

Manual lymphatic drainage: exploring the history and evidence base

Anne Williams

Anne Williams is PhD Student, Edinburgh Napier University

Email: A.Williams@napier.ac.uk

Over 100 years ago, Winiwarter, a German surgeon, described the use of massage to 'promote resorption' of fluid from swollen tissues in people with lymphoedema (Winiwarter, 1892: 397). In the present day, manual lymph drainage (MLD), a type of massage, has become established as an integral part of lymphoedema treatment. However, the limited empirical evidence base and lack of consensus on the use and efficacy of MLD (Devoogdt et al, 2009) means there is a lack of clarity regarding the application of MLD for people with lymphoedema. Some lymphoedema practitioners may have limited knowledge of MLD. Those who have learned the techniques may have limited resources or support to continue using them. The current drive towards cost effectiveness also means that bodywork treatments such as MLD may be given low priority in the planning and resourcing of services.

This paper will provide a brief history and outline the main features and principles of MLD. It will discuss the evidence around the mechanisms through which MLD may exert its effect, and then overview the findings from studies that have examined the clinical and therapeutic efficacy of MLD. Finally, it will discuss some implications for clinical practice in lymphoedema treatment and care.

History

In the 1930s, his ill health forced Emil Vodder to abandon medical studies and move from Denmark to the French Riviera. Inspired by a deep interest in anatomy and bodywork, and a fascination with the lymphatic system, he intuitively developed a form of massage. Vodder presented his method of manual lymph drainage at a conference in Paris (Vodder, 1936), returning to Copenhagen before the outbreak of World War 2 (Wittlinger, 2004). It was

nearly 30 years later that his lectures drew interest from doctors and others who greatly admired his work and recognized that this type of manual massage could benefit people with lymphoedema (Asdonk, 1966; Fischer, 1967). In 1965, Vodder made a presentation in which he described his conviction that MLD, along with breathing and relaxation exercises and improved diet, would play a key role in lymphatic disorders (Vodder, 1965). His conviction holds true today.

While Winiwarter had described massage methods such as 'petrissage', 'efflurage' and 'friction' (Winiwarter, 1892), Vodder's technique was characterized by gentle, pumping, circular movements using pressures of around 30mmHg, combined with a 'zero' or resting phase. The aim was to enhance drainage of lymph from the interstitial tissues without producing increased capillary filtration (Wittlinger and Wittlinger, 1992). Until his death in 1984, Vodder worked with many colleagues from different countries. This collaborative work led to the development of the conservative physical therapy approach to lymphoedema management, combining MLD with compression bandaging, skin care and exercise (Földi et al, 1985). Inevitably, these techniques have now developed in various directions, owing to specific expertise and research. While different schools of MLD have been established (*Table 1*), the underlying features and principles of the MLD technique remain similar across the different methods (*Table 2*). Importantly, each MLD school insists on robust training and updating methods to ensure practitioners are fully skilled, and use their hands wisely, in order to achieve a good outcome for people with lymphoedema and other conditions.

Evidence base

How does MLD exert its effect?

Although one of the first studies of MLD took place 40 years ago (Börcsok et al, 1971), the mechanisms through which MLD has its effect are not fully established. In part, this is owing to problems in differentiating the effect of MLD from those of other interventions such as compression therapy. Additionally, there are challenges in establishing valid and reliable means of measuring the changes that take place in the lymphatic and other systems, as a result of MLD. Techniques to measure lymph flow can be complex (Olszewski and Bryla, 1994) and many focus on the uptake of radio-labelled proteins at lymph nodes (Mortimer et al, 1990; Szuba et al, 2002, Kaféjian-Haddad et al, 2006). As

ABSTRACT

Manual lymph drainage (MLD) is an integral part of lymphoedema treatment but there is limited evidence to guide clinical practice. This paper outlines the historical background to MLD and provides insights into the evidence relating to the effect and efficacy of manual lymph drainage, highlighting considerations for lymphoedema practitioners

KEY WORDS

♦ Manual lymph drainage (MLD) ♦ Lymphoedema ♦ Evidence for MLD ♦ Therapeutic effect of MLD

such, lymphoscintigraphy has been used in several studies, for example to measure the rate of flow into lymph nodes (Szuba et al, 2002) or visualize and describe changes in lymph drainage patterns (Ferrandez et al, 1996). While this provides some insights, the studies do not provide information on the long-term effects of MLD on the anatomical, physiological or functional aspects of the lymphatic system and other tissues. Measurement of nodal uptake is also impractical following lymph node dissection.

Table 3 summarizes reported effects of MLD and highlights some interesting features. For example, Leduc et al used lymphoscintigraphy to suggest that proximal use of the 'call-up' technique influenced lymph flow in distal lymphatics (Leduc et al, 1988). Evidence suggests that MLD enhances movement of fluid into initial lymphatics, and influences the contraction rates of pre-collector and collector lymph vessels, moving lymph towards deeper drainage trunks. MLD also appears to influence lymph flow between lymph territories and has also been surmised to lead to proliferation of collateral lymphatics (Casley Smith and Casley Smith, 1997). Some important considerations arise from the findings of various studies and warrant further research. For example, it is known that inflammatory mediators, present in interstitial tissue as a result of lymph stasis, will influence smooth muscle and alter lymph pumping mechanisms (von der Weid and Zawieja, 2004). This might suggest that MLD could have a role in reversing these processes at an early stage in the development of lymphoedema, reducing local inflammation and oedema, and restoring the function of lymphatic vessels even before a clinically obvious or chronic oedema has developed.

It appears likely that MLD has local and systemic effects, for example influencing the autonomic nervous system (Hutzschreuter and Ehlers, 1986) and producing significant changes in the secretion levels of serotonin, histamine, adrenaline and noradrenaline (Kurz et al, 1978). However, the significance of these findings in terms of using MLD for people with lymphoedema, have not been established. Some studies have reported a reduction in limb volume after MLD that did not appear to correlate with a measurable change or improvement in lymph flow (Francois et al, 1989; Kafajian-Haddad et al, 2006), suggesting that changes in other aspects such as blood flow may be significant. The potential for lymph to return to the blood circulation at regional lymph nodes (Levick and McHale, 2003), reflects the importance of lymph node clearance, an important feature of the MLD sequence. Additionally, the ways in which MLD may reduce skeletal muscle spasm, and improve lymph drainage, through its influence on connective tissue layers, requires further consideration.

Clinical therapeutic effects of MLD in lymphoedema

Some of the early work into the therapeutic effects of MLD was published in German and therefore not easily

Table 1. Some features of different methods of MLD

Vodder (Wittlinger and Wittlinger, 1992)	<ul style="list-style-type: none"> This method uses different hand movements on the skin called 'pump', 'scoop', 'rotary', 'stationery circle' and 'thumb circle', depending on what area of the body is being treated (<i>Figure 1, 2</i>). It includes oedema movements at areas of fibrosis
Földi (Földi and Strößenreuther, 2003)	<ul style="list-style-type: none"> This method is based on Vodder strokes as above with emphasis on a 'thrust' and 'relaxation' phase. It includes edema strokes such as the 'encircling stroke'
Casley-Smith (Casley-Smith and Casley-Smith, 1997)	<ul style="list-style-type: none"> This method uses a slow and gentle 'efflurage', with specific movements using the side of the hand, over the 'watershed' areas between lymphotomes (skin lymph territories) (<i>Figure 3</i>)
Leduc (Leduc et al, 1991)	<ul style="list-style-type: none"> This method uses specific techniques: 'call up' (or 'inciting') and 'reabsorption' movements; this reflects how lymph is absorbed into initial lymphatics, then moves through larger pre-collector and collector lymphatics

Table 2. Features and principles of MLD

- Hand movements are used to stretch the skin in specific directions and promote variations in interstitial pressures, usually without the use of oils
- Movements are slow, repetitive and soporific, and usually incorporate a brief 'resting' phase, where the skin is allowed to return to its normal position
- Pressures vary according to underlying tissues but aim to promote lymph drainage without increasing capillary filtration and hyperaemia
- Deeper or firmer movements may be incorporated when treating areas of fibrosclerosis, with compression therapy usually applied afterwards
- The MLD sequence starts proximally and centrally, often with treatment to the neck (*Figure 4*)
- Functional and healthy regional lymph nodes are treated, for example the contralateral (opposite side) axilla and ipsilateral (same side) inguinal nodes (*Figure 5*) in an upper limb lymphoedema, or both axillae in a lower limb lymphoedema
- Proximal areas such as contralateral and non-oedematous lymph territories or lymphotomes are treated, including the midline or 'watershed area' between two skin lymph territories
- The ipsilateral trunk and lymphoedematous limb are treated, starting proximally, often with particular attention given to the root of the limb
- Early in the treatment, emphasis may be on treating the anterior and posterior trunk prior to treating the swollen limb.
- Breathing techniques are commonly used with MLD, often combined with controlled hand pressures by the therapist, to influence drainage in the deep abdominal lymphatic vessels and nodes
- Limb mobilization and relaxation techniques may be incorporated into the MLD treatment session

accessible to an English-speaking audience. Additionally, much of the work around MLD has been descriptive, or has evaluated the effects of combined treatments, without distinguishing the specific effects of MLD. The majority of studies have been undertaken with women who have breast cancer-related lymphoedema. Studies also tend

Table 3. Evidence summary: reported effects of MLD

- Stretching effect on lymph collectors and local smooth muscle, increased the frequency of contraction of lymphangions/ lymph vessels and increased lymphatic transport capacity (Hutzschenreuter and Brümmer, 1988; Hutzschenreuter and Herpertz, 1993)
- Lymph flow increased (as measured by lymphoscintigraphy) possibly owing to increased rate of contraction of lymphatics (Francois et al, 1989)
- Variations in interstitial pressures led to enhanced filling and emptying of initial lymphatics (Casley-Smith and Björlin, 1985)
- 'Call-up' technique propelled lymph in the collecting lymphatics and exerted a suction effect on distal lymphatics; the 'reabsorption' technique moved proteins from a subcutaneous tissue injection site (Leduc, 1988)
- Proximal MLD treatments produced a reduction in distal tissue pressure (Deryden et al, 1994)
- 'Accessory routes' within the lymph drainage system appeared to be 'stimulated' (Ferrandez et al, 1996)
- Reduction in limb volume occurred, but was not consistent with increased lymph transport as measured by lymphoscintigraphy (Kafejian-Haddad et al, 2006)
- Blood flow increased in superficial blood circulation and peripheral arteries (Hutzschenreuter et al, 1989)
- Blood flow increased through the femoral vein (Deryden et al, 1994)
- The influence of MLD on the autonomic nervous system produced a calming effect (Hutzschenreuter and Ehlers, 1988)
- Skin circulation improved (Hutzschenreuter et al, 1992)
- Urinary secretion of serotonin, histamine, adrenaline and noradrenaline increased (Kurz et al, 1978)
- Breathlessness decreased and sleep improved (Williams et al, 2002)
- Microlymphatic hypertension reduced (Franzeck et al, 1997), although this appeared to be a combined effect of MLD and compression bandaging

Figure 1: MLD across the back using rotary technique: Vodder method**Figure 2: Thumb circles to the dorsum of the hand: Vodder method**

to focus on changes in limb volume, using varied or poorly defined ways to measure or calculate limb volume, negating any opportunity for comparison or meta-analysis. Other outcome measures such as tonometry to assess changes in skin and tissues (Harris and Piller, 2003), or measures of symptom changes or quality of life, also require further validation as a means to evaluate MLD.

Table 4 highlights a sample of studies that have a particular focus on MLD in breast cancer-related lymphoedema. Most draw on small samples and some are not randomized or controlled. Several studies suggest that in some patient groups, MLD combined with compression bandaging may be more effective than using compression bandaging alone (Johansson et al, 1999; McNeeley et al, 2004). However, specific details of how MLD was used or the effect measured are often not made clear (Andersen et al, 2000).

Two studies from the UK investigated MLD and patient-administered massage (Sitzia et al, 2002; Williams et al, 2002). Williams et al (2002) undertook a randomized controlled cross-over study and showed that MLD had a significant effect in reducing excess limb volume in women with breast cancer-related lymphoedema ($p=0.013$) even without compression bandaging. Similar results with a trend towards MLD being more effective were reported by Sitzia et al (2002) although the authors suggested a larger study sample was required.

Implications for practice

Asdonk, a German GP who was one of the first to use MLD extensively in his practice, highlighted the broad

Table 4. Evidence: examples of studies of the therapeutic effect of MLD in women with breast cancer-related lymphoedema

Authors	Design	Findings and comments
Johansson et al (1999) <i>Effects of compression bandaging with or without manual lymphatic drainage in patients with post-operative arm lymphoedema.</i>	Non-randomized consecutive sample of women with breast cancer-related lymphoedema. Part 1- women with limb volume excess of >10% received 2 weeks of CB Part 2 - divided into 2 groups <ul style="list-style-type: none"> Group 1 had a further 1 week of CB/MLD (Vodder MLD method) Group 2 had 1 week of CB alone 	Data on 35 women showed: <ul style="list-style-type: none"> At end of Part 1 - mean reduction in excess volume of 26% At end of Part 2: <ul style="list-style-type: none"> Group 1 (CB/MLD) had further 11% reduction in excess volume Group 2 (CB) had further 4% reduction in excess volume Both groups had improvement in symptoms but MLD group had a significant reduction in pain (p<0.03)
Andersen et al (2000) <i>Treatment of breast cancer-related lymphedema with or without manual lymphatic drainage. A randomized study.</i>	Prospective randomized study comparing standard treatment with custom-made information versus standard treatment and MLD (Vodder method) with 8 MLD treatments over 2 weeks, in women with limb volume of <30%	Data on 42 patients showed: <ul style="list-style-type: none"> No evidence of treatment effect from MLD Forty-eight percent reduction in absolute oedema volume at 3 months in MLD group Sixty percent reduction in same in non-MLD group No difference in symptom scores between groups Complex method of calculating limb volume Quality of life measured but data not reported
Sitzia et al (2002) <i>Manual lymphatic drainage (MLD) compared with simple lymphatic drainage (SLD) in the treatment of post-mastectomy lymphoedema. A pilot randomised trial</i>	Prospective study of 28 women with unilateral arm lymphoedema . Women randomized to two groups: Group 1- 2 weeks CB/MLD (Leduc method) given by therapist Group 2- 2 weeks CB/SLD (a simple form of MLD) given by therapist	Data from 28 women showed: <ul style="list-style-type: none"> Group 1- 33.8% reduction in excess limb volume Group 2- 22% reduction in excess limb volume Initial excess volumes of 68.3% in Group 1 and 58.5% in Group 2 Small pilot study suggested that MLD was more effective than SLD but neither results were significant and larger sample of 56 participants required to achieve significance
Williams et al (2002) <i>A randomised controlled crossover study of manual lymph drainage (MLD) therapy in women with breast cancer-related lymphoedema.</i>	Prospective cross-over study of 31 women with limb volume excess of >10% (mean 35% excess) Women randomized to two groups: Group A: 3 weeks (15 treatments) MLD (Vodder method) combined with standard treatment of compression hosiery and information Group B: 3 weeks of daily patient self-administered massage combined with standard treatment with compression hosiery and information. 'Wash-out' period of 6 weeks then participants crossed over to: Group A: 3 weeks SLD and compression hosiery Group B: 3 weeks MLD and compression hosiery Measurement of change in excess limb volume, dermal depth using skin ultrasound, caliper 'creep' to assess trunk oedema and quality of life (EORTC QLQ C30)	Data from 31 women showed: <ul style="list-style-type: none"> MLD achieved a significant reduction in excess volume (p=0.013) MLD achieved a significant reduction in dermal depth in the upper arm (p=0.03) MLD achieved a statistically significant improvement in emotional function, dyspnoea, sleep disturbance and pain sensation Self-administered massage had no statistically significant effects MLD was used without CB in an attempt to isolate the effect of MLD Longer than 3 weeks is required to evaluate self-massage Outcome measures such as caliper creep and skin ultrasound need further validation
McNeeley et al (2004) <i>The addition of manual lymph drainage to compression therapy for breast cancer-related lymphedema: a randomized controlled trial</i>	Sample of 50 women who had lymphoedema after breast cancer randomized to 4 weeks of daily treatment with MLD (Vodder method) and compression bandaging (CB) or CB alone. Measurement of limb volume reduction expressed as percentage change in excess limb volume	Data on 45 women showed: <ul style="list-style-type: none"> Significant reduction in lymphoedema volume in both groups (CB and MLD/CB) with most benefit seen in the initial 2 weeks Statistically significant greater limb volume reduction with MLD/CB in those with early lymphoedema (p < 0.05) Better outcome with MLD/CB in those with mild lymphoedema (<15% excess volume) than in any other groups (p < 0.05) Range of movement and other aspects of quality of life or symptoms not assessed

Figure 3. MLD across the midline or 'watershed' between two skin lymph territories: Casley-Smith method



Figure 4: MLD to the neck: Casley-Smith method



Figure 5: MLD clearance of superficial inguinal lymph nodes



range of conditions for which MLD may be indicated, including post-thrombotic syndrome, degenerative nervous system and inflammatory conditions (Asdonk, 1975). Recent papers report on MLD in sports medicine (Vairo et al, 2009), conditions such as fibromyalgia (Ekici et al, 2009) and reflex sympathetic dystrophy (Duman et al, 2009). A potential role for MLD as part of a lymphoedema prevention programme is also highlighted (Torres Lacomba et al, 2010).

However, for those using MLD within their daily practice, a number of questions arise concerning how MLD should be used with different groups. As yet, the

evidence to inform these decisions is limited and as a result, it is important that practitioners reflect critically on their practice in using MLD. Measurement of outcomes using standardized, valid and reliable methods is crucial, as is the sharing of results in terms of 'successes' and 'failures'.

It is likely that some patient groups may respond better to MLD than others. For example, there is some indication that MLD may be more effective in those with 'mild' lymphoedema (McNeeley et al, 2004). Certainly it is possible that the presence of fibrosclerotic tissues influences the effect of MLD, rendering it less effective and indicating that compression therapy in the form of bandaging may more effective as a first line treatment in some groups. Equally this may be an indication for early intervention with MLD to reverse the changes that may lead to long-term tissue fibrosis.

While MLD is frequently used in combination with bandaging, some groups will require MLD as the first-line treatment. For example, those with oedema of the trunk and midline are a particular priority for MLD and there are papers describing the use of MLD in genital oedema (Katz et al, 2004), breast oedema (Mondry et al, 2002) and head and neck oedema (Figure 6) (Reiss and Reiss, 2003). Clinical experience suggests that women who have breast oedema after breast cancer treatment will respond readily to MLD, with good long-term outcomes. This is a particular group who may be motivated towards self-management approaches and may be taught self-massage of the breast area during a course of MLD. Importantly, the use of MLD in this group may highlight how bodywork provides a means through which health professionals can enable people to adjust to and accept changes in their body after cancer treatment.

The theoretical debate that MLD may somehow promote metastatic cancer is not substantiated in the minimal literature (Preisler et al, 1998), nor in clinical practice. However, this highlights the need for lymphoedema practitioners to work closely with medical colleagues to ensure that MLD is appropriately given. It is usually advisable to delay MLD treatments if someone is receiving cytotoxic chemotherapy, particularly as the chemotherapy itself may alleviate an obstructive oedema by reducing tumour bulk. However, if the focus of care is palliative, it may not be appropriate to delay lymphoedema treatment, as swelling may become poorly controlled. In these situations, MLD can also play an important role in the management of other symptoms such as pain, dyspnoea and constipation.

While MLD should not be used in the presence of acute infection, once antibiotic therapy has begun and systemic symptoms have passed, MLD can be considered. MLD is also useful in those with chronic inflammatory conditions. If recurrent infection has been a problem, antibiotic therapy may be indicated during the MLD period as temporary exacerbation of symptoms can occur.

Figure 6: MLD to the head and neck region: Leduc method
(Courtesy of Leduc UK)



Summary

MLD has a long history and a limited, but growing evidence base to guide practice. This paper has identified some of the principles and possible effects of MLD and discussed some implications for lymphoedema practice. The effects and efficacy of MLD will depend on various factors relating to the person, the nature of their lymphoedema, and the way the practitioner uses the MLD techniques in combination with other interventions such as compression therapy and self-management support.

There is still much to learn about how MLD should best be used in order to ensure effective and equitable treatment for all individuals with lymphoedema. However, fundamental to this is the need for collaborative working and research. Good quality information about MLD is also required for people with lymphoedema, other colleagues, and those involved in managing and developing services. Practitioners should be aware of the current evidence around MLD and ensure they are appropriately educated in the techniques and supported with applying them in practice.

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Further information

General MLD information, training and therapist details:
<http://www.mlduk.org.uk/>

Casley-Smith method:
<http://www.macmillan-lymphoedema-academy.org.uk/index.html>

Leduc method: <http://www.lymph.org.uk/>

Vodder method:
<http://www.vodder-school.co.uk/teachers/>

USA-based school for Földi method:
<http://www.klosetraining.com/>

KEY POINTS

- Manual lymphatic drainage (MLD) is often used in combination with compression bandaging, exercises, skin care and self-management support in the management of lymphoedema
- Manual lymph drainage has a long history but a limited empirical evidence base
- Different schools of MLD have been established, but the underlying principles of the MLD techniques remain similar across the various methods
- Research studies have described many different ways in which MLD may exert its' effect on lymphatic, vascular and other systems
- Hands-on treatment to the body, such as MLD, can be important in helping individuals to adjust to body changes after cancer treatment

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