

## Chapter 6

## MANUAL LYMPHATIC MAPPING (MLM)

In lymphedema, Manual Lymphatic Mapping (MLM) can be used to assess the patient's lymph pathways at any time, and define a specific treatment protocol.

The whole treatment plan must be consistent with the lymph pathways found with the manual lymphatic mapping. This technique is used to check the proper use of the compression bandage or garment, i.e. to confirm that the identified alternative pathways are still working and have not been misdirected by the compression (see Part 4, Chapter 5). Finally, the pathways so identified can suggest effective protocols for exercise under compression and other appropriate self-treatment.

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### **Lymph Drainage Therapy (LDT): "Manual Lymphatic Mapping"** AND ITS CLINICAL APPLICATIONS TO LYMPHEDEMA

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*This article first appeared in Lymph Link, September 2000, 13, 3: 1-3, 6-7 the newsletter of the National Lymphedema Network (NLN) and is reproduced here by kind permission with minor changes.*

Manual Lymphatic Mapping (MLM) is one of the most recent advances in the techniques used to specifically improve or restore the natural lymphatic drainage of the body. Based on recent scientific information, this new technique enables trained practitioners to work with greater precision by manually assessing the specific direction of lymphatic circulation.

#### **HISTORICAL BACKGROUND**

Specific lymphatic drainage techniques have come into use during the past 75 years. Osteopath F. P. Millard deserves credit for developing the first precise manual approach to the lymphatic system. Beginning in 1904, Millard conducted extensive lymphatic studies, the results of which he published in "Applied Anatomy

of the Lymphatics" in 1922. In his writings Millard used the term "lymphatic drainage" to describe his techniques.

Emil Vodder, a Danish practitioner and doctor of philosophy, is best known for his brilliant insights into techniques for enhancing lymphatic circulation. Between 1932 and 1936, in Cannes, France, Vodder and his wife developed a specific manual technique for lymph drainage. But because he was not a physician, physical therapist or massage therapist (in France, the practice of massage therapy is restricted to registered physical therapists), he had difficulty authenticating and gaining recognition for his technique. It was not until the end of the 1960s that Vodder's Manual Lymph Drainage technique was scientifically tested and its effects recognized.

More recently, the present author, a French physician, further improved on some of these techniques by developing ways to manually assess the specific rhythm, direction, depth and quality of the lymphatic flow. This approach, Lymph Drainage Therapy (LDT), also uses the technique called Manual Lymphatic Mapping (MLM), which helps practitioners assess alternative pathways to promote drainage of areas of interstitial fluid or lymphatic stagnation.

### WHAT IS LYMPHATIC RHYTHM?

To understand what causes the lymphatic rhythm, we must look at the anatomy and physiology of the lymphatic system. Elements of this system include lymph capillaries (or initial lymphatics) which carry fluid from interstitial spaces to pre-collectors, which then convey it to larger vessels called lymph collectors. These collectors are approximately 100 to 600 microns in diameter and consist primarily of chains of muscular units called "lymphangions. Possessing bicuspid valves (having two leaflets) lymphangions ("lymphangia" has been proposed as an alternative plural form) have been described as little "lymphatic hearts" (Mislin, 1961). Working much like the body's heart pacemakers, the lymphangions contract regularly throughout the lymphatic system (lymphangiomotricity), moving lymph in peristaltic waves. From the tunica media to the tunica externa, these muscular units have extensive sympathetic and parasympathetic innervation, somewhat similar to the alpha and beta receptors found in blood vessels.

### CONTRACTILITY OF THE LYMPHANGIONS

The first observations of lymphangion contractility were made in animals by such anatomists as Hewson, Heller, Lieben, Florey, and Pullinger. Other researchers (Kinmonth, Smith, Szegvari) published their descriptions of lymphatic vessel contractility in humans.

Waldemar L. Olszewski is credited with doing the first studies involving specific measurement of lymphatic vessel contractility in man. One of his many published reports concerned the results of cannulation of lymph vessels in five healthy male volunteers. Olszewski recorded a lymphatic rhythm of 6-8 contractions per minute creating a pressure of 1 to 33 mmHg. Other researchers reported similar results (Schmid-Schönbein, Sjoberg, Zawieja). For example, Guo-Ying Wang and Shi-Zhen Zhong in China concluded that the lymphatics contract at an average of 4.89 times per minute with a variation of +/- 1.03 times per minute.

Confirmation of the contractility of lymphatic vessels has definite clinical implications. First, practitioners of lymphatic

drainage should not consider lymph to be a passive medium and try to push it, like toothpaste from a tube, as some schools still teach. Since the lymphangion is made up of autonomic smooth muscles having automotricity, the techniques used should stimulate their natural contractions. It also may be necessary, through touch, to re-educate the regular contraction of these muscles if they have slowed down or stopped working due to edema, trauma, lack of exercise, aging, very cold conditions or use of certain drugs.

The hand pressure should be just enough to stimulate reabsorption and the automotricity of the lymphangions. The pressure should not be so heavy as to increase blood capillary filtration; such an increase tends to be counterproductive in cases of edema or lymphedema. It has been calculated that more than 30-40 mmHg of pressure can cause collapse of the lymphatic vessels. The ideal hand pressure generally is 1 oz. to 2 oz. (0.5 to 2 oz.)/cm<sup>2</sup>, which is about 4 to 8 oz. per square inch. Therefore, this method of lymph drainage often obliges the therapist to change his/her concepts of touch.

### MANUAL LYMPHATIC MAPPING (MLM) AND ITS CLINICAL APPLICATIONS

Manual Lymphatic Mapping is a non-invasive method by means of which trained practitioners using only their hands can identify the specific direction of the deep or superficial lymphatic circulation on an affected or unaffected area of a patient.

It has been noted, for example, that in cases of post-mastectomy upper extremity lymphedema that lymph flow can choose between some twenty alternate pathways to reroute toward an unaffected lymph territory (lymphotome), including anterior and posterior pathways toward the unaffected axilla, inguinals, clavicles, intercostals, Mascagni's pathways, vasa-vasorum and other special reroutes. It may be difficult for a manual practitioner to "guess" or assume which pathway will be taken by the lymph flow, and sometimes wrong assumptions can cause a significant loss of time and resources.

Manual Lymphatic Mapping enables trained practitioners to work at a high level of precision by manually assessing the direction of lymphatic circulation and finding more specifically the alternate pathway preferred by lymph/interstitial fluid in case of lymph circulation obstruction (photo 1-2).

MLM also allows the therapist to work more precisely with the natural anatomical variations in the lymphatic system of their patients.

Information about the direction and contractility of superficial and deep lymphatic circulation has definite clinical implications:

- 1) Identification of the specific directions of the lymphatic circulation, identification of the areas of fluid restriction and fibrosis.

As an assessment tool, Manual Lymphatic Mapping can help assess the effects of lymphatic drainage by evaluating the patient before, during and after the sessions (photo 2 and 3):

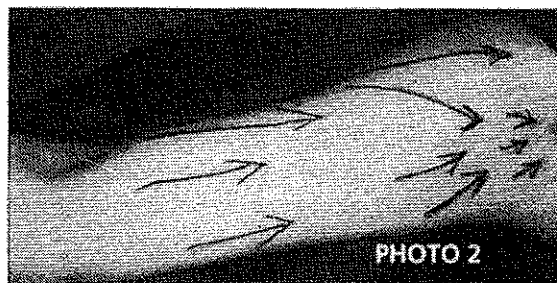
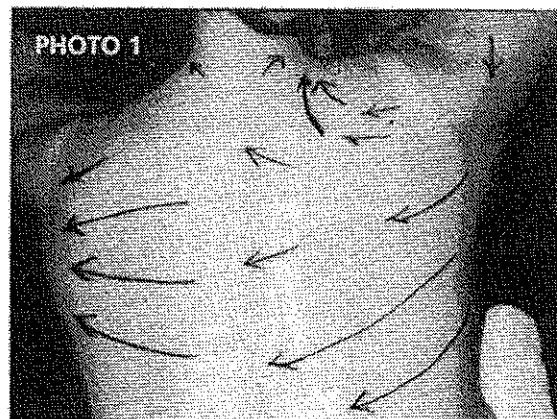
- Before the session, mapping is used to make an initial assessment of the areas of fluid restriction, stagnation and fibrotic tissue;
  - During the session, the therapist can determine whether the most appropriate area to work has been selected and how efficiently the lymph flow has been stimulated or rerouted;
  - After the session, mapping is used to verify the results of the technique, to check the areas of initial restriction, and to fine-tune sites that require further attention;
  - A sufficiently advanced therapist does not need to perform MLM on bare skin, but can actually map through bandaging and all kinds of medical compressions to help determine whether the reroute of fluid under the compression is consistent with the pathway determined and encouraged by the therapist. If not, the compression can be re-applied. A proper compression is essential for optimal effectiveness, comfort and patient compliance.
- 2) Description of the new "pathological watershed;"
  - 3) Identification of the various alternative pathways used by the lymphatic/interstitial fluid circulation and identification of the most efficient alternate pathways toward a healthy lymphotome.
  - 4) Selection of a physical treatment protocol.
  - 5) Preventative application (subclinical lymphedema): Evaluation of functional alternate pathways or area of stagnation in lymphedema latent phases of lymphedema (photo 1).
  - 6) Preventative Lymph Drainage Therapy with evacuation toward most efficient alternate lymphatic/interstitial fluid pathways.

### STUDYING THE MLM TECHNIQUE

Manually assessing the lymphatic rhythm and direction requires time and dedication. Without previous training it may seem totally impossible to feel such a subtle component of the lymph circulation.

We recommend that therapists new to this method first develop their skills for assessing the rhythm of the lymphatic flow. With training and practice, most are able to attain the sensitivity required to evaluate the rhythm, and then are able to determine the specific direction of lymphatic flow. In the author's experience, more than ninety percent of participants in the second-level training workshop are able to meet the challenge of manually finding the specific lymphatic pathways in an unknown lymph territory or lymphotome. In addition, students consistently find the same answers. These answers are consistent with superficial or deep lymphatic circulation as shown on anatomical charts.

While the technical means for measuring the accuracy of patient mapping in a non-invasive and scientific way are not yet available as of this writing, some investigations are currently underway using protocols to help measure and document this technique.



### CLINICAL APPLICATIONS OF MANUAL LYMPHATIC MAPPING

To clarify use of the lymphatic mapping technique on patients, we will present a few case examples.

The first case is of a 38-year-old woman who had a lumpectomy for a right breast carcinoma of 1 cm, grade I.

The patient had axillary node dissection (level I and II) with 11 nodes removed. All nodes tested negative for cancer. Surgery was followed by radiation therapy for two months.

While the patient did not display symptoms of clinical lymphedema and had not been treated with Complex Decongestive Physiotherapy (CDP), she was concerned about the risk of developing the condition and unclear about what exercises she could do safely.

In Photo # 1, the direction of the lymphatic flow was determined by Manual Lymphatic Mapping. The arrows indicate the patient's spontaneous "rerouting" of her lymphatic circulation after surgery and radiation therapy. Initial findings revealed that the superficial lymph circulation of her upper extremity was diverging and avoiding the axillary region (not shown). This was an adaptation to an abnormal condition (the removal of many of her axillary lymph nodes); under normal conditions, pathways of the upper extremity lymph circulation should all converge towards the axilla.

The post-surgical rerouting of the lymphatic circulation as seen in Photo # 1, follows two main "alternative pathways:"

- A) Clavicular pathways, as represented by numerous arrows, avoid the axilla and make a wide curve from the upper extremity and shoulder to the clavicle.
- B) Dorsal pathways that cross the posterior sagittal (midline) watershed; these are to be evacuated through the contralateral (opposite side) posterior upper quadrant lymphotome, which ultimately drains to the unaffected axilla.

In summary, this patient seems to have no major blockage of the superficial circulation at this point and no objective signs of edema. The lymph has rerouted naturally and efficiently, as it does in the 70 to 85 percent of post-mastectomy/post-radiation therapy patients who do not develop lymphedema. Moderate exercise seems indicated for this patient and a follow-up assessment may be recommended approximately every 6 months to one year to observe the evolution of the lymphatic alternative pathways.

In Photo # 2 the patient illustrates quite a different situation.

This patient, age 36, had a mastectomy in April 1996 with axillary node dissection. Of the 13 nodes removed, three tested positive for cancer. Further treatment included four cycles of chemotherapy and 33 radiation treatments. An episode of cellulitis required hospitalization and was treated successfully with antibiotics. The patient displayed very minor

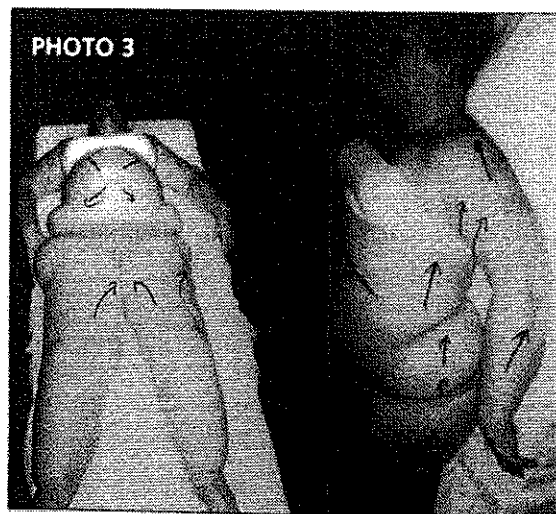
symptoms of clinical lymphedema in the forearm.

The lymphatic mapping as seen in Photo # 2 shows that the lymphatic drainage continues to converge toward the axilla and a strong flow can be mapped going through the axillary fascia. There is one superior lymphatic pathway starting to reroute and avoid the axilla, pioneering a new alternative lymphatic pathway. This rare case example illustrates that even after axillary dissection, chemotherapy and cellulitis, lymph can still attempt to follow the "path of least resistance" toward the axilla.

The initial objective of the practitioner after "mapping" the patient will be to gently encourage the lymph flow through the fascia. In this specific case the lymphatic circulation is totally rerouted toward the axilla after the first session. Nearly all the lymphatic circulation of her upper extremity somehow finds its way through the fibrosis and fascia layers of her axilla, which is quite uncommon. At this time and in this specific case, efforts to reroute her lymphatic pathways do not seem necessary.

Recommended follow-up care is to check the patient regularly to ensure that the axillary fascia does not continue to become more fibrotic and hinder the lymph flow to the axilla in the future. The process of fibrosis development may, in some cases, continue independently for many years, as we have seen in some documented cases of benign lymphedema up to 30 years after surgery. If this occurs a new, effective reroute will need to be found for lymph flow from the patient's upper extremity, chest and breast.

Photo # 3 illustrates how Manual Lymphatic Mapping can be used in assessing a most difficult case of lymphedema. This patient has primary lymphedema affecting all four extremities. The Manual Lymphatic Mapping depicts the superficial flow of lymph.



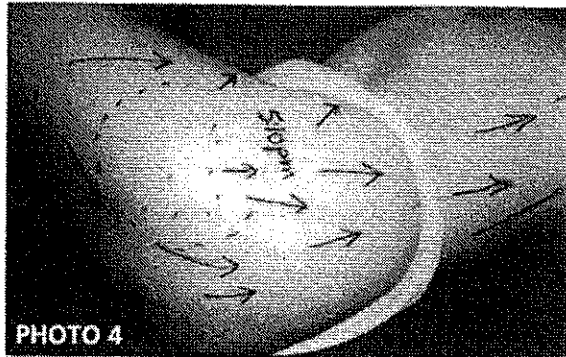


PHOTO 4

We note that the lymphatic drainage of the upper extremity veers away from the axillary nodes, rather than converging toward them as is seen in normal conditions. In this case it is mainly rerouting toward the clavicles, which are usually not a significant enough pathway to evacuate this extremity.

In the same way, the superficial lymphatic flow of the lower extremity is finding an alternative pathway toward a small group of thoracic nodes, close to the axilla. We also see in the front of the upper thigh the "new pathological watershed" (dotted line), the area from which lymph flows in opposite directions. The physiological watershed is usually located at the midline of the posterior thigh. This indicates most probably a significant blockage of the superior nodes of the upper extremity.

In treating lymphedema, the identification of the new "pathological watershed" is one of the tasks the therapist should perform, in order to more easily assess the new specific reroutes taken by the lymph flow.

In Photo # 4, we find a case of local post-traumatic lymphedema, a common condition encountered by many therapists.

Nineteen years prior to her being seen by us, the patient, while riding a bike, was hit by a car. The left side of her hip took the impact and she developed a severe chronic bursitis. This patient was seen during a seminar in front of a class of trainees. She initially presented with localized swelling and slight signs of inflammation without apparent fibrosis, local numbness in the upper thigh, minor pain during movement, pain during sleep that required her to sleep on the uninjured side of her body every night, slight skin discoloration and minor limitations in hip range of motion, with external rotation being most restricted.

The arrows in Photo # 4 show the initial results of the Manual Lymphatic Mapping and the abnormal lymphatic pathways. The lymphatic pathways of her lateral upper thigh do not converge toward the inguinal nodes but reroute pathologically around the iliac crest.

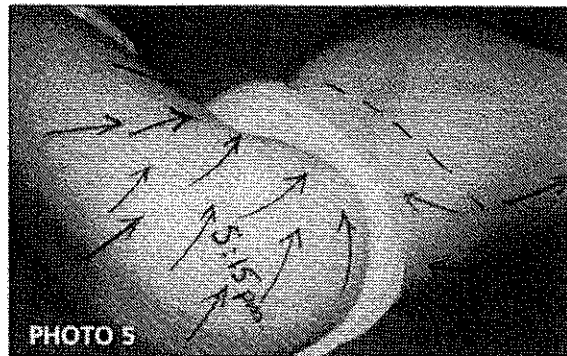


PHOTO 5

If the lymphatic mapping of the patient is pathological, it indicates the presence of a lymphostatic edema; i.e. lymphedema. In this case it can be called a secondary (post-traumatic) lymphedema.

What is noteworthy about this case is that the tissues did not develop fibrosis even after 19 years of local edema. We expected this patient to respond quickly to Lymph Drainage Therapy.

Photo #5 was taken a few minutes after the treatment was administered.

The lymphatic pathways are now rerouted toward the inguinal nodes. If the nodes are unaffected and the patient does not develop fibrotic tissue in the area, such as in this case, it is common and quite dramatic to see the lymph rerouting quickly toward physiological pathways.

"Normalization" of the local lymph circulation resulted in the disappearance of chronic swelling and inflammation. After five minutes, the patient reported a normalization of the skin color and decreased pain, discomfort and numbness. The patient declared that "it feels like it is my leg again. It hasn't felt quite normal all these years."

Upon assessing the range of motion in the limb, we found it had improved to within normal ranges. The day after the treatment, the patient reported that for the first time in 19 years she could sleep the whole night on the affected side without pain, paresthesia or discomfort.

The lymphatic circulation had found its pre-traumatic "path of least resistance." The patient had experienced no recurrence of her chronic condition in eight months of follow-up.

This case illustrates some of the possibilities for therapeutic intervention in lymphedema cases. In the event of post-surgical lymphedema or post-radiotherapeutic lymphedema with significant node dissection and/or with extensive fibrosis, we obviously cannot expect this kind of results. However, it is important to appreciate the way interstitial liquid and lymphatic pathways can reroute and find alternative pathways, and at times, as in this case, quite rapidly "normalize," dramatically improving the patient's condition.

## CONCLUSION

As the case histories clearly illustrate, lymphedema is a very complex condition, in which a "one-size-fits-all" approach may be less useful than an individualized one. The complexities, are compounded by evidence that all patients remain at risk for lymphedema for the rest of their lives and many complications can arise. Many types of lymphedema, even those of long duration, respond to conservative treatment, the first treatment of choice.

The refinement of the Manual Lymphatic Mapping techniques of Lymph Drainage Therapy offers the therapist an important tool for efficient management of lymphedema.

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