the foot and ankle, all of the typical clinical considerations must be thought of (type of injury, severity, healing time, type and level of

activity, etc). If rehabilitation and treatment is not managed properly an injury to the foot or ankle can ultimately cause secondary injuries. The application of ice after ankle sprain is accepted in clinical practice even if the strength of evidence supporting the use of Cryotherapy in management of acute soft tissue injury is generally poor [8,9]. And the appropriate technique of application of ice is also not studied. No study has rigorously compared the effectiveness of two different icing protocols; therefore there is no evidence to suggest an optimal mode, duration or frequency of ice application.

Ice treatment has also been shown to increase deficits in postural sway among individuals who have previous lateral ankle sprains. Treatment benefits of Cryotherapy are conflicting to decrease in performance variables are likely if returning to activity immediately following Cryotherapy [10]. Specifically, decreased muscle strength, vertical jump height, running speed, and agility measures have been noted following ice application across several anatomical areas [11-15]. Some authors have reported decreased balance following Cryotherapy in normal individuals [16].

Cryotherapy has been estimated to reach to depths of approximately 2-4 cm in approximately 26 min in standing [17]; however, the addition of compression via an elastic wrap is a common clinical practice that is suggested to increase the depths of penetration [18]. Consequently, Cryotherapy also reduces nerve conduction velocity of mechanoreceptors afferents and muscle spindle sensitivity. This results in a decrease in the amount of afferent sensory information reaching the central nervous system potentially impairing neuromuscular control and subsequent functional performance [19,20]. Prior, authors have reported decreased static standing balance following Cryotherapy. In normal individuals however, measures of dynamic standing balance may better represent the demands of the lower extremity during functional tasks and therefore may be a more appropriate assessment [21,22]. There are lack of evidences exists detailing with Cryotherapy on ankle sprain individuals. Many studies showed the positive effects on cold water immersion and ice pack application. No study had a fixed protocol for ankle injury. Cryotherapy is commonly used in physical therapy with many known benefits; however several investigations have reported decreased functional performance following therapeutic application. There is a lack of evidence detailing the effects of Cryotherapy in ankle sprain individuals. Therefore, the purpose of the present study is to know the effectiveness of ice pack versus cold water immersion on static and dynamic balance of ankle injuries.

MATERIALS AND METHODS

Experimental study was done on 30 ankle

injured athletes who were divided into two groups A and B randomly 15 subjects in each. Group A received ice pack application and Group B received cold water immersion for 20mins, 10days once daily. Static and dynamic balance scores were recorded before and after the treatment protocols with eyes closed. Static balance was assessed using the Balance Error Scoring System (BESS) described by Riemann et al. Dynamic balance was assessed using the Star Excursion Balance Test (SEBT) described by Gribble and Hertel [23]. Researchers have reported high inter tester reliability (intra class correlation coefficients = .78 to .96) and fair to good validity ($r = .42$ to $.79$) coefficients for the BESS [24] and high intra tester reliability for the SEBT (intra class correlation coefficients = .78 to .96) [25]. Although no validity coefficients are available for the SEBT, several authors have provided evidence that the SEBT is sensitive for screening various musculoskeletal injuries [26].

Procedures: Depending on the inclusion criteria age, sex, BMI between 19-25, no previous ankle injury, those who completed the test before 6 trails, these subjects were selected and the subjects those who are having open wounds, history of fracture around the ankle and foot, other neurological and orthopedic problems, multiple injuries and any other cold related problems were excluded. Concern form was taken from subjects prior to the treatment, testing procedure, benefits, time, duration, the importance of the treatment were explained to the subjects.

Cold water immersion was given for 20mins for the injured ankle in a basin mixed with water and ice cubes to a level at least 5 centimeters above the medial malleolus. The temperature of the water was monitored and adjusted with additional ice as needed to ensure the temperature. Standard ice pack application consisted of 20mins for the injured ankle in a piece of cotton the ice cube is kept and applied in a circular motion. The treatment duration is for 10 days.

The procedures for the BESS test involved 3 stance positions each on the stable and unstable surfaces for the dominant and non dominant limbs. The 3 stance positions were double leg stance with feet together, single-leg stance on

test limb with contra lateral knee in approximately 90° of flexion, and tandem stance with the foot of the test limb in line and anterior to the foot of the contra lateral limb (ie, the heel of the test foot touching the toes of the back foot). Each position was held with eyes closed and hands on hips for 20 seconds in duration, and scoring was determined by recording of errors. Errors included (1) opening eyes; (2) lifting hands from hip; (3) touchdown of non-stance foot; (4) step, hop, or other movement of the stance foot or feet; (5) lifting forefoot or heel; (6) moving hip into more than 30° of flexion or abduction; and (7) remaining out of position for longer than 5 seconds. The different stances, surfaces, and limb conditions produced 10 separate BESS tasks that were randomly assigned. The double-leg stance condition was not repeated for dominant and non dominant limbs. The SEBT protocol described by Gribble and Hertel requires participants to maintain a stable single-leg stance with the test leg and to reach for maximal distance with the other leg in each of the 8 directions. Participants were asked to execute a touchdown without using the reach leg for support. If it was determined that the reach leg was used for support or the stable base of support was compromised, the trial was repeated. The leg tested (dominant, non dominant) and order of reach direction were randomly selected before testing, and a 5-second rest with a 2-footed stance was required between reach attempts. Three trials were performed for each limb, with a 120-second rest period between trials. Before testing, participants were given 180 seconds to familiarize themselves with the SEBT grid and were asked to practice reaching in each direction. This latter period resulted in 6 trials for most directions. Subjects were instructed to reach behind the stance leg when performing trials in the posterior directions. Visual cues, such as objects on the floor and people not involved in the study, were removed from the testing area to help reduce visual and auditory influences. No encouragement or further instruction was given to the participants throughout testing. Reach distance was marked with chalk on the floor immediately next to the athletic tape that corresponded to the site of

touchdown. The distance from the centre of the grid to the point of touchdown was measured with a tape measure, the value was recorded to the nearest millimeter, and the chalk mark was removed after each reach to reduce visual cues.

RESULTS

Fig. 1: comparison of three components of BESS in two groups.

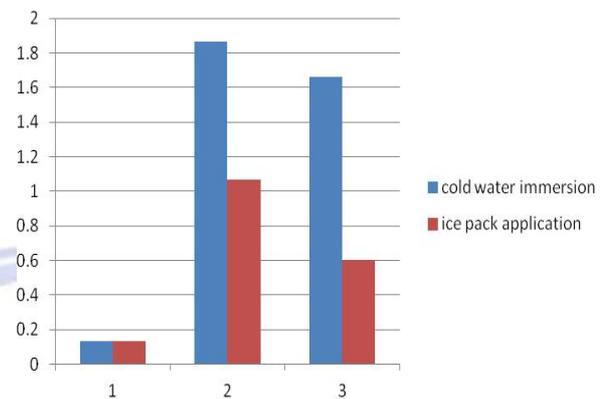
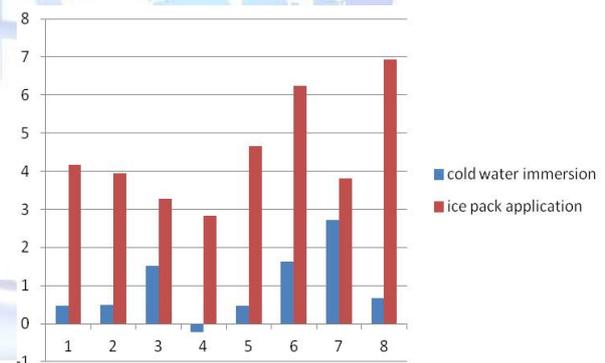


Fig. 2: comparison of each component of SEBT.



Unpaired t-test was used to compare balance scores between cold water immersion and ice pack application. The improvement in scores was measured by the difference between pre and post values of outcomes. The mean differences of SEBT of cold water immersion and ice pack application in anterior direction is considered very significant (P value is 0.0019), anterolateral direction is considered extremely significant (P value is 0.0006), medial direction is considered not quite not significant (P value is 0.0582), posteromedial direction is considered extremely significant (P value is 0.0007), posterior direction is considered very significant (P value is 0.0096), posterolateral direction is considered very significant (P value is 0.0038), lateral direction is considered not significant (P value is 0.4115), anterolateral direction is considered extremely significant (P value is < 0.0001). The

mean differences of BESS of cold water immersion and ice pack application of single limb stance is considered not significant (p value is 0.1497), double limb stance and tandem stance did not show any statistical difference as the mean value is 0.

DISCUSSION

The purpose of the study was to determine the effectiveness of ice water immersion versus ice pack application on improving the static and dynamic balance in ankle sprain athletes. Pre and post treatment values of star execution balance testing (dynamic), balance error scoring system (static) were recorded which suggests that the improvements in static and dynamic balance after cold water immersion is not significant when compared to ice pack application.

The dynamic balance measurements utilized in the current study may better approximate functional activities due to increased demand of lower extremity to maintain standing balance as is required with the majority of the functional tasks. After the application of ice pack and cold water immersion there is considered significance found between the mean differences of both the groups, where ice pack application group showed a marked improvement. Medial and lateral directions are considered not quite significant ($p=0.0582$, $p=0.4115$). The decreased dynamic balance in the cold water immersion is due to a significant cooling in the peripheral tissues, especially in the extremities for the first 30 minutes of the cold water immersion. This cooling has a direct effect on the Neuromuscular activity, which is primarily in the peripheral and not the central cooling. Wolf and Basmajian, who reported that decrease in skin and intra muscular temperature after a 5 minutes intervention [27]. These results are consistent with Rupp KA et al (2012) [28] who concluded that cold water immersion was more effective in significantly decreasing intra muscular temperature in the gastronomies when compared to the crushed ice – bag during treatment and 90 minutes post treatment. The peroneal muscles role in medial/lateral ankle stability and the decreased dynamic balance found in this study, immediate return to activities

following lateral ankle sprain and Cryotherapy appears unjustified.

The effects of the ice pack application and cold water immersion on static balance were same for double leg stance before and after the treatment protocol. Both the groups showed decreased number of errors. The number of errors in the single limb stance is less in ice pack application compare to the cold water Immersion. Whereas, there are number of errors in tandem stance after ice pack application. This may be due to decreased sensitivity of the cutaneous articular and musculotendinous receptors after Cryotherapy for 20 minutes. Surenkok O et al. (1998) [29], were the only investigator who employed proprioception test (joint position sense and static balance). After 2 separate Cryotherapy interventions in across over study design and did not find any significant changes. Kenozek TW et al. examined the effects of Cryotherapy on single leg stance in treatment with lateral ankle sprains with in the 4 to 7 days.

The other physiological responses were also explained in several studies to draw possible conclusion for reduced balance after ice water immersion are that both focal ankle joint cooling and ice water immersion would affect cutaneous, articular and tendonous receptors on the antero lateral aspect of the ankle. The ice water would also influence articular receptors elsewhere around the ankle and foot, but probably more importantly, would also cool the muscle spindles in the intrinsic and extrinsic foot muscles.

In addition to potential sensory effects of joint cooling there is evidence that ice bags applied to the ankle (or) knee joint significantly enhance motor function including muscle activation, muscle fiber nerve conduction velocity, force output and functional performance. Improvements are due to increased motor neuron recruitment following joint cooling [30].

CONCLUSION

In conclusion, the results of the current study demonstrated significant difference in the effectiveness of two Cryotherapy protocols on improving static and dynamic balance in ankle sprain athletes after 20mins of application. This suggested that the improvements in static and

dynamic balance after cold water immersion is better when compared to ice pack application.

Conflicts of interest: None

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