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*Lymphedema*

Randomized Controlled Trial > J Rehabil Med. 2008 Aug;40(8):645-50.

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# Effect of treatment with low-intensity and extremely low-frequency electrostatic fields (Deep Oscillation) on breast tissue and pain in patients with secondary breast lymphoedema

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**Free article**

## Abstract

**Objective:** To investigate symptoms and functional impairment in women with secondary lymphoedema of the breast following surgical treatment and to assess the therapeutic benefit of treatment with low-intensity and extremely low-frequency electrostatic fields (Deep Oscillation), supplementing manual lymphatic drainage.

**Methods:** Twenty-one patients were randomized either to the treatment group (n=11): 12 sessions of manual lymphatic drainage supplemented by Deep Oscillation, or to the control group (n=10): manual lymphatic drainage alone. Assessment included subjective pain and swelling evaluation, range of motion of the shoulder and the cervical spine, and analysis of breast volume using a 3D measuring system.

**Results:** Patients had high pain and swelling scores at baseline. Shoulder mobility was impaired in all patients; restriction of cervical spine mobility was common at baseline and declined further in the control group. Deep Oscillation resulted in significant pain reduction in the treatment group. The subjective reported reduction of swelling in both groups was confirmed objectively by 3D measurement only in the treatment group.

**Conclusion:** Additional Deep Oscillation supplementary to manual lymphatic drainage can significantly enhance pain alleviation and swelling reduction in patients with secondary breast lymphoedema compared with manual lymphatic drainage alone.

Randomized Controlled Trial > Clin Rehabil. 2012 Jul;26(7):607-18.

doi: 10.1177/0269215511427414. Epub 2011 Dec 15.

# Efficacy of low-frequency low-intensity electrotherapy in the treatment of breast cancer-related lymphoedema: a cross-over randomized trial

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## Abstract

**Objective:** To compare the efficacy of low-frequency low-intensity electrotherapy and manual lymphatic drainage in the treatment of chronic upper limb breast cancer-related lymphoedema.

**Design:** Cross-over single-blind random clinical trial.

**Setting:** Rehabilitation service.

**Participants:** Thirty-six women with chronic upper limb breast cancer-related lymphoedema.

**Methods:** Patients were randomized to undergo 10 sessions of manual lymphatic drainage followed by 10 sessions of low-frequency low-intensity electrotherapy or to undergo first low-frequency low-intensity electrotherapy followed by manual lymphatic drainage. There was a month of washout time between treatments. Each patient was examined just before and after each treatment. Researchers and outcome assessors were blinded for assigned treatment.

**Measures:** Outcomes were lymphoedema volume, pain, heaviness and tightness, and health-related quality of life measured with the Functional Assessment of Cancer Therapy Questionnaire for Breast Cancer version 4 (FACT-B+4). Carry-over, period and treatment effects were analysed. Treatment effect was assessed using paired t-test.

**Results:** Thirty patients finalized treatment. Comparing the changes in low-frequency low-intensity electrotherapy with manual lymphatic drainage changes, there were no significant differences. Low-frequency low-intensity electrotherapy did not reduce lymphoedema volume (mean of change = 19.77 mL,  $P = 0.36$ ), but significant reductions were observed in pain, heaviness and tightness (mean of change = 13.1, 16.2 and 6.4 mm, respectively), and FACT-B+4 summaries improved significantly (Trial Outcome Index mean of change = 5.4,  $P = 0.015$ ). Manual lymphatic drainage showed no significant changes in any of the outcomes

**Conclusion:** Although there are no significant differences between treatment changes, the observed trend towards a better health-related quality of life is remarkable in low-frequency low-intensity electrotherapy.

> [Minerva Med.](#) 2011 Aug;102(4):277-88.

## [Deep Oscillation: therapeutic-rehabilitative experiences with a new electrostatic device]

[Article in Italian]

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PMID: 21968626

### Abstract

**Aim:** Deep Oscillation® is an apparatus that produces low frequency electromagnetic radiations able to modulate immune reactions and, therefore, applicable to pain, tumour and inflammation treatments. The aim of this study is to evaluate how the Deep Oscillation® therapy works on conventional therapy resistant patients as the apparatus can be applied either to trauma derived from surgical wounds or on sports post-traumatic oedema, low back pain and/or sciatalgic pain and cervicobrachial pain.

**Methods:** In the first part of the study, 34 cases of recent surgical wounds have been treated with Deep Oscillation® with 3 times a week visits for 20 minutes. In the same way 30 cases of sports post-traumatic oedema, 20 cases of low back pain and/or sciatalgic pain and 10 cases of cervicobrachial pain were treated. Among these patients, 15 cases had also undergone contemporaneous nonsteroidal anti-inflammatory drugs intravenous drip, electrolytes and vitamins to verify the probable synergetic efficacy of both treatments.

**Results:** The results confirm that in some cases the Deep Oscillation® treatment is effective since the first/third therapy up to the restitutio ad integrum. It has also been demonstrated that the maximum efficiency of the Deep Oscillation® and nonsteroidal anti-inflammatory drugs synergetic treatment is probably due to the electromagnetic radiations able to facilitate the pharmacological uptake.

**Conclusion:** This study confirms the capacity of the electrostatic energy, released by Deep Oscillation®, to stimulate the patient's neurosensory system, raising his pain threshold and facilitating his pharmacological uptake and restoring his functional recovery more quickly.

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## **IMPROVING THE QUALITY OF LIFE THROUGH EFFECTS OF TREATMENT WITH LOW INTENSITY EXTREMELY LOW-FREQUENCY ELECTROSTATIC FIELD WITH DEEP OSCILLATION® IN PATIENTS WITH BREAST CANCER WITH SECONDARY LYMPHEDEMA TO PATIENTS TREATED WITH STANDARD LYMPH EQUIPMENT**

Atanas Petkov, Yana Kashilska, +1 author Dean Batzelov Published 5 August 2016 Medicine

**Objective:** To examine the damaged symptoms and functional disorders in women with secondary lymphedema after breast cancer surgery in which to evaluate the therapeutic benefits of treatment with low intensity and extremely low frequency electrostatic fields reproduced by the Deep Oscillation® with the program for a manual lymphatic drainage. **Methods:** Twenty-one patients, divided into two randomized groups. The first group of women consists of 11 women treated with 10 sessions lymphatic drainage with Deep Oscillation. And second control group included 10 women having undergone only standard lymphatic drainage. **Subjective assessment** includes pain and swelling; range of motion in the shoulder joint; movement of the neck and an analysis of the volume of the chest using a 3D system measuring. **Results:** At the beginning of therapy, patients had high scores for sensation of pain; swelling of the extremities; restricted movement in the shoulder joint; restriction in the movement of the spine in the neck portion. In the course of treatment the pain reduces its intensity, the volume of movement in the shoulder joint is returns, but in the study group, which is subjected to lymph drainage with low-frequency electrostatic fields of apparatus Deep Oscillation® indicators are much better. Moreover, significantly pain reduces. Subjective reduce swelling in both groups was confirmed objectively by 3D measuring only in the treatment group. **Conclusion:** Manual lymph drainage with deep oscillation leads to a significant reduction in pain relief and reduce swelling in patients with lymphoedema average breast compared with standard mechanical lymphatic drainage.

# Use of the HIVAMAT® 200 with manual lymphatic drainage in the management of lower-limb lymphoedema and lipoedema

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## Key words

HIVAMAT®200, manual lymphatic drainage; lipoedema; lymphoedema; oedema

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*Declaration of interest: None.*

Lower limb oedema is attributed to increased fluid in the extracellular space, which may be due to local or systemic causes. Local causes include lymphoedema, lipoedema, deep vein thrombosis and venous disease. Systemic causes include cardiac failure, renal failure, hypoalbuminaemia and medications such as calcium-channel blockers, steroids and anti-inflammatory drugs (Gorman et al, 2000). The principles of oedema treatment are to first manage the precipitating cause if possible. If there is persistent fluid in the limbs, however, methods to encourage fluid to move back into the venous or lymphatic circulation are advocated (Gorman et al, 2000).

## Lymphatic drainage

Manual lymphatic drainage (MLD) facilitates the drainage of accumulated extracellular fluids via the collecting lymphatic pathways. MLD is a standard lymphoedema treatment modality (Ezzo et al, 2015). Performed by an appropriately

## Abstract

**Background:** Manual lymphatic drainage (MLD) is a well-recognised and traditional treatment modality for oedema. HIVAMAT® 200 is a novel device that uses an intermittent electrostatic field to stimulate blood and lymphatic flow, thereby reducing oedema. This study aims to compare the effects of MLD alone to HIVAMAT® 200 plus MLD. **Method:** Three females with lipoedema and two males with lymphoedema were recruited. The larger leg was treated with HIVAMAT® 200 plus MLD and the contralateral limb with MLD only over the course of 3 weeks. Efficacy of treatment was determined with measurements of leg volumes and high-definition ultrasound to analyse oedema. **Results:** The mean reduction in volume for the HIVAMAT® 200 plus MLD-treated legs was 902 ml (SD 793 ml) and the mean reduction in MLD-only legs was 707 ml (SD 630 ml). While there was greater improvement in the HIVAMAT® 200-treated limb, this was not statistically significant ( $p=0.06$ ). Using high-definition ultrasound to analyse oedema, the limbs treated with HIVAMAT® 200 plus MLD showed significantly greater reduction in levels of oedema than the limbs treated with MLD alone ( $p=0.017$ ). **Conclusion:** HIVAMAT® 200 reduces lower-limb oedema and is at least as efficacious as MLD in achieving volume reduction. Prospective studies with larger numbers of participants are required to further evaluate this.

qualified practitioner, the affected area is manually massaged in a distal to proximal direction to encourage excess fluid to return to the circulation system (Ezzo et al, 2015). The frequency and duration of treatment is tailored to individual patients. Compression, in the form of bandages or garments, is applied in between sessions and thereafter to minimise the re-accumulation of fluid.

MLD is hypothesised to stimulate lymphatic contractile function by tissue manipulation, and hence promote the clearance of lymph fluid from the affected areas. Tan et al (2011) injected indocyanine green intradermally into subjects and compared the pre-MLD lymphatic contractile function against post-MLD lymphatic function in healthy and lymphoedematous limbs. They found that the average lymph velocity increased in both lymphoedematous and asymptomatic limbs, which supports the hypothesis that MLD stimulates lymphatic contractile function.

## HIVAMAT® 200

HIVAMAT® 200 (which stands for HIstological VARIable MAnual Technique), which is made by Physiomed Elektromedizen AG, is also known as Deep Oscillation® therapy. A special design makes it possible, using electrostatic attraction and friction, to produce mechanical vibrations in the body, not only at the skin surface but also in deeper tissues (Brenke and Siems, 1996; Boisnic and Branchet, 2013). The frequency can be varied within the 5–250 Hz range. The therapist applies an electrode to his or her own arm while the patient holds a small titanium bar, which connects both individuals to the equipment (voltage source). There is a vinyl film between the applicator and/or vinyl gloves are used. The patient functions as a dielectric. This results in a weakly conducting capacitive layer between the contact surfaces. In action, pulsed electrostatic attractions draw and pull the tissue towards the applicator/gloved hand and release it at the rhythm of the chosen frequency. The therapist sets the

pressure gradient, speed and direction of the movements. The patient can treat him- or herself with applicators if appropriate.

The treatment procedure is characterised by minimal external mechanical effect, which allows it to be used in cases of acute pain, soft tissue trauma and in the treatment of wounds. Numerous pilot studies have demonstrated pain reduction, minimisation of oedema, antifibrotic and anti-inflammatory effects, as well as improved wound healing (Gasbarro et al, 2006; Fistetto et al, 2011; Hernández Tápanes, 2012; Boisnic and Branchet, 2013). HIVAMAT is commonly used for the treatment of lymphoedema (Jahr et al, 2008). Deep Oscillation® has been shown by echographic image recording to penetrate to a depth of 8 cm (Hernández Tápanes et al, 2010).

### Aim

The aim of this study was to evaluate whether HIVAMAT® 200, combined with MLD, is useful as an adjunctive treatment modality in lower limb swelling compared to the efficacy of MLD alone.

### Methods

Patients who were referred for therapist-led treatment of lower limb swelling were considered for this study. The inclusion criteria included:

- Age >18 years
- Lower-limb swelling (unilateral or bilateral)
- The request for the treatment of excess fluid volume
- Informed consent to participate for the full 3 weeks of the study.

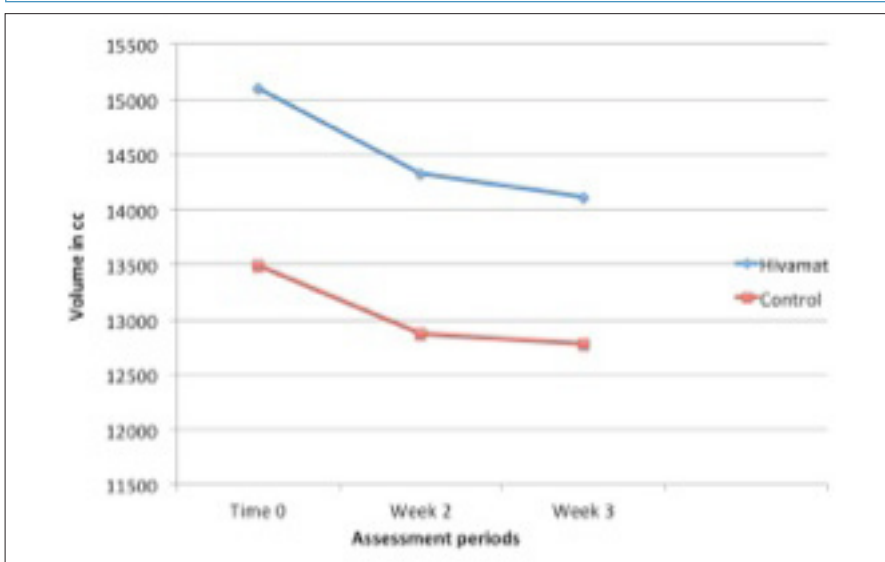
Exclusion criteria included previous treatment of any form on the participants' limbs. This study was approved by the local ethics committee.

The first five consecutive patients fulfilling the criteria were three females (lipoedema) and two males (lymphoedema). In each case, one leg was treated with HIVAMAT® 200 plus MLD, and the other with MLD over the course of 3 weeks. Efficacy of treatment was determined by measurements of leg volumes and high-definition ultrasound (HDU) scanning to analyse oedema.

Limb volume measurements and HDU scans to measure oedema were taken before, during and at the end of treatment (designated time 0, end of week 1 and end of week 3, respectively). Objective leg

**Table 1.** Effect of HIVAMAT® 200 plus manual lymphatic drainage on the study leg versus manual lymphatic drainage alone in the control leg in the 5 study subjects.

Subject	Age	Gender	Diagnosis	Study leg volume (cc)		Control leg volume (cc)	
				Time 0	Final	Time 0	Final
1	57	M	Right leg lymphoedema secondary to complications following right inguinal hernia and orchidectomy	12,402	12,190	12,351	10,911
2	56	F	Lipoedema	15,339	14,831	13,581	13,568
3	52	M	Primary lymphoedema of the right leg	16,940	15,217	13,068	12,241
4	47	F	Lipoedema	14,477	13,557	12,851	12,746
5	43	F	Lipoedema	16,354	14,781	15,593	14,443



**Figure 1.** Mean volume of limbs treated with HIVAMAT® 200 plus manual lymphatic drainage versus manual lymphatic drainage only (control) before (Time 0), during and at the end of the assessment period.

volumes were determined by measuring the circumference of each limb at 4 cm intervals, beginning from the malleolus and advancing proximally to the groin. Truncated-cone measurements were utilised and the volume of the leg between two adjacent measurements (a segment) was calculated using the following formula to give a volume in millilitres:

$$V = 4/12 \pi (C1 + C1 + C2)$$

where V is the volume of a segment, and C1 and C2 are the measured adjacent circumferences.

The entire limb volume is calculated by adding up the volumes of all the segments. This is a validated method of limb volume measurement commonly used in clinical practice (Ridner et al, 2007; Schaverien et al, 2012; Teo and Munnoch, 2015).

The HDU scanner (Episcan Longport Inc; with a frequency of 20 MHz, which gives an axial resolution at 65 µm) is an assessment tool that provides quantitative information on the fluid content of the epidermis, dermis and subcutis. Each HDU scan is analysed using a form of pixel distribution analysis whereby pixels below certain intensities are classed as low echogenic pixels (LEPs). The ratio of LEPs to total pixel (TP) count reflects the dermal water content. This provides a quantitative assessment of the level of oedema in the tissue (Gniadecka, 1996; Gniadecka and Quistorff 1996). The scan is taken consistently at the mid thigh and mid calf, for values of the proximal and distal legs, and the distal and proximal readings averaged to represent the average LEP:TP ratio for the entire limb.

The larger leg in all patients was assigned

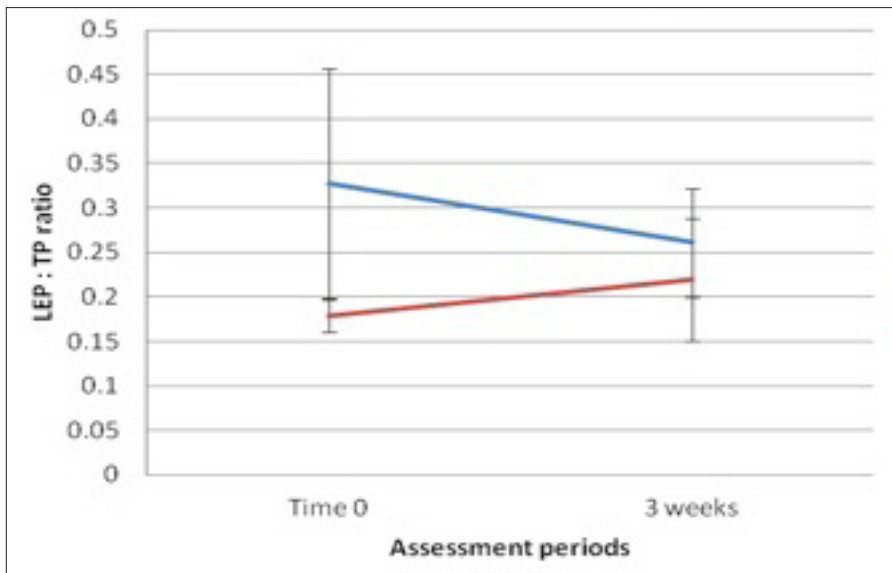


Figure 2. Analysis of the low echogenic pixels to total pixels (LEP:TP) ratio reflecting tissue oedema in the proximal legs. The LEP:TP ratio for HIVAMAT® 200 plus manual lymphatic drainage (blue line) showed a reduction in oedema, while manual lymphatic drainage only (red line) showed a slight increase in oedema.

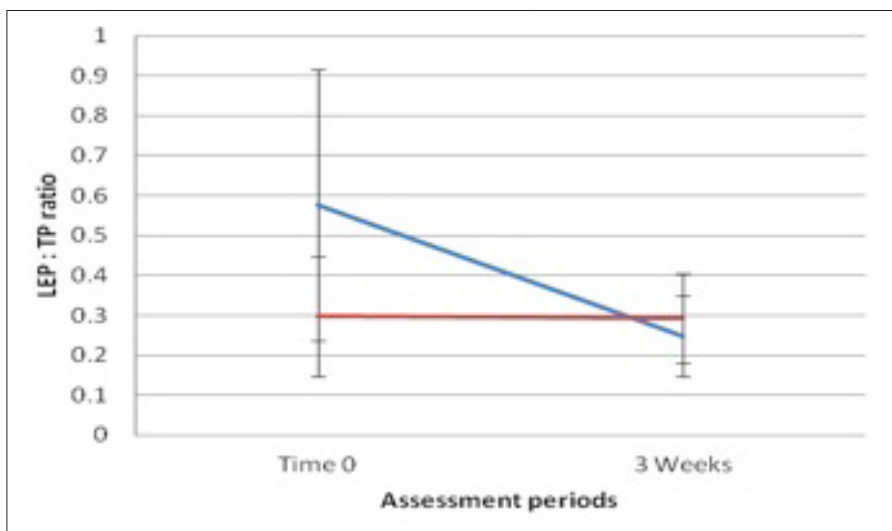


Figure 3. Low echogenic pixels to total pixels (LEP:TP) ratios of the distal leg demonstrating greater reduction of oedema in the distal limbs treated with HIVAMAT® 200 plus manual lymphatic drainage (blue line) compared to manual lymphatic drainage only (red line).

to receive HIVAMAT® 200 plus MLD and the smaller contralateral leg MLD only. Treatments were administered twice-weekly for the 3 weeks. HIVAMAT® 200 was applied at each session for 25 minutes at 200 Hz. Thigh-length compression garments (Class 2 or 3) were given to patients, to be worn continuously on both legs in the interim. All data were analysed using SPSS V20.

## Results

Mean patient age was 51 years (range 43– 57 years). All three females had

lipoedema, one male had primary lymphoedema and one had secondary lymphoedema following complications after a right hernia repair and right orchidectomy. The volumes of each study leg versus the control (MLD-only) leg over the 3 weeks of treatment are given in *Table 1*.

The mean reduction in volume for the HIVAMAT® 200 plus MLD legs was 902ml (standard deviation 793 ml) and MLD-only legs was 707ml (standard deviation 630ml). While there was greater improvement in the HIVAMAT®

200 plus MLD limbs (*Figure 1*), this did not reach statistical significance ( $p=0.06$ ).

The HDU scans showed that the mean LEP:TP ratios improved for the proximal and distal legs, indicating a reduction in oedema in the HIVAMAT® 200 plus MLD legs. Interestingly there was an increase in LEP:TP for the legs treated with MLD only (*Figure 2*) in the proximal leg. *Figure 3* shows the LEP:TP ratios for the distal (HIVAMAT® 200-treated) leg, demonstrating greater reduction in oedema in the treatment this leg compared MLD only.

The overall LEP:TP ratio for each limb (taking the mean of the distal and proximal reading) and change from time 0 to week 3 was compared in the HIVAMAT® 200 plus MLD group versus the MLD-only group using t-test analysis. This showed a statistically significant improvement in the reduction of oedema in the HIVAMAT® 200 group ( $p=0.017$ ).

## Discussion

### Lymphoedema and lipoedema

Lower-limb swelling can occur for a multitude of reasons, and can generally be attributed to increased deposition of fluid and/or fat. Lymphoedema is a common cause of lower limb swelling, in which an abnormality of lymphatic flow results in pooling of protein-rich lymph fluid in the interstitial tissues (Gorman et al, 2000). A study across a west London community in 2003, for example, reported a lymphoedema prevalence rate of 1.33/1,000 across all age groups (Moffatt et al, 2003). Lymphoedema may occur following trauma or infection or be secondary to malignancy or oncological treatment, such as nodal surgery or radiotherapy. Lymphoedema may also occur without any identifiable precipitating causes, when it is known as primary lymphoedema.

The standard treatment for lymphoedema is complete decongestive therapy (Huang et al, 2013), also known as decongestive lymphatic therapy, which should be provided by a qualified specialist practitioner (International Society of Lymphology, 2013). Decongestive lymphatic therapy consists of an initial reductive phase and subsequent maintenance phase. The initial phase consists of MLD, multilayer compression bandaging, therapeutic exercises, skin care



and education in self-management. The maintenance phase consists of lifelong self-delivered drainage, skin care and the use of compression garments (Huang et al, 2013).

Lipoedema is a bilateral and symmetrical limb condition that typically results in enlarged, painful lower limbs, although the upper limbs may be affected as well. It almost exclusively affects women and causes gross enlargement of the entire lower limb, with characteristic sparing of the ankles and feet (Langendoen et al, 2009). The aetiology is unknown but is postulated to be related to circulating oestrogens, as the onset is often associated with hormonal changes, such as puberty or pregnancy. There is increased deposition of fatty tissue with excess fluid (Langendoen et al, 2009). Földi and Földi (2006) performed an epidemiological study and estimated that 11% of the female population is affected.

The diagnosis of lipoedema is made on clinical grounds as described by Wold et al (1951):

- Almost exclusive occurrence in females
- Bilateral and symmetrical enlargement with minimal involvement of the feet
- Minimal pitting oedema
- Tenderness on pressure
- Easy bruising
- Persistent enlargement after elevation of the extremities or weight loss.

#### Assessing volume reduction treatment

There are numerous methods to assess response to volume reduction treatment and these include patient-reported outcome measures, such as reduction in heaviness and pain scores, episodes of cellulitis or quality of life questionnaires (Lopez Penha et al, 2014; van de Pas et al, 2015). More objective methods of assessing the success of treatment include volume measurement and ultrasound scans (Boyages et al, 2015).

Many techniques for volume measurement have been described. Magnetic resonance imaging, laser plethysmography (Stephan et al, 2000), computer-aided design and hand scanners are some of the current methods for limb volume measurement. The water displacement method is based on Archimedes' principle and involves

immersing the entire limb in water and calculating the volume of displaced fluid. This is considered the gold standard against which other volume techniques are compared (Sander et al, 2002; Karges et al, 2003; Ng and Munnoch, 2010) but has practical limitations with regards to equipment and patient factors. Girth measurement with a measuring tape is simple, quick, cost-effective and acceptable to patients. Karges et al (2003) compared water displacement and girth measurement and found both methods to be consistent and accurate. The authors use girth measurements in their clinical practice, find it clinically reliable, and hence suitable for the intentions of this study.

HDU scanning is a method of analysing the water content in tissues. It is simple, pain-free and provides a quantitative assessment of the level of oedema. The scan typically shows red pixels, which indicate tissue oedema (Figure 4), and blue pixels (Figure 5), which indicate healthy tissue. As mentioned in the methods section, each tissue scan is automatically analysed using a form of pixel distribution analysis, whereby pixels below a certain intensity are classed as LEP. The ratio of LEP:TP ratio has been shown to reflect dermal water content.

HIVAMAT 200's therapeutic Deep Oscillation® effects create cyclic movement through the entire depth of soft tissue from the skin, subcutaneous fat and muscles through to blood vessels and lymphatics (Fistetto et al 2011). This stimulates the mechanical pumping and redistribution of fluids. Deep Oscillation® is designed as an adjunct to surgical or other wound healing, sports medicine and respiratory diseases (Corneaux, 2011). Reinhold et al (2014) performed a study on 40 patients following osteosynthesis procedures on the extremities and spinal column. Patients were randomised to either Deep Oscillation® therapy or control. They found a significant pain-alleviating effect with Deep Oscillation®. Boisnic and Branchet (2013) conducted a clinical study of 20 subjects with periorbital bags or dark circles. They concluded that Deep Oscillation therapy was effective in reducing both dark circles and bags by an average of 40%. This was determined by

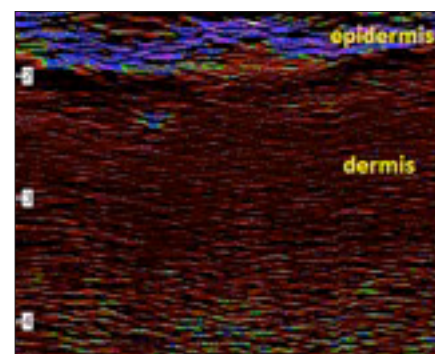


Figure 4. High-definition ultrasound scan showing a relative excess of red pixels compared to blue pixels, indicating oedema.

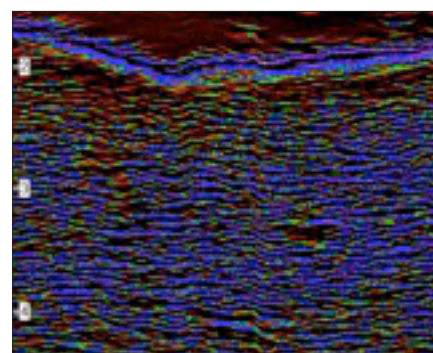


Figure 5. High-definition ultrasound scan showing reduction in red pixels and increase in blue pixels compared to Figure 4, indicating a reduction in oedema.

photography and dermatological scores, as well as ultrasound analysis. Jahr et al (2008) randomised 21 patients who had secondary lymphoedema of the breast following cancer treatment to either MLD supplemented with Deep Oscillation, or to MLD alone. They found that Deep Oscillation plus MLD was significantly better for relieving pain and swelling than MLD alone. Gasbarro et al (2006) analysed the effects of HIVAMAT 200 on the limbs of 20 patients and achieved a remarkably significant reduction in the circumference of the limbs and in the subcutis thickness. Other studies have found HIVAMAT 200 to be useful in the treatment of sports injuries, burns and epicondylitis (Brenke and Siems, 1996; Hernández Tápanes et al, 2010; Aliyev et al, 2012).

#### Limitations

There are several drawbacks to this study. The patient numbers are small and the assignment of the larger leg to HIVAMAT 200 plus MLD and smaller leg to MLD only incorporates a level of bias. While

both lipoedema and lymphoedema cause excess leg volume and oedema, the former is a bilateral condition and the latter often unilateral, making comparisons of the treatment and control leg distinct in these two diseases. The true efficacy of any treatment is highly reliant on patient compliance and the use of garments in the long term, which cannot be evaluated in a 3-week time period. Nonetheless, this pilot study provides valuable information on deep oscillation therapy.

## Conclusion

This is the first prospective study comparing HIVAMAT 200 plus MLD versus MLD only in the lower limbs. Although our results suggest greater efficacy with Deep Oscillation therapy for volume reduction, this did not reach statistical significance. The data do, however, show that HIVAMAT 200 was more effective in reducing oedema than standard MLD alone. The results of this pilot study are encouraging, and HIVAMAT 200 could be a useful addition to practitioners' armamentarium when treating oedematous limbs.

## Acknowledgements

AC designed the initial study and undertook treatments. IT and DAM reviewed all data, analysed the results and wrote the paper. The authors would like to thank Dr S Young who undertook the ultrasound analysis.

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# Management of Breast Cancer Related Lymphoedema

Simin Atashkhoei<sup>1</sup>, Solmaz Fakhari<sup>2\*</sup>

Lymphoedema followed by mastectomy due to breast cancer treatment is the most morbid condition that may affect the survival of the patients (1). The incidence of breast cancer related lymphoedema is about 20% of the breast cancer survivor population. Furthermore, it is known that the risk of breast cancer related lymphoedema is higher after an axillary lymph node dissection, chemotherapy and radiotherapy than a sentinel node biopsy (2). Occasionally, it is a rare event almost occurs beyond years (3).

Lymphedema management includes reducing size of edema, prevention of situation worsening and attenuation of infection risk in this population. It is prudent that management perform by expert clinician (4). However, none of treatment method can completely manage the problem (1). Currently, variety of treatment methods such as physical techniques, surgical approaches, low level laser therapy (LLLT), deep oscillation, sympathetic ganglion block, and acupuncture are available. Conventional management is performed as combination therapy by skin care (applying moisturizers), massage, special bandaging, physical exercise, and compression referred to comprehensive decongestive therapy which has popularity in the west countries. It is more efficient in combination with self-management (1).

Supportive treatment methods usually apply to intensive and maintenance phases and depend on severity of lymphoedema. In one randomized clinical trial, using of advanced pneumatic compression (flexible system) was more efficient than standard type that applied in 12-week course in lowering ion of lymphoedema (5). During maintenance phase, elastic sleeve and low stretch bandage are required after heavy decongestive physiotherapy for maintenance stability of lymphoedema volume (6).

At the palliative care (PC), physiotherapy plays a major role in the supporting and treating of patients who are suffering as pain and other distressing symptoms, such as respiratory symptoms due to lymphoedema. One of these treatments is manual lymphatic drainage in PC patients. Patients usually after manually drainage by physiotherapist will experience clinical improvement in severity of symptoms including pain and volume of lymphedema (7). Among the analgesic techniques, cervical stellate ganglion block is effective approach to reduce oedema volume

and thickness of arm with lymphedema, and improvement of patient's satisfaction (8). Other methods includes LLLT is a useful treatment method of breast cancer-related lymphedema that serially influences on multiple fibrotic regions (9). De Valois et al reported that acupuncture/moxibustion combination is acceptable method as adjunct for improvement of life quality

(10). Tidhar and Katz-Leurer found that aqua lymphatic therapy (ALT) for 3 months is a novel and a safe method with early effects on mild to moderate lymphoedema. They suggested that further studies are needed to evaluate the effect of ALT on organ volume reduction (11). In addition, it has been shown the combination of low-intensity and extremely low-frequency electrostatic fields (deep oscillation) and manual lymph drainage are methods significantly effective to resolve pain and to reduce edema in patients with secondary breast lymphoedema compared with manual lymphatic drainage alone (12).

Some of investigations have reported subcutaneous drainage can be considered a useful option for the relief of distressing symptoms caused by the oedema in patients with advanced cancer (13). Several beneficial surgery techniques also are applied for lymphedema management; include physiological methods and reductive techniques (3). Among of physiologic methods, flap interposition, lymph transfer and lymphatic bypass are performed to reduce lymphedema as restoring lymphatic drainage. It can be rely on liposuction (reductive technique) to remove fibrofatty tissue responsible to lymph fluid stasis. Now, microsurgical variation of lymph bypass is a popular approach that entrapped lymph node in edematosis organ is redirected to another lymphatic base (3).

In summary, education and training of patients are necessary elements for providing patient care. However, correct management needs to multidisciplinary approach for reduction of lymphedema implications on quality of life in breast cancer population.

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## Eight Years On – An MLD DLT Practitioner & Lymphoedema Therapist Review Of DEEP OSCILLATION® (HIVAMAT® 200) Therapy

DEEP OSCILLATION® therapy arrived in the UK in 2007, reaching the Republic of Ireland in 2009. Eight years on, PhysioPod® who are NHS approved suppliers, asked Private and NHS MLD Practitioners to provide accounts of their use of DEEP OSCILLATION® for primary and secondary lymphoedema, lipoedema and lipo-lymphoedema.

Of particular interest to PhysioPod® is the feedback received of more complex and challenging cases; including breast oedema with fibrosis present, cording developed after node removal, head and neck lymphoedema and breaking down stubborn fibrosis and scar tissue; where other treatment methods have not been effective.

### What is DEEP OSCILLATION®?

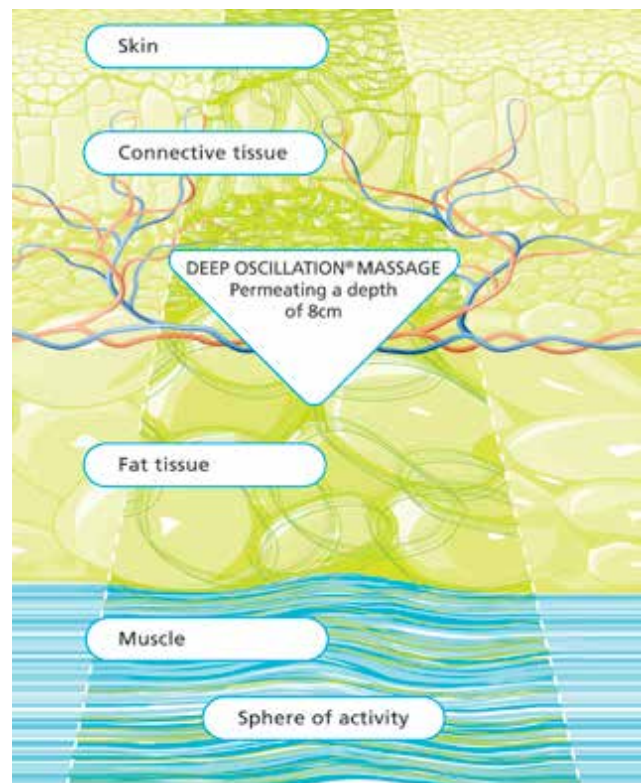
DEEP OSCILLATION®, developed by Physiomed Elektromedizin in Germany is an internationally patented therapeutic design which utilizes the forces of pulsed electrostatic attraction and friction to provoke oscillations, which act deeply on the tissues of the body from the epidermis down through the conjunctive and adipose layers and into the muscles. Hernandez Tapanes et al (2010) (1) were able to prove, by diagnostic ultrasound, penetration of the oscillations up to an 8cm depth (see diagram). Observed physiological effects of the therapy include oedema resorption (2). The therapy also limits the production of inflammatory mediators, especially during the treatment for chronic pain and more so during the treatment of fibromyalgia (3) strengthening of the cutaneous tissues (4), stimulation of the wound healing process (5,6).

A Video Report from Dr. MSc. Luis Felipe Medina C. Lic concluded: "Although this is an initial trial, resonance and kinetic movement of the connective tissue effected by an electrostatic field generated by DEEP OSCILLATION® can be evidenced and visualized via ultrasound imaging. The illustrated test series visualises for the first time the impact on tissue of DEEP OSCILLATION® in real time. The method offers an interesting methodical approach for future studies.

<http://hivamat.info/deep-oscillation-effect-in-tissues-recorded-by-ultrasound-imaging.shtml>

### How is DEEP OSCILLATION® applied?

DEEP OSCILLATION® is applied through light vinyl gloves enabling the Practitioner to feel what is happening in the tissue. Applicators can be used as an alternative, which also enable patient self-management. In a treatment session, a small titanium bar is placed loosely in the palm of the patients' hand or between their toes and the Practitioner adheres an electrode to their forearm or ankle (an extension lead enables easy movement around the couch from the unit). This forms the three-way connection for the therapy to work. As the lymphatic drainage routine begins, intermittent, electrostatic impulses permeate the entire tissue layers to a depth of 8cm as above. It is a pleasant, non-invasive therapy, which is enjoyed by both the Practitioner and their Patient. As DEEP OSCILLATION® is so gentle it makes it an unmatched treatment alternative in fresh trauma, applied day one post operatively, for acute pain and in the area of open wounds. Unlike other electrotherapies, where metal pins and plates are implanted, these are not a contraindication. The therapy can be applied all over the body, including the eyelids. Since it received it's patent in 1988, no adverse effects have been reported by practitioner or patient.



**MLD Practitioner Feedback:****Female, Age 59, Severe Fibrosis of Lower Arm, Hand and Fingers**

“The lady was treated for left breast cancer with mastectomy, axillary node clearance and adjuvant chemotherapy. Nine months following completion of her chemotherapy, she started to develop problems with her left hand and fingers. She noticed difficulty in bending her fingers and ‘firmness’ in the skin on her hand. This progressed until her hand, fingers and lower arm became fibrotic/sclerotic and there was very little movement in the wrist and fingers. Lymphoedema assessment revealed no oedema, slight inflammation, and severe fibrosis. Referral to several other specialties revealed no cause for the changes in her arm. She worked in a bank and because of her limited hand mobility, was no longer able to work. A course of short stretch compression bandaging combined with manual lymphatic drainage was commenced, but after 2 weeks there was very little change in her symptoms. A chance conversation with a Physiotherapist in Australia led to her purchasing a DEEP OSCILLATION® Personal from PhysioPod®. She used this 3 times a day on her arm, hand and fingers, and within 3 weeks her symptoms had started to improve. After 2 months she was able to use her hand and fingers and the fibrosis had almost resolved. This led to a significant improvement in her ability to carry out her self-care needs, but she was still unable to return to work. She continues with her regimen faithfully every day and takes the unit with her when she travels to her family holiday home in Ireland.”

**Marie Todd,**

Lymphoedema CNS, Specialist Lymphoedema Service, NHS Greater Glasgow and Clyde  
[www.physiopod.co.uk/nhs-greaterglasgow-and-clyde.shtml](http://www.physiopod.co.uk/nhs-greaterglasgow-and-clyde.shtml)

**Female, Age 47, Secondary lymphoedema of the arm and cording**

“The lady had a right and left breast lumpectomy in 2012. Although the biopsy result was negative on the right breast but she had a centennial nodes removal on the left breast, which followed with 6 cycles of chemotherapy. This lady had a family history of breast cancer from maternal side. I started treating her with lymphatic drainage combined with oscillation therapy to minimise the development of secondary lymphoedema of the left arm. In October 2013 she was diagnosed with right breast cancer. Immediately she had an axillary clearance followed by radiotherapy and chemotherapy. Unfortunately the second intervention left her with the problem of cording (an accumulation of protein particles in the tissue, which makes the skin hard, red, painful and very sensitive to touch). She restarted her lymphatic drainage treatment. The cording in the right armpit around the scar tissue was very tender, swollen and causing restriction of the arm movements. I started treating this lovely lady with DEEP OSCILLATION® therapy via the HIVAMAT® 200. On the first 2 sessions I tried to work only on the proximal side of the cording, at the end of each treatment she felt relieved and had more flexibility of the arm. On her 3rd visit I started working closer to the cording and eventually on the scar tissue. She had altogether 6 treatments with me, which improved her arm movements and she started doing everyday tasks without any restrictions”

**Sossi Yerissian,**

BLS, MLD UK, PHIA Vodder MLD DLT Practitioner and Lymphoedema Therapist  
[www.physiopod.co.uk/sossi-yerissian-w1g6ja.shtml](http://www.physiopod.co.uk/sossi-yerissian-w1g6ja.shtml)

**Female, Age 46, Secondary lymphoedema of the breast**

“The lady came to me after breast cancer treatment, which included lumpectomy, lymph node dissection, chemotherapy and radiotherapy. She developed lymphoedema of her right breast soon after radiotherapy and was in a lot of pain, also due to scar tissue and cording. After the first treatment with MLD and DEEP OSCILLATION® Naomi found relief from the pain and discomfort and her breast no longer felt hard and heavy. She found the treatment itself very relaxing and soothing. Naomi’s oedema is now managed with regular MLD with DEEP OSCILLATION®, compression, skin care and exercises.”

**Female, Age 55, Severe head and neck lymphoedema**

“The lady underwent trans oral laser surgery to remove a cancerous tumour from her right tonsil followed by an ear-to-ear neck dissection to remove cancerous lymph nodes in March 2014. This was followed 6 weeks later by 6 weeks of daily radiotherapy, which was completed early June. During August her neck started to swell and became very uncomfortable and painful. She saw me in mid September for MLD and DEEP OSCILLATION®. After the first treatment session her tongue swelling had reduced and she had more tongue movement, which in turn had made eating easier. She has improved further after regular, initially frequent, treatment sessions.”

**Regina Dengler,**

RGN, BLS, MLD UK Casley Smith MLD DLT Practitioner and Lymphoedema Therapist  
[www.physiopod.co.uk/regina-dengler.shtml](http://www.physiopod.co.uk/regina-dengler.shtml)

**MLD Practitioner Feedback, cont'd:****Female, Age 47, Treatment of cording with MLD and DEEP OSCILLATION®**

"I have treated several patients suffering from cording after breast cancer surgery. This lady was suffering with arm and hand swelling and had been recommended to see me by a mutual friend who was also having treatment for secondary lymphoedema. The lady was still undergoing chemotherapy but was particularly struggling with restricted arm movements due to cording. After MLD to the neck, unaffected axilla, chest and proximal affected arm, the HIVAMAT® 200 was brought into play and I carried out treatment along the route of the cording. Even after the first treatment, there was an improvement in the thickness of the cording and movement of the affected arm was much freer. I saw the client a few times, until she was happy that the cording had resolved. This is just one example of the power of the HIVAMAT® 200 and I continue to use it within my practice on a regular basis."

**Lesley Batten,**

BLS, MLD UK, Vodder MLD DLT  
Practitioner & Lymphoedema Therapist  
[www.physiopod.co.uk/lesley-batten.shtml](http://www.physiopod.co.uk/lesley-batten.shtml)

**DEEP OSCILLATION® Therapy with Patient Undergoing Radiotherapy and Chemotherapy**

"Working both in the NHS and private practice I have been using the HIVAMAT® 200 along side MLD with my oncology patients for the last 18 months to great benefit. Their initial reaction is often 'how does this work?' and 'is it going to hurt?' The actual results are that the patients really like the 'buzz sensation' therefore helping to relax them at what is a stressful time and essentially receiving the true benefits of excellent longer lasting results on their oedema. During radiotherapy the lymph nodes and skin are often affected resulting in skin damage to varying degrees and the nodes losing their function. This very gentle combination of MLD and HIVAMAT® 200 treatment appears to help the healing process as well as reducing their oedema. Also with chemotherapy patients, depending on how they are coping and the regime they are being given, I have found it to be just as beneficial in being effective for oedema and very much appreciated especially when there is neuropathy as a side effect of the chemo. I have found that the combination of MLD and HIVAMAT® 200 has reduced limb volume, softened fibrotic tissue and have also had reports from patients stating their hair and nails are stronger"

**Rosemary Gardner**

ITEC Dip, IiHHT Dip, MPACT, MITCH, CLT, PLT, SRT MLD UK Foldi MLD DLT  
Practitioner & Lymphoedema Therapist  
[www.physiopod.co.uk/rosemary-gardner.shtml](http://www.physiopod.co.uk/rosemary-gardner.shtml)

**The use of HIVAMAT® 200 in the treatment of Head and Neck Lymphoedema Patients**

"The Leeds Lymphoedema team has been using HIVAMAT® 200 (DEEP OSCILLATION®) in conjunction with Manual Lymphatic Drainage for over 2 years. Manual Lymphatic Drainage as a stand-alone treatment gives good results over time. Since introducing HIVAMAT® 200 we have found the results happen more quickly, especially when softening fibrosis or scar tissue. The advantage for the Practitioner is that they are still delivering a hands-on treatment, just with the addition of gloves. This enables them to feel the tissues as they work, adjusting their movements and depth of working alongside the frequency of the oscillations to obtain optimum results for the patient. It also still enables good control of their hands in delicate and small areas. The treatment is pleasant to receive and we have only ever had positive feedback. The treatment of Head and Neck oedema can be challenging for both therapist and patient. To be able to achieve effective results more quickly is hugely positive for the patient. It also frees up clinic slots to enable more patients to be treated. The use of HIVAMAT® 200 has definitely improved the overall treatment opportunities we can give our patients."

**Catherine Groom,**

Leeds Lymphoedema Service  
BLS, MLD UK, PHiA Vodder and Casley Smith MLD DLT Practitioner and Lymphoedema Therapist  
[www.physiopod.co.uk/wharfedale-hospital.shtml](http://www.physiopod.co.uk/wharfedale-hospital.shtml)

### Lipo-lymphoedema

In compiling this review, PhysioPod® thought it valuable to revisit the comments of Lynora Kennedy in 2009, the first MLD Practitioner in Scotland to use DEEP OSCILLATION®

“I became very excited after working on a client with Lipo-Lymphoedema. As many MLD therapists will know, this condition can be exasperating, not just for the client, but for the therapist too, as improvement in the condition can take a long time. I have been seeing Mrs M for some years, doing twice yearly 10 day CDT treatments as well as monthly treatments. She is very compliant, and keeps the bandaging on between the daily CDT appointments. The results have been OK, but nothing outstanding - until I used the HIVAMAT® 200. I wouldn't go so far as to say it 'revolutionised' her treatment, but something pretty close! She enjoyed the treatment immensely, and found it profoundly relaxing (she has a very stressful job and is carer for a family member, so physically tired most of the time). The volume loss was quite spectacular for lipo-lymphoedema and she was able to go into OTC compression tights for the first time in about 25 years. This is maintaining, 15 months on from the first HIVAMAT® 200 treatment. I see her every 3rd week, and have managed one 10 day CDT session with her this year - volume loss was measured in the hundreds, rather than tens, of millilitres. Her pain levels are negligible and her general health has improved too.”

#### Lynora Kennedy

BLS, MLD UK, PHIA Vodder MLD DLT Practitioner and Lymphoedema Therapist

[www.physiopod.co.uk/lynora-kennedy.shtml](http://www.physiopod.co.uk/lynora-kennedy.shtml)

Setting the trend in acquiring a personal DEEP OSCILLATION® unit for self-management between visits to their therapist or Lymphoedema Clinic, another patient of Lynora's gave the following testimonial:

“We were given a demonstration of her HIVAMAT® 200, and were so impressed that Mum decided to take the chance and invest in a personal unit for us to both use. We can't begin to say how much of a difference it has made - to come home, use the unit for 20 minutes, and for it to take the heavy, fluidy, feeling out of our legs and arms and more importantly to relieve any pain. Thanks to the HIVAMAT® number of MLD massages we go for. Although it seems so gentle when using it, the massage helps to move a lot of fluid out of limbs. We would have no hesitation in recommending the HIVAMAT® 200 to anyone, especially other sufferers of Lipoedema”

Louise, United Kingdom

### General Feedback of DEEP OSCILLATION® therapy

“Generally clients find the use of the HIVAMAT® 200 'comforting' and appreciate its use. I particularly like its use on 'fibrotic' tissue due to the lymphoedema or scar tissue. Especially useful when surrounding muscle structure has become hypertonic due to poor use of the affected limb post surgery more particularly the arm. I have used the HIVAMAT® 200 on neck and face following extensive oral surgery with good effect and received the thumbs up for that one! Its use when peripheral neuropathy is present is also greatly appreciated by clients.”

Lesley A. Guilfoyle NAMMT (RM)  
BLS, MLD UK Vodder MLD DLT Practitioner,  
Human & Equine Lymphoedema Therapist  
[www.physiopod.co.uk/lesley-a.-guilfoyle-nammt-rm.shtml](http://www.physiopod.co.uk/lesley-a.-guilfoyle-nammt-rm.shtml)

“At the Beacon Lymphoedema Service we have four portable DEEP OSCILLATION® units which we loan to patients when it's clinically appropriate. We train patients to use the machines to encourage lymphatic drainage and we've had some excellent results. We've found this process really helps empower patients to care for their own Lymphoedema and patients have given us great feedback too.”

Lorraine Brown,  
Lymphoedema Clinical Nurse Specialist  
Virgin Care's Beacon Lymphoedema  
Service in Guildford

“I was first introduced to DEEP OSCILLATION® in August 2009. I realised what I was seeing and feeling was quite remarkable and would be hugely beneficial to many, if not all, of my patients who didn't fall into the contra indication categories which are the same as MLD plus pregnancy and pace-maker. In late November 2009 I bought a HIVAMAT® 200 machine and have worked consistently with the machine on a variety of lymphatic conditions. I treat Primary Lymphoedemas, subcategorised into lymphoedema, lipoedema and lipo-lymphoedema. I also treat a large number of patients with Secondary Lymphoedema; caused by cancer, surgery, radiotherapy and trauma. The use of DEEP OSCILLATION® has a significant effect on tissue and circulation response to manual lymphatic drainage, by reducing surface tissue tension, softening consolidation at deeper levels, breaking up areas of fluid engorgement, aiding vascular and lymphatic flow, stimulating normal peripheral nerve stimuli, initiating the return of involuntary vesicle pulsation to assist the propulsion of lymph, thus relieving pain and stiffness caused by fluid and toxin entrapment and retention in the tissues. Patients relax and enjoy receiving the gentle, rhythmical buzz from the machine, in the knowledge their limb/body volume decreases before their eyes, pain thresholds change allowing for a greater range of movement and relaxation.

DEEP OSCILLATION® also has hidden depths initiating:

- Positive physical changes following serious illness or prolonged disability
- With physical change, self-management and condition control becomes doable.
- Greater understanding and self-awareness improves patients' psychosocial perception and offers a measure of self-belief and independence.

Recently I had to revert back to manual lymphatic drainage without DEEP OSCILLATION® on a long-standing breast patient. A sudden onset of epilepsy revealed a brain mass resulting in the removal of a benign meningioma. I had forgotten how labour intensive and tiring treating without the added benefit of DEEP OSCILLATION® was. I am more appreciative than ever to have Deep Tissue Oscillation at my fingertips.”

Christine Talbot,  
SRN, BLS MLD UK, Vodder, Leduc, Casley  
Smith MLD DLT Practitioner and Lymphoedema  
Therapist/Bowen Therapist. BA Member.  
[www.physiopod.co.uk/christine-talbot.shtml](http://www.physiopod.co.uk/christine-talbot.shtml)

## ROLE OF HIVAMAT® (DEEP OSCILLATION) IN THE TREATMENT FOR THE LYMPHEDEMA OF THE LIMBS

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### ABSTRACT

**Background.** The important goals achieved by biomedical technologies led us to search for new mechanisms for the treatment of the lymphatic pathologies. The aim of this study is to examine a new instrumental physiotherapeutic method which makes use of intermittent electrostatic fields with deep oscillation.

**Materials and methods.** HIVAMAT® 200 acts on the connective tissue with pulsing electrostatic fields which produce a deep resonant vibration of the tissues involved. By repeating this process in swift succession tissue deformations are caused. This allows fibre and tissue layers to regain motility and flexibility. On the basis of these remarks we conducted a clinical and instrumental study in order to check its efficacy in treating lymphedema of the limbs. From May to December 2005, 20 patients affected by lymphedema of the limbs underwent HIVAMAT® 200 treatment wearing II class compression garments.

**Results.** The results obtained in 20 patients confirmed that this method can play an important role in the treatment of such a complex disease. We achieved a remarkably significant reduction in the circumference of the limbs and in the subcutis thickness.

**Conclusion.** The advantage of HIVAMAT® 200 lies in the combination of electricity and several manual massage techniques which improve the treatment quality and efficacy. Moreover, due to its potential for self-treatment, patients can undergo treatment at home.

**KEY WORDS:** Lymphedema treatment, Intermittent electrostatic fields with deep oscillation.

### INTRODUCTION

Lymphedema is a chronic and progressive disease which may lead to disability from a physical, functional and psychological point of view. For this reason, it requires a targeted intervention, an early diagnosis and a comprehensive follow up care. The crucial difference between lymphedema and other vascular edemas is due to its constant fibrosis progression. This is because lymphedemas have a higher protein concentration which is responsible for the inflammation chain activation (1).

From a clinical point of view, the more the inflammation element is present, the more connectivization and therefore fibrosis may occur.

The definition of the causes of the lymphatic disease and its evolution state are also crucial elements to take into account in

order to determine the therapy timing and methods (2,3). From the rehabilitation perspective, this makes use of well-proven physiotherapeutic techniques which have been tested by numerous clinical studies carried out in university departments as well as in the medical field (see guidelines CIF-2004 and CONSENSUS DOCUMENT ISL-2003) (4,5,6,7). These physiotherapeutic techniques are commonly referred to as "Complex Decongestive Physiotherapy (CDP) of the lymphedema which consists of 2 phases and it is based on compression bandages and decongestive exercises (8,9).

The aim of this study is to examine a new instrumental physiotherapeutic method which employs intermittent electrostatic fields with deep oscillation. HIVAMAT® 200 acts on the connective tissue with pulsing electrostatic fields which produce an intense resonant vibration of the tissues involved. The mechanism is made up of a semiconductor layer and a minimal electrostatic field set up between the therapist's hands and the patient's tissue. The repetition of this phenomenon in quick succession generates rhythmical deformations of the tissue which is pumped through in its entire depth. This action allows fibre and tissue layers to regain motility and flexibility and improve tissue nourishment thanks to an increase in ATP production. HIVAMAT® 200 acts mainly on intercellular circulation of the interstitial connective tissue. Treatment results in a normalization of the fluidity of circulation.

### MATERIALS AND METHODS

From May to December 2005, 20 patients affected by lymphedema of the limbs underwent treatment by HIVAMAT® 200 combined with II class elastic stockings.

There were 16 females and 4 males aged between 30 and 60. HIVAMAT® 200 was applied following the procedures of manual lymph drainage (MLD). This consists in the preparation of the central and peripheral lymph node stations and then the successive drainage to lymph centres following the ways of lymphatic flow with a specific focus on the areas of major lymph accumulation. Treatment lasted 30 minutes and it was carried out twice a week. Each treatment was subdivided into 2 phases: initial medium-high frequency (25-80 Hz, 80-200 Hz) was aimed at softening the indurated tissue and stimulating the transportation of liquids whereas low frequency (25-80 Hz) acted as a strong pumping effect which allowed an effective interstitial drainage. After treatment the elastic stocking was applied on the affected limb.



The clinical conditions and the ecographic examination made by *PHILIPS iu22* were a part of the study inclusion criteria (10). Measurements of the circumference of the limbs were taken at 3 precise levels: above the ankle, at the upper 1/3 of the leg and at the upper 1/3 of the thigh. Such levels were also determined in each patient by considering the height from the ground in order to have a constant and precise level of measurement. Ecographic examination was performed at the same levels in order to evaluate subcutis morphology and thickness before and after treatment. This allowed us to evaluate qualitative modifications of the edema such as its state of subcutis connectivization and the presence of fluid lymph accumulation. Moreover, all patients who were under edema specific or non-specific pharmacological treatment were excluded from the study. On the other hand, patients who had finished complex physical treatment about 40 days earlier were included in order to not evaluate patients that could have had long-term benefits after intensive treatment.

## RESULTS

Variations of the circumferences, the subcutaneous thickness as well as qualitative variation in the subcutis layer affected by lymphedema were clinically and ecographically evaluated in these 20 patients after an eight-week course of HIVAMAT® 200 treatment. Treatment was also combined with compression stockings which are known to not influence significantly edema progression.

Before treatment the measurement of the circumference of the lower 1/3 of the leg ranged between 22.0 and 32.0 cm with a 25.9 cm average.

After treatment this average was down to 24.9 cm ranging from 21 to 34 cm.

This 1 cm average reduction was highly significant according to the t student test ( $p < 0.001$ ).

At the upper 1/3 of the leg circumferences ranged between 36 and 45 cm with a 39.3 cm average. At the end of the therapeutic cycle results ranged between 35 and 44 cm with a 38.4 cm average. According to the t student test this difference was remarkably significant

At the upper 1/3 of the thigh circumferences ranged between 57 and 75 cm before treatment with a 63.6 cm average. After an eight-week course of treatment the average was 62 cm ranging between 55.5 and 73.5 cm. (*Table 1*)

Ecography was carried out at the same level where circumferences were measured, that is, in the medial upper and lower 1/3 of the leg and the upper 1/3 of the thigh.

Measurements of the subcutis thickness at the lower 1/3 of the leg ranged between 3.50 and 5.09 with a 4.12 cm average. After treatment this value decreased to 3.97 cm ranging between 5.41 and 3.34 cm. This difference was also significant ( $p < 0.001$ ). At the upper 1/3 of the leg the subcutis thickness ranged between 5.73 and 7.16 cm with an average of 6.26. After treatment it decreased to 6.14 cm ranging between 5.57 and 7 cm. This difference was not found to be significant.

The final measurement of the subcutaneous thickness was taken at the upper 1/3 of the thigh. The average value of the initial thickness was 9.86 (range 8.83-11.7) and at the end of treatment this was reduced to 9.67 ranging between 7.95 and 11.3 cm. These results were remarkably significant ( $p < 0.001$ ). (*Table II*)

The aim was to undertake a qualitative evaluation of the subcutaneous layer conditions as well as the dominant feature, such as edema, presence of lymphatic lakes associated with the presence of lymph at the subcutaneous layer, fibrosis and sclerosis. In all cases a substantial reduction of the fibrotic component and the sovrafascial edema (if any) was observed. From a clinical perspective, this result revealed the presence of a tender edema. At the end of the study, this allowed us to provide patients with new intensive treatment where no side effects were observed, neither initially nor subsequently in the use of this machine. (Photo 1 - 2).

**Table 1 - Measurement of the circumferences of the limb.**

SEGMENT	Mean Average before treatment (cm)	Average post treatment (cm)	Range before treatment (cm)	Range post treatment (cm)
Lower 1/3 leg	25,9	24,9	22,0 - 32,0	21,0 - 34,0
Upper 1/3 leg	39,3	38,4	36,0 - 45,0	35,0 - 44,0
Upper 1/3 thigh	63,6	62,0	57,0 - 75,0	55,5 - 73,5

**Table 2 - Measurement of the subcutaneous thickness.**

SEGMENT	Mean Average before treatment (cm)	Average post treatment (cm)	Range before treatment (cm)	Range post treatment (cm)
Lower 1/3 leg	4,12	3,97	3,50 - 5,09	2,1 - 3,5
Upper 1/3 leg	6,26	6,14	5,73 - 7,16	5,57 - 7,00
Upper 1/3 thigh	9,86	9,67	8,83 - 11,7	7,95 - 11,3



Photo 1. Ecographic window of a limb with lymphedema with evident connectivization and presence of lymphatic lakes.

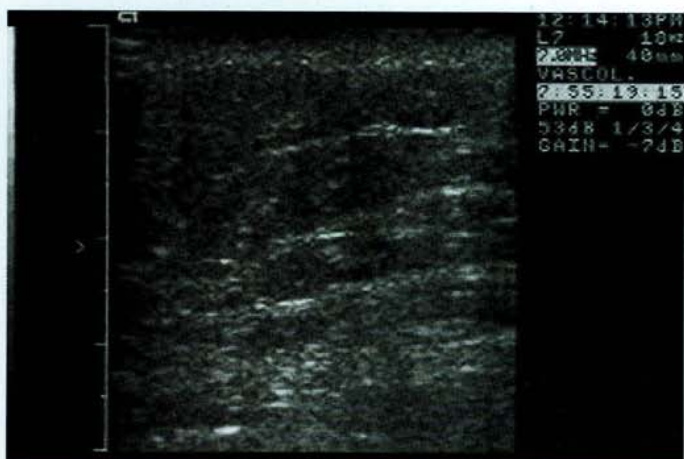


Photo 2. Same "ecographic window": evident reduction in the lymph accumulation and connectivization.

## DISCUSSION

Based upon our research results it is evident that in the case of lymphedema, no definite clinical resolution of the disease can be expected. However, there is a clear improvement in the objective and subjective parameters and this aim was accomplished with the application of the deep oscillation method.

Thanks to HIVAMAT® 200 we achieved a remarkably significant reduction in the circumference of the limbs affected. The type of clinical evaluation used, if applied rigorously, is able to confirm the above-mentioned results in any treatment aimed at improving lymphedema.

Both qualitative and quantitative evaluations were carried out in order to monitor the structural aspect of the subcutis. As a result, the ecographic studies have confirmed that the deep oscillation application significantly reduces the subcutis thickness.

There is no scientific literature on the deep oscillation method for treating lymphedema. Nevertheless, our study clearly showed how this treatment can be successful in slowing lymphedema progression down.

## CONCLUSIONS

Lymphedema represents a chronic, irreversible and debilitating condition where progression is inevitable. Instrumental tests are useful to confirm the clinical diagnosis, determine residual lymphatic function, select and evaluate therapeutic methods. The treatment goal is to remove stagnating lymph in order to avoid the onset of subcutaneous fibrosis, prevent complications such as lymphangitis, severe functional impairment, cosmetic embarrassment and amputation of the limb. This results in an improvement of the patient's quality of life. Non-invasive conservative therapy represents the best approach to lymphedema. Surgical procedures such as lymphovenous anastomosis, are reserved for specific conditions and they are rarely recommended as primary therapeutic option.

The Complex Decongestive Physiotherapy (CDP) of lymphedema is commonly employed as primary treatment and is based on hygienic measures, skin care, manual lymph drainage (MLD), compression bandages and decongestive exercises.

HIVAMAT® 200 is a new instrumental physiotherapeutic method which employs intermittent electrostatic fields with deep oscillation in order to stimulate the transportation of interstitial liquids and their components and allow fibre and tissue layers to regain motility and flexibility. All these effects are achieved through minimal external pressure.

On the basis of our experience, the optimum treatment for lymphedema of the limbs can be achieved through two or three-week cycles of CDP. Thus, through a combination of CDP and deep oscillation methods, which are able to stimulate transportation of interstitial fluids and their components, we can ensure an improvement of the treatment quality, a reduction in treatment times with positive effects on the patient management costs and an improvement of the patient's quality of life. Furthermore, thanks to the possibility of self treatment patients are given the chance of undergoing continuous therapy at home.

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# Effect of Physical Methods of Lymphatic Drainage on Postexercise Recovery of Mixed Martial Arts Athletes

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## Abstract

**Objective:** Physical methods are reported to be important for accelerating skeletal muscle regeneration, decreasing muscle soreness, and shortening of the recovery time. The aim of the study was to assess the effect of the physical methods of lymphatic drainage (PMLD) such as manual lymphatic drainage (MLD), the Bodyflow (BF) therapy, and lymphatic drainage by deep oscillation (DO) on postexercise regeneration of the forearm muscles of mixed martial arts (MMA) athletes.

**Design and methods:** Eighty MMA athletes aged  $27.5 \pm 6.4$  years were allocated to 4 groups: MLD, the BF device, DO therapy, and the control group. Blood flow velocity in the cephalic vein was measured with the ultrasound Doppler velocity meter. Maximal strength of the forearm muscles (Fmax), muscle tissue tension, pain threshold, blood lactate concentration (LA), and activity of creatine kinase were measured in all groups at rest, after the muscle fatigue test (post-ex) and then 20 minutes, 24, and 48 hours after the application of PMLD.

**Results:** The muscle fatigue test reduced Fmax in all subjects, but in the groups receiving MLD, DO, and BF significantly higher Fmax was observed at recovery compared with post-ex values. The application of MDL reduced the postexercise blood LA and postexercise muscle tension.

**Conclusions:** The lymphatic drainage methods, whether manual or using electro-stimulation and DO, improve postexercise regeneration of the forearm muscles of MMA athletes. The methods can be an important element of therapeutic management focused on optimizing training effects and reducing the risk of injuries of the combat sports athletes.



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