



WHITE PAPER

---

# THERADOT™



## DEEP OSCILLATION THERAPY

### INTRODUCTION

Deep oscillation therapy (DOT) is a method of combining repetitive pulsating oscillations with manual therapy. The treatment approach and related technology was developed in Germany in the early 1980's. The early adopters of the modality in the United States were mainly clinicians specializing in athletic injury rehabilitation. A DOT device known as the HIVAMAT™ became popularized within sports medicine circles for the treatment of acute and sub-acute pain and swelling. In more recent years DOT has proliferated into the lymphedema therapy setting and the post acute rehab setting. It is presently one of the fastest emerging modalities because of the ability to combine deep oscillation therapy with manual therapy and because of the high level of patient satisfaction associated with the treatment. The DOT technology and ease of use has also improved through the years and is now available as a portable device. Deep oscillation therapy is unique because it is an electromechanical modality which distinguishes it from electrical stimulation. It is also perceived as being more comfortable than electrical stimulation. Deep oscillation therapy creates an electrostatic



field between the clinician's hands and the tissue of the patient.<sup>1</sup> It allows the clinician to combine manual therapy with electrostatic oscillations to promote pain relief, and decrease swelling by mobilizing lymph fluid and swelling out of an injured area. The repetitive pulsating

oscillations feel like a comfortable vibrating sensation to the patient. Higher frequency oscillations (80-250Hz) provide rapid but gentle oscillations that are recommended for pain modulation and dissolving lymphatic waste in the acute phase of tissue

healing.<sup>1</sup> The lower frequency oscillations (5-25) Hz are believed to produce a pulsating pumping action in underlying tissues to promote movement of swelling through the lymphatic system and for increasing circulation to the injured area.<sup>1</sup>

### INDICATIONS

The indications for deep oscillation therapy include muscle relaxation, increased circulation, pain relief, increased tissue mobility, and edema reduction (including lymphedema when combined with manual lymphatic drainage). All of these are important factors in restoring function and maintaining muscle and joint mobility.

### CONTRAINDICATIONS

Deep oscillation therapy has been used safely throughout the world for over 40 years. The patient should be screened for the following contraindications prior to treatment with DOT.<sup>2</sup> Patients with these conditions should not be treated with DOT.

- Acute infections
- Acute venous diseases (thrombosis)
- Malignancies
- Pacemakers - patient and practitioner
- Hypersensitivity to electrostatic fields
- Pregnancy - patient and practitioner
- Active tuberculosis
- Untreated cardiac disease (e.g. congestive heart failure, cardiac insufficiency, decompensated cardiac edema, and cardiac arrhythmia)
- Infectious skin diseases
- Vertebrobasilar insufficiency

### APPLICATION

The electrostatic field can be delivered through a handheld applicator or through the clinician's hands when vinyl gloves are worn. The use of the vinyl glove application method is the most widely used

because it allows for the transmission of the electrostatic field into the patient while also allowing the clinician to perform manual therapy techniques (figure 1). A small amount of talcum powder is applied to the treatment area to absorb any perspiration on the surface of the skin and to allow for an easier glide of the gloved hand(s) on the skin. The massaging effect created by the electrostatic field and the manual therapy techniques works to increase blood flow and to open the lymphatic system to increase lymphatic return. It is recommended that the DOT session begin with treatment to lymphatics that are proximal to the edematous area to clear the area and open the lymphatic system. Once this is completed DOT can be applied over the edematous area with emphasis on using manual therapy techniques that focus on removing edema and maintaining and improving tissue mobility. The total treatment time can last from 15 minutes to 60 minutes based on the treatment objective and patient's response.



**Fig 1.** Administering deep oscillation therapy through vinyl gloves while performing manual therapy. Note that the clinician has an electrode on their forearm the patient has one on their arm to complete the electrostatic field

## EFFECTS ON PAIN

Deep Oscillation Therapy has been theorized to reduce pain largely through a gating mechanism. The electromechanical vibration promotes hyper-stimulation of the wide diameter heavily myelinated A-beta afferent nerve fibers to promote blocking of pain at the spinal cord level. A study of acute lateral ankle sprains in amateur athletes demonstrated a decrease in pain in the group receiving DOT compared to the control group.<sup>3</sup> The only parameter of deep oscillation therapy reported in this 6-week study was a treatment time of 20 minutes.

Additional studies on acute lateral ankle sprains showed mixed results. For example, Friesen<sup>4</sup> examined the effect of adding DOT at (150 Hz for 10 min, followed by 5 min at 20 Hz, at 85% intensity) to standard care for acute ankle sprains. A significant difference in pain reduction in the deep oscillation therapy group was found on day 1 of the treatment. However, no significant differences were found on days 2-5 of treatment.<sup>4</sup>

A study analyzing the effects of DOT on lower leg pain concluded that the intervention was effective in decreasing pain.<sup>5</sup> A single DOT treatment was delivered (1:1 mode and 70-80% intensity). The DOT treatment began by stimulating the lymphatic channels at the cisterna chyli (just below xyphoid process), the inguinal lymph node, and the popliteal lymph node at a frequency of 150 Hz all for a minute each. Next, the calf was treated for 11 minutes at three different frequencies (120 Hz for four minutes, 85 Hz for three minutes, 20 Hz for four minutes).

Lastly, the subject was treated distal to the popliteal lymph node at 25 Hz for 5 minutes. The researchers theorized that the pleasant vibrating sensation associated with DOT had a gating effect which masked pain and caused analgesia. The authors emphasize the concept of treating the lymphatic channels prior to providing direct treatment to the injured site.

Deep Oscillation therapy has also been studied for the treatment of elbow pain. O'Brien and Watson studied DOT for the treatment of lateral epicondylalgia in 20 subjects.<sup>6</sup> The treatment group received two 25-minute DOT sessions per week for 4 weeks. The control group received standard care. The oscillation was set to 2:1 mode and treatment was delivered at 200-250 Hz for 10 minutes, 40-65 Hz for 5 min, and 85 Hz for 10 min, for a total of 25 minutes. The study concluded that the DOT group demonstrated decreased pain and increased function at 6 weeks compared to the control group.

Deep oscillation therapy has been used in the treatment of complex regional pain syndrome (CRPS). The pleasant light vibration is better tolerated than electrical stimulation and is less likely to be perceived as a noxious stimulus by the patient. Mratskova reported using DOT to treat a distal radius

fracture that was complicated by the development of CRPS.<sup>7</sup> Deep oscillation therapy (100–200 Hz, 15 min, modulation mode of 1:1, with an intensity that was perceived by the patient as light vibration) was administered over the course of 10 treatment sessions. Mratskova reported pain reduction, edema reduction, and improved range of motion that was maintained at 3-month follow-up.<sup>7</sup> Future research on DOT to treat CRPS should be focused on developing randomized controlled trials involving a larger number of patients.

## EFFECTS ON SWELLING

The effect of DOT on swelling related to acute ankle sprains has been studied with mixed results. Compared to standard care alone, the addition of deep oscillation therapy yielded a significant difference between groups on day 4 of the treatment for girth reduction.<sup>4</sup> However, no reduction in swelling was measurable on days 1-3, or day 5.<sup>4</sup>

Based on the research of Winkelmann et al, a single deep oscillation therapy session (20 min, 150–165 Hz) is not able to produce measurable decreases in pain and swelling in acute ankle sprains beyond that of standard care.<sup>8</sup> Hausmann et al<sup>9</sup>, concluded that the use of deep oscillation therapy to decrease pain and swelling in patients with acute lateral ankle sprains compared to standard care warranted a Strength of Recommendation of Level B. The authors recommended that further research needs to be conducted. Additionally, the authors identified that some of the existing research is plagued by incomplete reporting of parameters.

## EFFECTS ON FLEXIBILITY

Deep Oscillation therapy has been shown to improve hamstring flexibility in a study of 29 subjects.<sup>10</sup> One 28-minute treatment (1:1 mode, 70% to 80% intensity, at various frequencies) produced an average increase of 6.2 degrees of hamstring flexibility. The researchers began the intervention by administering DOT to the lymphatic channels at the cisterna chyli (just below xiphoid process), the inguinal lymph node, and the popliteal lymph node at a frequency of 150 Hz all for a minute each. This was done to open the lymphatic channels prior to administering DOT to the Hamstrings. The frequency was then

adjusted to 64 Hz for 20 minutes for treatment of the hamstrings. The final 5 minutes was used to treat the lymphatics in the inguinal region at a frequency of 25 Hz.

The authors propose that increased hamstring flexibility may be a result of several different mechanisms. These include muscle relaxation, activation of the lymphatic system, and the dissolving of indurations (hardened tissue). Indurations are increased fibrous elements that restrict tissue mobility. It is theorized that DOT has both an anti-inflammatory effect that can help prevent the development of indurated tissue as well as an antifibrotic effect that can help to dissolve indurations.

## EFFECTS ON LYMPHEDEMA

In 2006 Gasbarro et al<sup>11</sup> reported the use of deep oscillation therapy in the treatment of chronic lower extremity lymphedema in 20 patients. The parameters began with high frequency DOT (80-200 Hz) for pain, softening of indurated (hardened) tissue, and to dissolve lymphatic waste (proteins and leukocytes) in the interstitium. This was followed by low-medium frequency DOT at 25-80 Hz for strong pumping effect to promote interstitial drainage. Deep Oscillation was performed as a supplementary treatment to manual lymphatic drainage (MLD) and was administered twice per week for 8 weeks. The authors reported decreased limb circumference measurements. They concluded that DOT when combined with MLD facilitates the movement of interstitial fluids and the accompanying proteins and leukocytes. Gasbarro et al<sup>11</sup> suggest that DOT helps the fiber and tissue layers to regain motility and flexibility with only minimal external pressure. This report was the first published data on the use of DOT for the treatment of lymphedema. A limitation is that there was not a control group for comparison.

A second study on lower extremity lymphedema also showed positive results.<sup>12</sup> The pilot study consisted of 5 subjects, three females (lipoedema) and two males (lymphodema). The researchers reported that DOT and MLD was more effective than MLD alone. Each subject had one leg treated with DOT plus MLD, and the other with MLD only. Deep oscillation therapy treatments (200 Hz for 25 minutes)

were administered two times per week for 3 weeks. The reduction in edema was determined by measurements of limb volume and high-definition ultrasound scanning. The data in this limited sample size shows that DOT was more effective in reducing edema than standard MLD alone. The researchers concluded that the results of this pilot study are encouraging and indicate that DOT could be a useful addition to standard care when treating edematous limbs. Additional well-designed studies with larger sample sizes are merited.

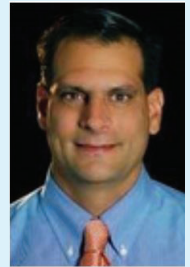
Further support for combining DOT and MLD can be found in a study by Jahr et al<sup>13</sup>. The researchers concluded that the addition of DOT as a supplementary treatment to manual lymphatic drainage can significantly decrease pain and swelling in patients with secondary breast lymphedema compared with manual lymphatic drainage alone. The study included 21 subjects. The treatment group received 15 min pre-treatment period of conventional manual lymphatic drainage, followed by deep oscillation-assisted lymphatic drainage of the breast and chest wall and arm. The DOT parameters consisted of 100 Hz for 30 mins, followed by 30 Hz for 15 minutes over the course of 12 treatments. The control group received manual lymphatic drainage only. This study supports the growing practice of combining manual lymphatic drainage and DOT.

## SUMMARY

Deep oscillation Therapy has seen an increase in clinical use and research in recent years. In the United States utilization of the modality was originally in the athletic rehabilitation field, it has since expanded into the lymphedema therapy setting and the post-acute care setting. Additional well-designed studies are necessary to fully understand the capabilities and limitations of DOT.

### JOSEPH A. GALLO, DSC, ATC, PT

Dr. Joe Gallo earned his BS in Physical Education and Athletic Training and his Master's in Physical Therapy. He also holds a Doctor of Science degree in Physical Therapy. He currently serves as a Professor at Salem State University. He has also held faculty appointments in various physical therapy and physical therapist assistant programs in his over 20 year career as an educator and clinician. He has taught over 300 continuing education workshops to rehabilitation specialists across the United States. His main area of research is focused on the evidenced based use of therapeutic modalities. Joe's research on electro-physical agents has been published in the Journal of Orthopaedic and Sports Physical Therapy and the Chinese Journal of Sports Medicine.



## REFERENCES

1. Kraft K, Kanter S, Janik H. Safety and effectiveness of vibration massage by deep oscillations: a prospective observational study. *Evid Based Complement Alternat Med*. 2013;(6):679248.
2. THERADOT Deep Oscillation Therapy Device Instruction Manual. THERADOT — Richmar (richmarweb.com)
3. Aliyev R. Better functional results of conservative treatment in fresh lateral ligament injuries of the ankle with additional deep oscillation. *Phys Med Rehab Kuror*. 2012;22(1):9-15. doi:10.1055/s-0031-1295494.
4. Friesen L. Effect of deep oscillation therapy on the reduction of swelling and pain following acute ankle sprain [unpublished master's thesis]. Harrisonburg VA: James Madison University Harrisonburg; 2010.
5. Christian, ME, Koenig RC, Winkelmann ZK, Games KE. The Effects of Deep Oscillation Therapy for Individuals with Lower-Leg Pain, *Journal of Sports Medicine, and Allied Health Sciences*. 2019; Vol. 4: Iss. 3, Article 3. DOI: <https://doi.org/10.25035/jsmahs.04.03.03>
6. O'Brien A, Watson JS. "Deep Oscillation Therapy in the Treatment of Lateral Epicondylalgia: A Pilot Randomized Control Trial." *Journal of Sports Medicine & Doping Studies* 6 (2016): 1-4.
7. Mratskova G. Use of deep oscillation therapy in rehabilitation program for patient with distal radius fracture with complex regional pain syndrome. A case report. *Trakia Journal of Sciences*. 2020, Vol. 18, Suppl. 1, pp 187-193, doi:10.15547/tjs.2020.s.01.034.

- <sup>8</sup> Winkelmann Z, Games K, Demchak T, Manley Z, Valencia C. Role of deep oscillation therapy in the treatment of acute lateral ankle sprains. *Br J Sports Med.* 2015;49(suppl 1):A1. doi:10.1136/bjsports2015-095573.2
- <sup>9</sup> Hausmann M, Ober J, Lepley AS. The Effectiveness of Deep Oscillation Therapy on Reducing Swelling and Pain in Athletes With Acute Lateral Ankle Sprains. *J Sport Rehabil.* 2019;28(8):902-905. doi:10.1123/jsr.2018-0152
- <sup>10</sup> Winkelmann ZK, Roberts EJ, Games KE. Acute Effects and Perceptions of Deep Oscillation Therapy for Improving Hamstring Flexibility [published correction appears in *J Sport Rehabil.* 2019 May 1;28(4):403]. *J Sport Rehabil.* 2018;27(6):570-576. doi:10.1123/jsr.2017-0044
- <sup>11</sup> Gasbarro V, Bartoletti R, Tsolaki E, Sileno S, Agnati M, Conti M, et al. Role of Hivamat (Deep Oscillation) in the treatment for the lymphedema of the limbs. *Eur J Lymphol* 2006; 16: 13-15.
- <sup>12</sup> Teo, I., Coulborn, A., & Munnoch, D.A. (2016). Use of the HIVAMAT® 200 with manual lymphatic drainage in the management of lower-limb lymphoedema and lipoedema. *Journal of Lymphoedema*, 2016, Vol 11, No 1
- <sup>13</sup> Jahr S, Schoppe B, Reissauer A. 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. *J Rehabil Med.* 2008; 40(8):645-650. PubMed ID: 19020698 doi:10.2340/16501977-0225