

Effects of Cryotherapy and Massage Therapy on Selected Clinical Variables in Ailing Experimentally Induced Delayed Onset Muscle Soreness

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Abstract

One of the most frequent and recurring injuries brought on by exercise is delayed onset muscle soreness. Elite athletes and weekend warriors alike can be affected by this type of muscle strain, which is commonly associated with a return to training or the implementation of a new form of exercise activity. The primary purpose of the study is to find out the efficient therapy by comparing two physiotherapy applications (Cryotherapy & Massage therapy) in ailing experimentally induced delayed onset muscle soreness. 60 volunteers from Pioneer College of Physiotherapy were randomly selected and were assigned in to 3 groups – control group, experimental group I and experimental group II. Experimental group I received treatment with massage after delayed onset muscle soreness. Experimental group II received treatment with cryotherapy after delayed onset muscle soreness and control group received no treatment. The pre and post test analysis were made on Pain score using VAS, muscle circumference and muscle creatine kinase level after delayed onset muscle soreness using ANCOVA and Scheffe's Post hoc test. The two experimental groups showed significant improvement in ailing delayed onset muscle soreness than the control group but no significant differences were found between the two experimental groups.

Keywords: DOMS, Pain, Muscle circumference, Creatine kinase.

Introduction

One of the most frequent and recurring injuries brought on by exercise is delayed onset muscle soreness. Elite athletes and weekend warriors alike can be affected by this type of muscle strain, which is commonly associated with a return to training or the implementation of a new form of exercise activity. Although symptoms can vary in intensity, the general presentation includes stiffness, aching and tenderness, especially with movement and palpation, peaking at about 24-48 hours post-exercise and then gradually dissipating over the next few days.

For the average exercise novice or enthusiast, Delayed onset muscle soreness may only be an uncomfortable or inconvenient case of overindulging in an activity and underestimating its effects. The amateur athlete can rest a few days and with lesson learned, use better judgment when reinstating their activity program. But for the professional with a rigorous training schedule, the situation is far more serious. Delayed onset muscle soreness has the potential to affect performance and injury risk through several factors: Perceived functional impairment, reduction in joint range of motion, reduction of strength and power, and compensatory changes in muscle recruitment with the strain of unfamiliar stress to other muscles.

Most researchers agree on a multi-factor hypothesis as yet unproven for delayed onset muscle soreness, beginning with the concept of initial muscle and connective tissue damage caused by eccentric exercise. Thus if the external load exceeds the muscle's ability to actively resist the load, the muscle is forced to lengthen and active tension is generated. Several biochemical disruptions within the body's system are attributed to muscle injury, including ion imbalance, which activates an enzyme that can further degrade muscle protein, and an elevation in circulating neutrophils leading to inflammation.

Although this myth has continued to make the rounds in massage and cryotherapy circles, researchers do not currently factor it in to their multi-model hypothesis on delayed onset muscle soreness. While a variety of treatments for delayed onset muscle soreness have been studied, their proven success in relieving symptoms has been minimal. Stretching, widely recommended as a preventative, can actually induce muscle soreness. Other approaches with mixed or negative results include ultrasound, electric current techniques, homeopathy and hyperbaric oxygen therapy.

Massage and cryotherapy as a treatment for delayed onset muscle soreness, has also had its ups and downs in clinical trials. In a systematic review published in 1998, Edzard Ernst examined the findings of seven previously published reports deemed to be valid, though flawed, controlled studies in this area. Nevertheless, Ernst notes the conceivable positive impact of massage on the hypothesized biochemical process of delayed onset muscle soreness. So this study was to find the effects of massage and cryotherapy on delayed onset muscle soreness.

Purpose of the Study

The purpose of the study was to determine the best therapy to be administered on delayed-onset muscle soreness by comparing two physiotherapy applications massage therapy and cryotherapy.

Need of the Study

Many treatments have been investigated including manual applications, electrical stimulation, ultrasound, cryotherapy, repeat bout exercise, preventative training, anti-inflammatory medications and even hyperbaric oxygen therapy. Unfortunately none have been shown to undoubtedly benefit delayed onset muscle soreness.

The common problems underlying the majority of these studies are poor study designs and not large enough sample sizes to allow significant conclusions to be drawn. Certainly more investigation is needed into the pathophysiology and treatment of delayed onset muscle soreness, and until then, prevention is better than cure. So this study enhances the influence of massage and cryotherapy on delayed onset muscle soreness.

Review of Literature

Smith et al (1994) investigated the effects of athletic massage on delayed onset muscle soreness, creatine kinase (CK) and neutrophil count in fourteen untrained subjects following eccentric isokinetic contractions of the biceps. Two hours following the exercise bout a thirty minute sports massage or a placebo was performed. The massage involved effleurage and petrissage. The choice of the two hour post exercise administration of massage was based on the principles of restorative massage used by the Soviet sports therapists at the time, which was reported to enhance relaxation and restoration of the athletes body.

It is proposed that massage between 1-3 hours post exercise interferes with the initiation of the acute inflammatory response. The critical event during this time is the accumulation of neutrophils followed by a decline in their circulation as they marginate to the vessel walls and subsequently emigrate to the traumatised tissue. The subsequent accumulation of macrophages depends on the initial accumulation of neutrophils.

This process has been reported following eccentric exercise. It is hypothesized that massage disrupts margination and subsequent emigration of neutrophils into the area of injury causing prolonged elevation of circulating neutrophils thereby reducing the intensity of inflammation and reducing pain and discomfort associated with delayed onset muscle soreness. Results indicated significantly reduced levels of delayed onset muscle soreness and creatine kinase, prolonged elevation of neutrophils and diminished diurnal reduction in cortisol in the massaged group.

Yanagisawa O et al (2003) - In their study on "The effects of various therapeutic measures on shoulder strength and muscle soreness after baseball pitching", intended an investigation of the effects of various therapeutic measures on the shoulder strength and muscle soreness after baseball pitching. The study was done by Experimental design with participants threw 98 pitches in a simulated single game. The mode of the therapeutic measures after pitching were classified into 4 groups; the control group (CON), the ice treatment group (IT), the light shoulder exercise group (LSE) and the ice treatment with LSE group (ILSE).

Each therapeutic measure was applied to the dominant shoulder immediately after pitching. Participants are 7 healthy, skilled baseball pitchers. Measures include both shoulder strength and muscle soreness were measured before pitching, immediately after pitching (Post-P), at the time of the therapeutic measure (Post-TM), and 24 hours after pitching (Post-24 h).

The results of the study are all 4 groups showed shoulder strength losses in shoulder abduction, internal/external rotation with no shoulder abduction or with the shoulder abducted to 90 degrees immediately after pitching. ILSE had greater recovery from Post-P values at Post-TM or Post-24 h than the other methods in all 5 shoulder strengths..

Both IT and ILSE had beneficial effects on reducing the shoulder muscle soreness at Post-TM or Post-24 h. the conclusion of the study is The findings of this study suggested that ILSE was the optimal therapeutic measure against decreased shoulder strength or increased shoulder muscle soreness resulting from the repetitive baseball pitching.

Methodology

Sixty student volunteers with age group ranging from 18 -25 of both sexes and medically fit of Pioneer College of physiotherapy were randomly divided in to three groups. The groups are namely Experimental Group I, Experimental Group II and control group. They were given eccentric exercise for biceps muscle to induce experimentally induced delayed onset muscle soreness.

- ⊕ Experimental Group I – received treatment with Massage therapy after delayed onset muscle soreness.
- ⊕ Experimental Group II – received treatment with Cryotherapy after delayed onset muscle soreness.
- ⊕ Control Group – received no treatment.

After twenty fours of experimentally inducing delayed onset muscle soreness, the subjects were assessed for pain using visual analogue scale, muscle circumference using inch tape, muscle creatine kinase level by creatine kinase lab test. The post test scores were taken after three days of treatment protocol.

Treatment parameters

- Treatment mode : Massage , Cryotherapy, Control Group
- Sitting per day : Two applications per day
- Duration of treatment time : 15 minutes
- Duration of treatment : Three days
- Position of patient : Lying

Experimental group I – Massage therapy includes application of stroking and petrissage manipulations on biceps muscle with proper positioning and comfort.

Experimental group II – Cryotherapy includes ice towel application on biceps after proper precautions and comfort.

Results and Discussion

The pre and post test scores of the variables collected were analysed using ANCOVA technique and Scheffe’s post hoc test. From table I, II & III, it could be seen that there was no significant difference between the control and the two experimental groups during the pre-test indicating that the randomisation was perfect while assigning the subjects to the groups.

There was a significant difference between the control and the experimental groups in relieving pain, reducing muscle circumference and reducing muscle creatine kinase during the post test, as the probability values was less than the 0.05. This would clearly indicate that due to the application of either massage therapy or cryotherapy in the experimental groups shown improvement in ailing delayed onset muscle soreness than control group.

By means of post hoc analysis, the difference between the two experimental groups has not been significantly proved to be better in ailing delayed onset muscle soreness.

Table - I
Ancova for Pre, Post and Adjusted Post Test Scores of Experimental Group I, Experimental Group II and Control Group on Pain (Score in cm)

Test	Experimental group I	Experimental group II	Control group	SV	Ss	DF	MS	F
Pre test	20.63	20.67	20.72	Between	.01	2	.006	.008
				Within	43.87	57	.76	
Post test	9.40	10.09	15.68	Between	68.47	2	34.23	30.16
				Within	64.69	57	1.13	
Adjusted means	3.58	3.83	5.94	Between	.86	2	.43	.869
				Within	28.37	56	.49	

* Significant at .05 level of confidence.

Table - I A
Scheffe's Post Hoc Test for Pain

Experimental group I	Experimental group II	Control group	Mean difference	CI
3.58	3.83	-	0.25	1.11
-	3.83	5.94	2.11	1.11
3.58	-	5.94	2.36	1.11

Experimental group I which received massage therapy as their management for delayed onset muscle soreness alleviate pain by opening micro-circulation which washes out the pain metabolites, it reduces tissue tension and promotes general relaxation and also favours the release of endorphins in descending pain control pathway. It was documented with the study of the review study done by Ernst, 1997 concludes that massage appears to have a positive effect on delayed onset muscle soreness. Experimental group II which received cryotherapy as their management for delayed onset muscle soreness alleviate pain by decreased nerve conduction velocity and reduction of muscle spindle activity by braking pain-spasm-more pain-more spasm cycle by creating vasoconstriction. It was documented with the study of Alfagy and George, 2007 in reducing pain tolerance after application of cryotherapy.

Table - II
Scheffe's Post Hoc Test for Muscle Circumference

Experimental group I	Experimental group II	Control group	Mean difference	CI
32.21	30.91	-	1.30*	1.60
-	30.91	35.37	4.46*	1.60
32.21	-	35.37	3.15*	1.60

Experimental group I which received massage therapy as their management for delayed onset muscle soreness reduce muscle circumference by pumping movement which suck fluid through blood vessels and lymph channels. It creates a vacuum which reduces muscle circumference by reducing swelling. It was documented with the study of the review study done by Charles-Liscombe, 1998 concludes that massage reduces swelling through physiological mechanisms after delayed onset muscle soreness.

Experimental group II which received cryotherapy as their management for delayed onset muscle soreness reduce muscle circumference by Lewis hunting response of initial vasoconstriction, increased venous return, increased lymphatic return and also by reducing the intramuscular temperature by 3-7 degrees. It was documented with the study of Clarkson, 1989 in reducing muscle circumference after ice towel application over the biceps muscle.

Table - III
Ancova for Pre, Post and Adjusted Post Test Scores of Experimental Group I, Experimental Group II and Control Group on Muscle Creatine Kinase (Score in U/L)

Test	Experimental group I	Experimental group II	Control group	SV	SS	DF	MS	F
Pre test	761.25	762	762.25	Between	0.7	2	.35	.042
				Within	472.95	57	8.29	
Post test	147.5	144	567	Between	218.63	2	109.3	15.8
				Within	393.7	57	6.90	
Adjusted means	32.21	30.91	35.37	Between	5.55	2	2.77	.421
				Within	374.95	56	6.57	

significant at .05 level of confidence.

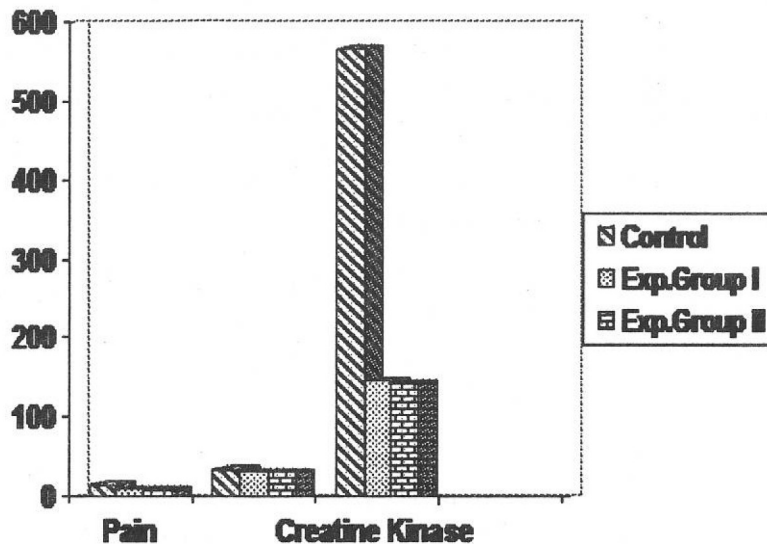
Table - III A
Scheffe's Post Hoc Test for Creatine Kinase

Experimental group I	Experimental group II	Control group	Mean difference	CI
147.72	143.93	-	3.78*	72.04
-	143.93	566.84	422.90*	72.04
147.72	-	566.84	419.11*	72.04

Experimental group I which received massage therapy as their management for delayed onset muscle soreness decrease muscle creatinine kinase level by opening micro-circulation which washes out the pain metabolites, improving tissue permeability which makes the micro pores in membranes to open and enable fluids and nutrients to pass through. It was documented with the study of the review study done by Smith et al, 1994 showed in his results that massage reduces muscle creatinine kinase.

Experimental group II which received cryotherapy as their management for delayed onset muscle soreness decrease muscle creatinine kinase level by capillary permeability in tissues and also by vasoconstriction folled by vasodialtion in removing creatinine linase, lactic acid and other waste products. It was documented with the study of Eston and Peters, 1999 conclude that cryotherapy has been speculated to reduce tissue permeability thereby reducing muscle creatinine kinase.

Figure - 1
Bar Diagram showing the Post Test Scores of Pain, Muscle Circumference and Muscle Creatine Kinase Level for Control, Experimental Group I and Experimental Group II on Delayed Onset Muscle Soreness



Conclusions

From the statistical analysis, it is concluded that significant reduction of pain, reduction in muscle circumference and decrease in muscle creatine kinase level was obtained in the two experimental groups than the control group. But the differences between the two experimental groups were not significantly proved. So Massage therapy and Cryotherapy were equally having a beneficial role in ailing Delayed onset muscle soreness.

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