A Study on Effect of Phonophoresis on the Management of Delayed Onset Muscle Sorenessin Healthy F'emale Adults

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Abstract

Background: Delayed-onset muscle soreness (D OMS) is described as a sensation of pain and stiffness in skeletal muscle following a session of rigorous or unaccustomed exercise. Many interventions have been used in an attempt to prevent delayed onset muscle Soreness. This include stretching, massage, cryotherapy, electrical stimulation, ultrasound, pharmacological agents, and warm up and cool-down. Warm up (Gentle exercise preceding vigorous physical activity) is said to reduce muscle strain injuries by increasing muscle temperatures and hence muscle compliance. The effectiveness of ultrasound on DOMS shows that ultrasound enhanced the development of DOMS but that this enhancement was offset by the anti-inflammatory analgesic action of salicylate phonophoresis. Study aimed to compare the effectiveness of warm up and phonophoresis on the management of DOMS in healthy female adults.

Material & Method: This comparative study was conducted among the 40 subjects of age group ranging frorn 18 to 25 years recruited from Yenepoya University. Prior to participation, the subjects were explained about the study and obtained an informed consent from all the participants. Tenderness was measured in 10 minutes 24and 48 hours after exercise by applying a pressure algometer and recorded the measurement

Result: Total of 40 female who consented to be part of study were included and grouped as Group A (Warm-up) and Group B (Phonophoresis). The results of this study showed effect of phonophoresis on DOMS is more than warm up. There was a statistically significant difference in the mean between the two groups ($p<0.001$), warm up and phonophoresis group

Conclusion: The study showed that phonophoresis is more effective in alleviating DOMS than warm up.

Keywords: *Warm up, DOMS, Phonophoresis, soreness.*

Introduction

Phonophoresis consists of using ultrasound to drive a drug through the skin and into underlying tissues. In theory, ultrasound can enhance the trans-dermal delivery of certain pharmacologic agents to skeletal muscle, tissue, bursae, tendons, and so on. Delayed-onset muscle soreness (DOMS) is described as a sensation of pain and stiffness in skeletal muscle following a session of rigorous or unaccustomed exercise. The term "delayed-onset" refers to the fact that peak levels of soreness typically occur around 24 to 72 hours following the exercise session. Delayed-onset muscle soreness does appear, however, to

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be a transient disorder, and there are no apparent permanent effects of this condition.[1] The typical symptoms associated with DOMS are pain, strength loss, muscle tenderness, stiffness and swelling.[2] Exercise-induced muscle damage and DOMS are temporary phenomenon, they cause reduction in muscle contractile force, ROM and physical performance. Therefore proper treatment methods are needed to enhance recovery from the muscle injury and to alleviate DOMS. [2]

Activity that places un-accustomed loads on muscle may lead to delayed onset muscle soreness. This type of soreness is different from acute soreness, which is the pain that develops after the cessation of exercise, peaks between 24 and 72 hours, arid eventually disappears by 5-7 days post exercise.[3] This is usually attributable to an increase in hydrogen ions associated with lactic acid accumulation. Although the actual pathophysiology of DOMS is debatable, most researchers agree that it results from strenuous eccentric muscle activity. Eccentric resistance training causes extreme soreness compared to static and concentric muscle actions which causes little or no delayed soreness.[4] It is generally agreed that the presence of disrupted sarcomeres in myofibrils and damage to the excitation-contraction coupling system are the two prominent signs of damage in a muscle immediately after it has been subjected to a series of eccentric contractions.[5]

Many interventions have been used in an attempt to prevent delayed-onset muscle soreness. This include stretching, massage, cryotherapy, electrical stimulation, ultrasound, pharmacological agents, and warm up and cool-down. Some of these interventions are self-administered and some are administered by physiotherapists or other health professionals .It is thought that the compliant muscle can be stretched further before it is damaged. With the onset of physical activity, muscular contractions will generate more heat than at rest. This increase in muscle temperature has been found to improve the necessary chemical reactions that make a muscle contract.[6]

It is important that there is a need to systematically investigate the optimal way of managing delayed-onset muscle soreness thus preventing damage to muscle fibres. The study aimed to compare the effectiveness of warm up and phonophoresis on the management of DOMS in healthy female adults.

Material & Method

This comparative study was conducted among the subjects of age group ranging from 18 to 25 years. Prior to participation, the subjects were explained about the study and an informed consent was taken from the subjects. Subjects were screened for the inclusion and exclusion criteria and those who fulfil the criteria was included in the study. Ethical clearance was taken from the Ethical clearance committee. 20 samples were included in each group that is, (warm up and phonophoresis) forming a total of 40 samples as study population.

Subjects aged between 18-25yrs of female were included and individuals with cardiac, neurologic and musculoskeletal disorders, any current illness, un-cooperative participants and taking any anti-inflammatory medications were excluded from the study.

Healthy female adults were selected to one of two groups using a blocked procedure (20 participants per group). Each participant was allocated to one of two groups: a warm-up, group A and a phonophoresis, group B. Initially, all participants rested in a seated position for 10 minutes. Subsequently, participants in group A performs l0-minute warm-up. Muscle soreness was induced using unaccustomed eccentric exercise. The exercise were designed to induce muscle soreness in the gastrocnemius muscle of the right leg and involved walking backwards downhill

on a tread mill inclined at 13 degrees for 30 minutes, leading with the right leg. A participant was instructed to take large backward steps with the right leg and to strike the treadmill with the toe of the right foot and with the right knee extended. Immediately after the exercise, participants of phonophoresis group got 10 minutes of phonophoresis treatment.[2,7]

Participants in warm up group sat for further 10 minutes. Participants were instructed to refrain from strenuous physical activities for three days after the exercise in this study. Muscle soreness in the gastrocnemius muscle of the right leg was assessed10 minutes after the exercise, and then at 24-hour intervals over the three days following the exercise.

Procedure: Group A performs l0-minute warm-up consisted of walking forwards uphill on a gently inclined treadmill (3degrees inclination) for 10 minutes at 4.5 to 5 kph. Muscle soreness was induced using unaccustomed eccentric exercise to all the participants. The exercise was designed to induce muscle soreness in the gastrocnemius muscle of the right leg and involved walking backwards downhill on a treadmill inclined at 13 degrees, for 30 minutes, leading with the right leg. Participants were instructed to take large backwards step with the right leg and to strike the treadmill with the toe of the right foot and with the right knee extended. Immediately after the exercise, participants of group B got 10 minutes of phonophoresis treatment[2] with a fixed frequency of 1 MHz and a 10-cm2 sound head was used to administer the treatments. Treatment procedures commenced with the therapist applying a fixed amount (10-12mL) of salicylate cream to the skin and then applying the ultrasound head over the cream using small, continuous, circular movements. Group B received ultrasound treatment initiated at 1.5 w/ cm of continuous-wave ultrasound and the intensity was decreased when the subject experienced anything other than a sensation of mild warmth. Participants of group B were seated for further 10 minutes and they were treated on three consecutive days by 24 hour interval. (7' I and to) All the participants were instructed to refrain from strenuous physical activities for three days after the exercise in this study.

Visual analogue scale: Soreness was rated on two scales: a 100-mm visual analogue scale anchored at 'no pain' and 'most severe pain' and a l0-point numerical rating scale anchored at .no pain' and 'most severe pain'. Participants reported when they first felt discomfort. Low forces are associated with high levels of tenderness.

Pressure algometer: Tenderness was measured in 10 minutes 24and.48h ours after exercise by applying pressure algometer to the calf over the belly of the most-tender part of the gastrocnemius muscle with progressively increasing force. [8]

Statistical Analysis

The data was entered in the Microsoft Excel sheet and analysed using SPSS (Version 22. 0) for windows. Paired t-test/Wilcoxon signed rank test was used to compare the pre-post comparison for both the methods (warm up and phonophoresis) based on normality. Two independent sample t test/Mann Whitney U-test were used to compare the effectiveness of warm up and phonophoresis in management of DOMS based on normality.

Result

Total of 40 female who consented to be part of study were included and grouped as Group A (Warm-up) and Group B (Phonophoresis).

Table 1: Comparison of pressure algometer reading between the groups at day 1, 2 and 3			
Day	**Group A**	**Group B**	**T (p value)**
Day 1	5.74 ± 1.27	5.36 ± 1.05	1.025 (0.312)
Day 2	5.27 ± 1.34	4.34 ± 1.31	2.226 (0.032)*
Day 3	6.93 ± 1.05	6.60 ± 1.26	0.893 (0.378)
*p<0.05 was considered statistically significant.			

There was a statistically significant difference in the mean pressure algometer scores between group A and B for day 2 (p value<0.05). There was no statistically significant difference in the mean pressure algometer scores between group A and B for day 3. (p value >0.05) (Table 1)

Table 2: Comparison of VAS score between the groups at day 1, 2 and 3			
Day	**Group A**	**Group B**	**T (p value)**
Day 1	3.90 ± 1.99	4.25 ± 1.94	0.562 (0.578)
Day 2	5.05 ± 1.73	5.50 ± 1.79	0.808 (0.324)
Day 3	2.30 ± 1.08	2.65 ± 1.38	0.890 (0.379)
*p<0.05 was considered statistically significant.			

There was no statistically significant difference in the mean VAS scores between group A and B for day 1, 2 and3 respectively.(p value>0.05) (Table 2)

Discussion

This study was conducted by Yendurance Zone, Yenepoya University, to compare the effectiveness of warm up and phonophoresis. This study was performed among the 40 female adults aged between 18 to 25 years. This population was chosen to generalize the results for this age groups. This study was conducted at Yendurance Zone, Yenepoya University was completed in the month of April 2016. The results of the study indicated that phonophoresisis effective than warm up for the management of DOMS in terms of pressure algometer reading and VAS score and were also comparable to other studies.

In a study by Roberta YW et al. the results showed that warm-up reduced muscle soreness. In another study Brain C et al, did a study on effects of ultrasound and Trolamine salicylate phonophoresis on delayed-onset muscle soreness. The results showed that salicylate phonophoresis may be useful in clinical situations in which it is desirable to administer ultrasound without increasing inflammation.[9]

In a study by Tiffany Windju, et al., to assess the use of Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) in treating delayed onset muscle soreness (DOMS). Author concluded that NSAIDs work to reduce inflammation by inhibiting the cyclo-oxygenase COX enzyme which is necessary for prostaglandin synthesis; when inflammatory prostaglandins cannot be made vascular permeability is not increased, swelling is limited and less soreness

is experienced at the site of muscle injury.[10] According to the present study warm up and phonophoresis showed significantly greater gains in the management of DOMS. The gains achieved by warm up and phonophoresis was significantly different from each other. It is important that phonophoresis is effective to alleviate DOMS and to enhance recovery from muscle injury.

In the current study, all the girls who participated successfully completed the study without missing a single session with the same eagerness and keenness throughout the study. The goals established at the initial and subsequent evaluations were met as quickly and as sensibly as possible.

Limitation: Due to small size we cannot project the findings of our study to be entire population of healthy female adults.

Conclusion

Phonophoresis showed to be more effective than warm up in alleviating DOMS than warm up. The comparison done between the two groups (warm up and phonophoresis) suggests that both warm up and phonophoresis have some effect in alleviating the DOMS.

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