Original Article

EFFECTS OF MASSAGE VS ACTIVE EXERCISE ON EXPERIMENTALLY INDUCED DELAYED ONSET OF MUSCLE SORENESS

A. Chaturvedi Pilladi *, Patchava Apparao, CH. Ashok Chakravarthi, P. Keerthi Chandra Sekshar.

Assistant Professor, Dept. of physiotherapy, Swatantra Institute of Physiotherapy and Rehabilitation, Rajahmundry, Andhra Pradesh, India.

ABSTRACT

Background: To evaluate the effect of massage versus active exercise on experimentally induced delayed onset of muscle soreness.

Method: 30 subjects were divided into two groups, Experimental group received Massage and control group received active exercises, results were taken by measurement of pain and functional stair climbing capacity of knee joint were taken by visual analog score and functional knee rating score.

Results: obtained results were analyzed with the use of Paired T-test, which has been carried out to observe the treatment impact between the groups before and after the treatment. After a 4 week treatment period, the subjects in the Group I (Quadriceps message) compared with the subjects in the Group II (Active exercise) had shown a statistically significant improvement with the outcome measures at 0.05 level.

Conclusion: Quadriceps massage was found much effective in decreasing Delayed onset of muscle soreness than active exercises.

KEYWORDS: Delayed onset of muscle soreness (DOMS); Massage therapy (MT); Exercises (EX); Cycling (CLY); Repetition (RM).

Address for correspondence: Dr.A. Chaturvedi, Assistant Professor, Dept. of physiotherapy, Swatantra Institute of Physiotherapy and Rehabilitation, Rajahmundry, Andhra Pradesh, India. **Email:** pilladichaturvedi@rediffmail.com

Access this Article online

Quick Response code

International Journal of Physiotherapy and Research
ISSN 2321- 1822
www.ijmhr.org/ijpr.html

Received: 04-06-2013 Accepted: 19-11-2013
Peer Review: 04-06-2013 Published: 11-12-2013

INTRODUCTION

Delayed onset of muscle soreness is common problem that interfere with rehabilitation as well as activities of daily living. The sensation of delayed onset of muscle soreness that results from muscle overuse is an almost universal experience. Most of the adults who were moderately active have experienced some degree of delayed onset muscle soreness (DOMS) whoever involved in exercise, athletes, heavy manual labor, or other forms of occasional muscular over exertion has at times experienced the stiffness tenderness associated with delayed onset of muscle soreness.[1]

The sensation of delayed onset of muscle soreness is usually felt with 8 to 10 hours of exercise, which is exacerbated during movement or palpation. The magnitude of pain increases during first two hours and peaks between 24 and 72 hours then dissipates over the next five to seven days.[2]

ETIOLOGY AND PATHOPHYSIOLOGY

DOMS is typically associated with unaccustomed exercise involving a significant eccentric component (talag 1983). The intensity of delayed onset of muscle soreness is closely associated to the degree of torque produced during eccentric exercise.[3]

Eccentric exercise involves the forced lengthening of muscle as it contracts against a resistance, such as lowering weight from a

position where the muscle is shortened (concentrically contracted). Eccentric contractions generate greater tension per cross sensational area of active muscle than concentric contraction (Armstrong 1984). High velocity, high intensity eccentric activities, such as downhill running are the conditions where the maximal structural damage and DOMS are likely to occur. To either muscle fiber (or) connective tissues supported by many authors.[4]

It has been suggested that this lengthening of a muscle over stretches the sarcomere which allows exercise calcium ions to enter the muscle fiber from surrounding interstitial fluid. This calcium influx might then activate a protease system which would digest structural proteins and cause muscle damage and changes in membrane permeability.[5]

Any one of the following factors can be the causative agent of delayed onset of muscle soreness.

1. Minute tear in muscle itself.

2. Osmotic pressure changes that causes retention of fluid in the surrounding tissue.

3. Muscle spasm.

4. The tearing of portion of muscle connective tissue currently popular theory to cause DOMS is that there is some form of mechanical disruption.

Symptoms and signs: Includes muscle pain, Tenderness, Joint stiffness, Decreased range of motion, Decreased muscle strength.

High intensity exercise

It is defined as high intensity, high velocity, and maximum repetition of intermittent long duration eccentric exercise program.[6, 7]

Delayed onset of muscle soreness

It is defined as the sensation of discomfort pain in skeletal muscles following physical activity, usually eccentric, to which an individual is not accustomed.

Massage

In 1884, Graham defined Massage as "a group of procedure which are usually done with the hands, such as friction, kneading, rolling and percussion of external tissues of the body in a variety of ways, either with curative, palliative, or hygienic object In View "(L.Bradam)

Technique of massage

1. Effleurage
2. Petrissage
3. Friction
4. Tapotement or percussion massage

Active exercise

The exercise performed by a subject actively achieve the therapeutic benefits is called active exercise. [7, 8]

MATERIALS AND METHODS

For this entitled study Subjects were collected from department of physiotherapy, GSL Medical College Rajahmundry. The study sample of 30 subjects between 18 to 26 years male college going students. Subjects were selected from student's population by randomized sampling procedure.

Materials used for this study are Weights, functional knee rating score, pain score, Powder, Treatment couch, Towel, Pillows, Bicycle ergometer. **Inclusion criteria** All subjects of age ranging from 18 to 26 male volunteers, non athletic male students, No injury to lower limb, No resistance training of quadriceps in the past four months preceding the study, Visual analog score range for pain is 4-8, Functional knee rating score range is 4-6, **Exclusion Criteria** Injury to lower limbs during protocol, Athletic population, Who were on resistance training with eccentric training program for lower limbs, People who take NSAIDS during protocol.

All subjects who were selected on the basis of inclusion criteria underwent a base line measurement of strength, flexibility, cardio vascular system assessment and muscle girth were taken according to the assessment procedure. The subjects were in comfortable position and explained about the mode and aim of the study and as well as procedure of the study.

Eccentric training program:

Authorhad explained the exercise protocol.

Step1:15kg of barbell is used for 30 min exercise both leg squatting for 30 degrees fallowed by 10 min rest was given.

Step2:25 kg of barbell is used,for 30 min exercise both leg squatting for 30 degrees fallowed by 15 min rest was given.

Step3: with the use of 25 kg barbell for 40 min duration.

Following Exercise Program: followed by pre treatment measurement of pain&functional stair climbing capacity of knee joint were assessed by using vas score and functional kneerating score respectively.

PROTOCOL FOR GROUP I:

The experimental group comprised of 15 subjects they were treated by massage. Pre Treatment measurement of pain and functional stair climbing capacity of knee joint were taken by using visual analog score (VAS), and functional knee rating score. The subjects are in a comfortable lying position, explained about the treatment technique, method of study, and aim of the study to the subject.

Then powder is applied to the treatment area and the following technique such as Effleurage, Petrissage, Friction, Tapotement or percussion massage, Stroking. The treatment is given of about 20 min duration each technique for about 5 min post treatment measurement of pain and functional stair climbing capacity of knee joint were taken by using VAS score, and Functional knee joint rating score.

PROTOCOL FOR GROUP II

The control group also comprising of 15 subjects they were treated by using active exercises.

Active Exercises The subjects performed 5 – 6 sets of active exercise separated by 2 to 3 min of rest

Exercise Program consists of Pain free active range of motion exercises was started. It comprised of active assisted stretching exercise to the quadriceps, Mild squatting exercise at 15 to 30 degrees progression to cycle ergometer and stair climbing exercise, finally functional progression suggests speed, Range of motion, Progressive stair climbing exercise.

OUT COME MEASURES: Pre values and post values are taken from the patients before and after 4 weeks of treatment session through Functional knee rating score and Visual analog score.

RESULTS AND TABLES

Statistical analysis was done using the statistical soft ware "**spss** 16.0 version"

Parameter	N	MEAN	SD	t-value	Df	p-value
VAS (PRE)	15	6.93	0.88	12.435	14	<0.05*
VAS (POST)	15	3.33	0.89			
FKRS (PRE)	15	5.2	0.94	15.12	14	<0.05*
FKRS (POST)	15	9.066	1.03			

* indicates significant at 5% level

Table - I: Analysis of Group – I (Experimental group) Paired t-test has been used.

Parameter	N	MEAN	SD	t-value	Df	p-value
VAS (PRE)	15	7	1.06	7.432	14	0.05*
VAS (POST)	15	4.8	0.77			
FKRS (PRE)	15	4.933	0.96	7.903	14	0.05*
FKRS (POST)	15	7.866	1.59			

* indicates significant at 5% level

Table -II: Analysis of Group – I (Control group) Paired t-test has been used.

Parameter	N	MEAN	SD	t-value	Df	p-value
CONTROL GROUP VAS (POST)	15	4.8	0.77	4.785	28	< 0.05*
EXPERIMENTAL GROUP VAS (POST)	15	3.333	0.89			
CONTROL GROUP FKRS (POST)	15	7.866	1.59	2.443	28	<0.05*
EXPERIMENTAL GROUP FKRS (POST)	15	9.066	1.03			

* indicates significant at 5% level

Table-III: Comparison between control group and experimental group was done by Unpaired t-test has been used.

After a 4 week treatment period, the subjects in group I (Massage for Quadriceps) and Group II (Active Exercises) had shown improvement with the outcome measures; but on comparing group I with group II, group I had shown a statistically significant improvement at 0.05 level with the outcome measures i.e.; Visual Analog Score shows(p=<0.05) and Functional Knee Rating Score shows (p=<0.05).

DISCUSSION

The aim of the study was to evaluate the effectiveness of Massage and Active exercises on Pain and functional activities. The results of the present study revealed significant differences exist between the two groups that Massage and Active exercises. Hence, the alternate hypothesis stating that there is significant improvement with Massage to reduce

DOMS effect can be accepted and the null Hypothesis can be rejected.

E-Ernst in his study was concluded that massage is effective in Delayed onset of Muscle Soreness from several hypothesis and pathophysiology of delayed onset muscle soreness exercise lead to local accumulation of Metabolic waste which in turn sensitizes A delta and C fibers causing pain. Exercise causes muscle ischemia which results in the production of pain. Exercises results in intramuscular edema which activates mechano receptors thus causing pain. Eccentric exercise leads to damage of connective tissues which leads to pain. Exercises leads to the release of inflammatory by products which sensitize nerve fiber causing pain. Exercise leads to destruction with in muscle fibers liberating muscle CK which is the cause of pain. Positive effects of massage on pain caused by this mechanism are conceivable. This results suggests that quadriceps massage give early improvement then the active exercise.[9]

Tara Cooley Et Al. in his study mentioned about muscle cramps associated with exercise. This is due to hyperexcitibality of lower motor neuron, possibly related to loss of fluid, and electrolytes, and low magnesium level.[10] Evans Rk et al. in their study mentioned about passive warm up performed before eccentric may be more beneficial than active warm-up or no warm-up in attenuating swelling but does not prevent, attenuate, or resolve more quickly the other clinical symptoms of eccentric muscle damage as produced in this study. [11, 12, 13]

Weerapong et al in their study mentioned about stretching and massage showed substantial effects on delayed onset muscle soreness. To reduce loss of muscle function after eccentric exercise athletes should perform a specific warm-up. Osaka K et al in their study mentioned about warm-up exercise before the eccentric also attenuated eccentric induced muscle damage. [14, 15]

CAPT Michael Ross, in their study showed that performing low impact aerobic activities such as biking or walking at a moderate pace, blood flow can be increased to the affected muscles, which may help diminish soreness.[16, 17, 18] Smith LL, in their study mentioned about sports massage will reduce Delayed onset of Muscle Soreness and CK when massage administration 2 hours after the termination of eccentric exercises. This may be due to a reduce emigration of neutrophilis and higher levels of serum cortisol.[19]

J.E.Hillbert, et al explained how massage decreases muscle soreness include improved sleep patterns, increased endorphin and serotonin levels, and decreased levels in stress hormones following treatment. Massage may activate pressure instead of pain receptor, their by lowering soreness intensity. SDR Galloway et al quoted that athletes and physiotherapists clearly feel that massage is largely used in the preparation for competitive events. It is clear that massage is largely used in the preparation for competition, and in assisting recovery from completion rather than for treatment of specific problems. Secondly, it is unclear whether track and field athletes demand a greater amount of massage intervention than other athletes, or whether there is a preference for use of massage by particular physiotherapy teams. Therefore, it would seem appropriate for continued data collection to monitor the use of massage at major events, by sport, and to assess the use of massage by different physiotherapy techniques. Finally without good quality, well controlled studies on the efficacy of massage remains wholly based on anecdotal accounts from athletes and physiotherapists. Although some studies are now being performed in this area, it is vital that more work is conducted to understand the mechanisms for the perceived benefits.[20]

Therefore this study done on the patients did provide a proven insight into distinction of which mode of treatment between both the groups was better and found that Massage is proved in reducing DOMS than active exercises.

This study also showed that Active exercises was effective in reducing DOMS in table I as the active exercises group was proved less beneficial than Massage group. This study shows a considerable improvement in relieving soreness of Quadriceps in subjects. In this way, the result of present study indicates Massage is proved to be effective intervention than Active Exercises in subjects with DOMS, through physiological and as well as statistical measures.

CONCLUSION

Based on the t-value of pain score and functional knee rating score it was seen there is significant differences between the calculated value and statistical value.

Comparing the mean deviation, standard deviation and t-values of experimental and control groups it could be seen that significance is grater in quadriceps massage group than the active exercises.

It should be remembered that experimental study was conducted for a short duration of time and not much control factors could be established through the mean improvement of quadriceps massage was more effective than the active exercise for experimental induced delayed onset of muscle soreness in normal subjects.

So it can be concluded that the null hypothesis is rejected and alternate hypothesis is accepted.

LIMITATIONS

This study was conducted on small sample size, short duration and conducted on normal population.

REFERENCES

1. Weber MD, Servedio FJ, Woodall WR. The effects of three modalities on delayed onset muscle soreness. J Orthop Sports Phys Ther. 1994 Nov;20(5):236-42.
2. Smith LL. Causes of delayed onset muscle soreness and the impact on athletic performance: a review. J Appl Sport Sci Res 1992; 6 (3): 135-41.
3. Roger Eston, Christopher Byrne, Craig Twist. Muscle function after exercise-induced muscle damage:Considerations for athletic performance in children and adults. Journal of Exercise Science and Fitness (2003), 1(2):85-96.
4. M J Cleak and R G Eston.Muscle soreness, swelling, stiffness and strength loss after intense eccentric exercise. Br J Sports Med. 1992 December; 26(4): 267–272.
5. The Role of Massage in Sports Performance and Rehabilitation: Current Evidence and Future Direction. N Am J Sports Phys Ther. 2008 February; 3(1): 7–21. PMCID: PMC2953308.
6. U. Proske, D L Morgan. Muscle damage from eccentric exercise: mechanism, mechanical signs, adaptation and clinical applications. J of physiol 2001 Dec 1;537:333-45. doi: 10.1111/j.1469-7793.2001.00333.x
7. Wernbom M, Augustsson J, Thomeé R. The influence of frequency, intensity, volume and mode of strength training on whole muscle cross-sectional area in humans. Sports Med. 2007;37(3):225-64. PMID:17326698.
8. Giovanni De Domenico Beard's Massage: Principles and Practice of Soft Tissue Manipulation. Elsevier Health Sciences, June 20017, ISBN: 0721603505.
9. J E Hilbert, G A Sforzo and T Swensen. The effects of massage on delayed onset muscle. Br. J. Sports Med. 2003;37;72-75. doi:10.1136/bjsm.37.1.72
10. Olsen O, Sjøhaug M, van Beekvelt M, Mork PJ. The Effect of Warm-Up and Cool-Down Exercise on Delayed Onset Muscle Soreness in the Quadriceps Muscle: a Randomized Controlled Trial. J Hum Kinet. 2012 Dec;35:59-68. doi: 10.2478/v10078-012-0079-4. Epub 2012 Dec 30. PMID:23486850 [PubMed] PMCID: PMC3588693.
11. Evans RK, Knight KL, Draper DO, Parcell AC. Effects of warm up before eccentric exercise on indirect markers of muscle damage. Med Sci Sports Exerc. 2002 Dec;34(12):1892-9. PMID: 12471293.
12. Kazunori Nosaka, Kei Sakamoto, Mike Newton, and Paul Sacco. Influence of Pre-Exercise Muscle Temperature on Responses to Eccentric Exercise. J Athl Train. 2004 Apr-Jun; 39(2): 132–137. PMCID: PMC419506.
13. Pagaduan JC, Pojskiæ H, Užièanin E, Babajiæ F. Effect of Various Warm-Up Protocols on Jump Performance in College Football Players. J Hum Kinet. 2012 Dec;35:127-32. doi: 10.2478/v10078-012-0086-5. Epub 2012 Dec 30. PMCID: PMC3588691.
14. Chen CH, Nosaka K, Chen HL, Lin MJ, Tseng KW, Chen TC. Effects of Flexibility Training on Eccentric Exercise–Induced Muscle Damage. Med Sci Sports Exerc. 2011 Mar;43(3):491-500. doi: 10.1249/MSS.0b013e3181f315ad. PMID: 20689450.
15. Diana L. Thompson. The lactic acid debate: Somatic research, Associated Bodywork & Massage Professionals, March/April 2011, Retrieved from http://www.abmp.com/textonlymags/article.php?article=173 on 12 July 2013.
16. David Katz. ABC for Fitness™ Development Team. 2006 revised September 2008, Retrieved from http://www.davidkatzmd.com/docs/ABCManual.pdf on 10 June 2013.
17. Weerapong P, Hume PA, Kolt GS. The Mechanisms of Massage and Effects on Performance, Muscle Recovery and Injury Prevention. Sports Med. 2005;35(3):235-56. PMID: 15730338
18. Corrie A. Mancinelli, D. Scott Davis, Leila Aboulhosn, Misty Brady, Justin Eisenhofer, Stephanie Foutty. The effects of massage on delayed onset muscle soreness and physical performance in female collegiate athletes.2006, 1;7:5-13.
19. Ross Turchaninov, MD, B. Prilutsky, LMT Science of Sports Massage, Retrieved from https://www.scienceofmassage.com/dnn/som/journal/1009/sports.aspx on June 2013.
20. Fuhrman J, Ferreri DM. Fueling the vegetarian (vegan) athlete. Curr Sports Med Rep. 2010 Sep-Oct;9(5):313.

How to cite this article: A. Chaturvedi Pilladi, Patchava Apparao, CH. Ashok Chakravarthi, P. Keerthi Chandra Sekshar. Effects of Massage Vs Active Exercise on Experimentally Induced Delayed Onset of Muscle Soreness. Int J Physiother Res 2013;05:238-42.