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Does Manual Lymphatic Drainage Have Any Effect on Pain Threshold and Tolerance of Different Body Parts?

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Abstract

Objective: The purpose of this study was to investigate the acute effects of manual lymphatic drainage (MLD) on pain threshold and pain tolerance of different body parts.
Methods and Results: Thirty healthy individuals (10 women and 20 men) participated in this study voluntarily. Pain threshold and pain tolerance of the upper and lower limbs were evaluated with an algometer before and after MLD. Pain threshold and pain tolerance were assessed on the mid-ulna, hypothenar area, quadriceps, and mid-tibia before and after MLD. There was a significant increase in the pain threshold of the mid-ulna, quadriceps, and mid-tibia and the pain tolerance of the mid-tibia after the application of MLD ($p < 0.05$).
Conclusions: This study demonstrated that MLD increased pain threshold and pain tolerance, which may be important for pain control and other components of complex decongestive therapy, such as compression and exercise.

Keywords: complex decongestive therapy, algometer, pain threshold, pain tolerance

Introduction

Manual Lymphatic Drainage (MLD) is a treatment developed by Danish biologist Emil Vodder and his wife Estrid Vodder.[1] Földi also developed an MLD technique known as the Földi method.[2] During the application of MLD, the lymph vessels are gently massaged to mobilize lymphatic fluid. This application significantly increases lymphatic activity, helps to regulate the immune system, clears blockages, eliminates metabolic waste and toxins from the body, and reduces excess fluid.[3,4]

MLD includes standing apartments, pumping, scooping, and rotating manipulations. This technique can be applied to all areas of the skin, including the neck, abdomen, anastomosis, and extremities.[2] The duration, direction, pressure, and sequence of the techniques are specific to MLD.[5]

MLD manipulations are perceived by receptors in the skin. After touch stimulus, the impulses are switched in the stations of spinal cord and transferred to cerebrum. However, the nerve fibers have collateral (lateral) pathways to inhibitory cells in the spinal cord. These inhibitory cells are connected to the switch cells of the pain pathway. If an inhibitory cell receives an impulse, it becomes inhibited. During manipulation, several neighboring touch receptors are stroked in succession. Accordingly, each of these receptors sends action potentials at the beginning and end of the contact, and each of these action potentials causes the pain transmission to be inhibited. Therefore, with MLD, ''stroking'' can cause a decrease in pain.[6]

The International Pain Research Organization defined ''pain threshold'' as the smallest stimulus that is felt as pain and ''pain tolerance'' as the maximum pain stimulus that a person can tolerate.[7]

When the literature on MLD was reviewed, only one study was found that addressed the effects of MLD on pain threshold over the trapezius muscle,[8] and to our knowledge, no studies were located that examined pain threshold and pain tolerance in the upper and lower extremities separately. The aim of this study was therefore to investigate the acute effects of MLD on pain threshold and pain tolerance.

Materials and Methods

This study was carried out in the Department of Physiotherapy and Rehabilitation of the Faculty of Health Sciences at Gazi University. Thirty healthy volunteers (10 women and 20 men) were included in this study. Permission was obtained from Gazi University Medical Faculty Ethics Committee (October 9, 2017, No. 24074710-33). All the participants signed informed consent forms, and all MLD applications were

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carried out by a physiotherapist who had obtained a certificate in Complex Decongestive Physiotherapy from the Földi Schuele.

Inclusion and exclusion criteria

Individuals older than 18 years of age and without any disease affecting the lymphatic system (i.e., systemic illness, surgery, or trauma) were included in this study. Individuals with any contraindications for MLD, such as thyroid, heart and kidney disease, cardiac rhythm problems, menstrual cycle and pregnancy, and individuals using regular medication, were excluded.

Treatment protocol

Application of manual lymph drainage. MLD was performed on healthy subjects. It has been shown that this procedure does not pose a risk for cardiovascular system in healthy individuals.[9] MLD was applied using Földi technique, in which the treatment ranking is planned by considering the anatomical distribution and physiological structure of the lymphatic system.

The basic principles of MLD are:

- When an extremity is being treated, the treatment always starts proximally.
- The technique should be applied slowly and gently.
- During MLD, deep breathing exercises should be combined with MLD.
- MLD must be performed by lymphedema therapists trained in the field.[10,11]

The order in which MLD was applied is as follows[2,12–14]:

The MLD sequence starts with the neck, then moves toward abdominal deep drainage, lymph drainage of the anastomotic region, lymphatic drainage of the ventral part of the upper trunk, lymph drainage of the dorsal parts of the upper and lower trunk, ventral lymph drainage and lymph drainage of the region between the dorsal section, hip, lower costa, and crista iliaca, respectively.

Arm region lymph drainage. The drainage sequence of this region comprised effleurage, excitation of the axillary lymph nodes with standing circles, arm medial circles, handwashing on the deltoid muscle, a combination of lateral and circular pumping movements, circles around the medial and lateral epicondyle, passive elbow flexion, standing circles, draping of the frontline flexors and extension areas with circles, pumping, or circles, circles in the dorsal region of the wrist, circles on the back of the hand, circles on the thumb and other fingers, and effleurage.

Leg region lymph drainage. The order of the MLD application consisted of effleurage, excitation of the inguinal lymph nodes, standing circles on the medial part of the thigh, pumping the ventral part of the thigh, pumping and circles on the ventrolateral part of the thigh, pumping on the patella region, circles on the popliteal lymph nodes, circles on the medial part of the knee, circles under the pes anserinus area, draping of the calf with one hand, pumping on the area of the tibialis anterior, draping of the calf with two hands, circles through the Achilles tendon from the submalleolar area, passive joint movements while applying circles on the ankle, circles on the dorsal part of the foot, circles on the fingers and effleurage.

Evaluation protocol

The participants were rested for 15 minutes in the supine position before MLD was administered. The demographic characteristics (i.e., sex, age, height, weight, body mass index, dominant arm, and dominant leg), pain threshold and pain tolerance of the participants were documented.

Evaluation of pain threshold and pain tolerance

A baseline brand digital algometer device was used to assess pain threshold and pain tolerance. This instrument is proved to be reliable and valid. In addition, having the same tester to implement the appropriate measures further increases its reliability.[15] The baseline brand digital sensor was calibrated before evaluation. The device was turned on, and the display automatically calibrated itself by showing zero. A ''prop'' tip of 1 cm^2 was used for all the measurements. Before the measurement process, middle ulna, hypothenar region, quadriceps, and mid-tibia point were marked. The

Table 1. Comparison of Pain Threshold and Pain Tolerance Before and After Manual Lymphatic Drainage

	Before MLD (median/mean)	*After MLD (median/mean)*	*T/Z*	p
Mid-ulna				
Pain threshold (kg/s)	6.55 (3.93 ± 10.73)	7.29 (3.93 ± 17.50)	–2.531	**0.017**
Pain tolerance (kg/s)	13 (4 ± 21.20)	12.76 (8.43 ± 21.83)	–0.469	0.642
Hipotenar area				
Pain threshold (kg/s)	6 (3.20 ± 10.50)	6.98 (3.30 ± 12.86)	1.306	0.192
Pain tolerance (kg/s)	10.51 (4 ± 18.96)	11.06 (6.90 ± 20.73)	–1.667	0.106
Quadriceps				
Pain threshold (kg/s)	5.81 (2.80 ± 8.36)	7.20 (4.26 ± 18)	3.754	**<0.001**
Pain tolerance (kg/s)	11.14 (4.10 ± 17.50)	10.75 (7.10 ± 18.53)	2.808	**0.005**
Mid-tibia				
Pain threshold (kg/s)	7.03 (3.43 ± 11.70)	7.94 (3.73 ± 14.90)	–3.048	**0.005**
Pain tolerance (kg/s)	11.83 (7 ± 21.36)	13.21 (6.30 ± 20.03)	–2.618	**0.014**

Significant results are shown in bold.
$p < 0.05$.
MLD, manual lymphatic drainage.

measurement was repeated three times with 5-second intervals. For each point, the average values were recorded. The algometer was placed at a steep angle to each point, and the value on the display recorded as pain threshold.

The participants were asked to report the presence of pain by saying ''yes'' and when they first felt pain at the touch point, the value on the device was recorded as pain threshold. Second and third measurements were taken from the same point after the device was removed, for 5 seconds to relax the tissue.

The same body points were used to assess pain tolerance. When the participants felt unbearable pain, they said ''yes,'' and the pain tolerance was recorded according to the value on the device display. The change in pain threshold and tolerance before and after MLD is given in Table 1.

Statistical analysis

All the analyses were conducted using IBM SPSS v.21. Continuous variables were described using arithmetic mean, median, and standard deviations. The normality assumption was checked by using Kolmogorov–Smirnov test. To compare differences between before and after measures, the paired *t* test was used if parametric test assumptions hold, otherwise Wilcoxon test was used. The level of statistical significance was taken as $p < 0.05$.

A power analysis based on our data showed that 30 individuals demonstrated a 95% significance in musculus Quadriceps pain threshold.

Results

Results related to individual characteristics

The study was completed with 20 healthy females and 10 healthy males. The median age and range of the participants were 22 and 21–26 years, respectively. The right arm was the dominant side for 93.3% of the participants and left arm for 6.7%. The right leg was the dominant side for 86.7% and left leg for 13.3%.

Results related to pain threshold and pain tolerance

There was a significant increase in the pain threshold of the mid-ulna, quadriceps, and mid-tibia and pain tolerance of the mid-tibia after the application of MLD ($p < 0.05$). This increased pain threshold and pain tolerance indicated that the individuals were able to tolerate painful stimuli at a high level. The significant parameters are indicated in bold.

Discussion

To the best of our knowledge, this is the first study to examine the pain threshold and pain tolerance of different body parts separately during the application of MLD. There was a significant increase in the pain threshold of the mid-ulna, quadriceps, and mid-tibia and the pain tolerance of the mid-tibia following the application of MLD. This increased pain threshold and pain tolerance indicated that the individuals were able to tolerate painful stimuli at a high level.

In the door control theory proposed by Wall and Melzack, low rhythmic stimuli such as MLD can create inhibitions on the nociceptive receptors of the skin.[16] It was thought that increases in the pain threshold and pain tolerance in the participants in our study after the administration of MLD could lead to an increase in the release of pain-reducing neurotransmitters such as serotonin. Although there has been no evidence about the effects of MLD on pain, serotonin levels have been shown to increase after conventional massage.[17] The autonomic nervous system is spread over many areas of the body and can be found in blood vessels, lymphatic vessels, and connective tissue. The lymphatic system and the hypothalamus work together to influence the responses of the autonomic nervous system.[8] The precise (and currently unexplained) relationship among the lymphatic system, hypothalamus, and the nerve sources in the lymphatic innervation system makes it difficult to explain the effects of MLD on pain threshold and pain tolerance comprehensively.[18]

Understanding changes in the perception of pain during and after the application of MLD in clinical practice will help to make these practices more conscious. It can be speculated that compression applications after MLD may be tolerated well by patients and exercise may increase pressure on tissues, but according to the results of this study, patients may not notice the amount of pressure being applied.

Limitations

More significant changes could have been obtained with respect to pain threshold and pain tolerance if this study had been performed on lymphedema patients. Therefore, further studies can be conducted with lymphedema patients.

Conclusion

Knowing the effects of MLD on pain threshold and pain tolerance is believed to expand our understanding of the indications of MLD. Thus, this study was conducted to examine the effects of MLD on pain threshold and pain tolerance in the upper and lower limbs. To the best of our knowledge, this is the first study that separately examines the upper and lower limbs. Our results indicated that MLD increases pain threshold and pain tolerance significantly in healthy subjects. Moreover, understanding the reasons of how MLD affects pain may help to plan the treatment for patients with pain. Thus, further studies may focus on the benefits of MLD in controlling pain in chronic venous insufficiency and lipedema patients.

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Author Disclosure Statement

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