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# USE OF OSTEOPATHIC TECHNIQUES IN TREATMENT OF LYMPHATIC DYSFUNCTION

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## Summary

The lymphatic system has always been the key area of interest of osteopaths. Despite lack of precise data on the subject, the beginning of the 20th century already saw evolution of an array of effective techniques as clinical observations prompted clinicians to deal with this area of the body.

Osteopathic techniques serve to eliminate impediments to lymphatic flow and have autonomic effect, especially as far as the sympathetic system is concerned, which coordinates work of lymphatic vessels. Some osteopathic techniques serve to promote lymphatic flow.

The aim of the research paper is to present osteopathy as an adjunctive techniques in treatment of lymphatic system insufficiency, with special emphasis on the whole interconnections between the musculoskeletal system, the lymphatic system and the nervous system.

**Key words:** lymphatic edema, osteopathy, angiology.

## ***The characteristics of the lymphatic system***

The lymphatic system is the second circulatory system of the body that facilitates integration of all tissue fluids. Its basic function is to guarantee equilibrium of the intercellular fluids volume, filtrate and remove foreign substances (for example bacteria) from tissue fluid. Another important function is to transport metabolic products released by cells and the remains as well as triglycerides absorbed by the digestive tract [1].

Lymphatic vessels of the lower limbs consist of the surface system which transports about 80% of lymph from the limbs: vessels running along the saphenous vein and the small saphenous vein and deep network with arteries and deep veins. The subfascial system of the lymphatic vessels conducts lymph into the deep inguinal lymph nodes. From there it flows into iliac lymph nodes [1].

Lymph transport is possible through the contractions of the lymphangion, which should be at a rate 10/min. Smooth muscle contractions of the lymphangion, the autonomic nervous system and contractions of arteries in the lower limbs, all affect motor activity of the lymphangion. Note that subfascial lymphatic vessels are placed in a connective tissue sheath along with veins and arteries.

The lymphatic system is a passive system and its function depends on external factors [1, 2, 3].

### ***The lymphatic system insufficiency***

Lymphatic edema involves edema of tissue. It is caused by accumulation of tissue fluid and lymph in tissue and lymphatic vessels as a result of primary or secondary damage to the lymphatic vessels [4].

The lymphatic system insufficiency can be divided into dynamic and mechanical. In the case of dynamic variant, high volume insufficiency, the net ultrafiltrate (fluid load containing proteins) is higher than transport capacity of the system which in anatomical and functional terms is efficient. This leads to extracellular edema. The mechanical insufficiency (low volume) occurs when lymphatic vessels are damaged and transport capacity is limited. Provisional lymph volume corresponds to the limited value of the system's transport capacity [3, 4, 5].

The lymphatic edema arising from mechanical insufficiency of the lymphatic system can be divided into primary and secondary. Primary lymphatic edema is caused by hypoplasia or agenesis of lymphatic vessels. It can be innate (occurring before the first year of life) or late (occurring after 35 year of life), early (occurring between 1 and 35 year of life), late (after the age of 35). Secondary edema is caused by various lymphatic vessel damaging factors and can be divided into post-inflammatory, postoperative, after lymphadenectomy, tumor related, post-traumatic, occurring after lymphatic vessels and lymph nodes radiation, parasite-induced, venous-lymphatic, due to immobility of limbs or paralysis [4, 5].

Lymphatic disorders can also occur due to "safety valve" failure, which involves lower transport capacity of vessels and, at the same time, increased lymphatic load. It occurs in lymphangiosclerosis, where vessels become damaged due to lymphatic hypertension. Hemodynamic insufficiency is caused by failure of right ventricle of the heart as the heart can not pump blood into pulmonary artery. This may lead to the embolism of the right ventricle of the heart and venous obstruction. There is an increase in ultrafiltrate load, lymphatic pressure and the load is higher than transport volume resulting in cardiac edema [3].

### ***Tissue fluid mechanism***

Lymphatic flow is affected by a few factors. One of them is interstitial fluid pressure, which normally is around 6.3mmHg. Each rise in pressure is associated with a rise in capillaries' lymph absorption rates. A rise to 0 mmHg may cause a 20 fold increase in capillary filtration, which in normal conditions is 120ml/h [6,7]. If the pressure rises above 0 mmHg, the interstitial fluid pressure rises too and as it becomes higher than the pressure in the lymphatic vessels, the lymphatic vessels shut down impeding drainage.

Factors affecting interstitial fluid pressure:

- A. A rise in capillary pressure (systemic hypertension)
- B. Decreased osmotic pressure of colloid plasma (cirrhosis with lowered synthesis of plasma proteins)
- C. A rise in interstitial fluid level of proteins (hypoalbuminemia in starving people)
- D. Leaking capillaries (as a result of accumulation of toxins, for example after a rattlesnake bite)

Lymphatic pump can also be a factor. Lymphatic vessels are equipped with intrinsic mechanism that allows them to propel lymph. When lymph enters a vessel, the distention of the vessel occurs and in bigger vessels the distention promotes contraction of the smooth muscles of the vessels, facilitating lymph transport. The cycle is repeated. There are no smooth muscles in the capillaries but their endothelial cells are equipped with contracting fibers (myoendothelial fibers) which react to an increase in fluid volume in similar way. The flux of lymph through capillaries produces a delicate subpressure and lymph suction from the capillaries as they contract and relax. In the limbs the contraction rate is 6–8 s per cycle [7,8,9]. This corresponds to 8-10 cycles per minute.

External pressure is also a factor. Each rise in pressure on the vessels increases flow. Arterial pulsation of adjacent arterial vessels also produces increased flow.

Breathing, especially diaphragm, also significantly affect the lymphatic system. Movements of the tendinous portion affect cisterna chyli.

All movements of interior organs such as occurring during respiration, peristalsis of the intestines, as well as limb movements have effect on the lymphatic flow.

The respiratory diaphragm massages the lymphatic system. What's more, in the process of respiration a difference in pressure conditions is created between the thorax and the abdominal cavity. This, along with one-directional flow of lymph, helps lymph to enter venous circulation. When breathing accelerates or slows down the flow is adequately affected. Rigorous exercises along with limb, organ and diaphragm movements can make the lymph flow 15–20 times faster. In normal conditions pelvic diaphragm works along with the thoracic diaphragm.

When both diaphragms work properly, their contractions create optimal pressure conditions, enabling correct flow of lymph from pelvis minor. If the interior organs are to function properly, the pelvic floor has to be elastic all the time. When it is stiff, the diaphragm movements will increase pressure in interior organs disturbing their function and affecting drainage in the pelvic region and the abdominal cavity. Alternate movements of the diaphragms in the process of breathing create effect of an artificial pump, serving the lymphatic vessels and venous sinuses of the pelvis, anus area and peritoneum. To better protect this region, the body is equipped with, apart from the levator muscle of anus, a diaphragm called urogenital diaphragm [10, 11].

## **Osteopathic treatment of lymphatic edema**

The osteopathic treatment affects all body systems, especially the lymphatic system. Andrew Still, the creator of osteopathy, viewed this system as the most crucial system of the body and was the first scientist to draw attention to it and its role in preserving health and combating diseases.

Conservative treatment is usually applied to treat lymphatic edema. In the case of adult patients and children a complex anti-stasis therapy is recommended. It includes skin and nail hygiene, manual lymphatic massage, elastic bands and bandages with anti-edema function, medical exercises to support muscular pump function. And finally, osteopathic manipulations as described in English scientific literature.

Osteopathic treatment used in lymphatic edema can be divided into two groups according to their function. The aim of the first one is to eliminate restrictions to lymphatic flow and the second to promote drainage in areas where the flow is disturbed.

The objective of the osteopathic therapy is to restore equilibrium of the lymphatic system which can only function properly when no edema occurs. Seeing as the lymphatic system is passive it requires proper body movements and proper drainage. The osteopathic treatment improves body movements and enables adequate fluid dynamics.

The osteopathic techniques can be beneficial for our bodies on different levels:

### 1. Mobilization of fluid circulation.

Activation of lymph circulation, indirect stimulation of capillaries of the circulatory system, venous vessels, interstitial fluids, cerebrospinal fluid and synovial fluid. Osteopathic manipulation helps to propel static fluids (edema, primary or secondary lymphadenopathy) in skin, mucosa, internal organs, joints, cranial sutures, periosteum etc.

### 2. The osteopathic techniques drain:

- a. toxins: serving as adjunctive therapy promoting tissue regeneration, for example in the areas of scars, fractures and surgical procedures
- b. macromolecules (proteins): they help to eliminate fluid with high levels of proteins from extracellular tissue, absorb inflammations and edemas
- c. fat: lipocytes evacuation

### 3. Stimulate immunological system:

Improved lymph flow which carries antigens to the lymphatic nodes means improved antigen/ antibody contact. The techniques can have preventive role but also therapeutic as their beneficial role is observed in inflammations, both chronic and sub-acute, such as bronchitis, sinusitis, tonsillitis, laryngitis, arthritis, chronic fatigue syndrome, autoimmune diseases etc.

### 4. Stimulate parasympathetic system: stimulation of the lymphatic system activates the parasympathetic system and lowers activity of the sympathetic system. This can be beneficial in combating stress, in depression and sleep disturbances.

### 5. Alleviate pain: the osteopathic techniques reduce fluid stasis and can inhibit nociceptors

6. Reduce muscular hypertonus, congestion etc [12].

The objective of the osteopathic treatment of the lymphatic system is to restore equilibrium of the system through restoration of its proper function without edemas. As the system is passive, adequate motion and adequate drainage of lymph are of essence. The osteopathic therapy results in:

- improved absorption of fluid
- improved circulation and respiration
- lower levels of proteins in the endothelium
- more balanced pH of the organism

Fascia which supports lymphatic vessels, venous vessels, arterial and nerves is crucial for proper function of the systems. Twisted, with reduced elasticity, adhesions will hinder lymph flow. The literature [13] describes four regions of the body in which changes in the tonus of the fascia system can occur: occipus-atlas, cervical-thoracic, thoracic-lumbar and lumbo-sacral column. The regions described by Zink constitute passages between three main elements of our bodies: head, thorax and pelvis and, along with their diaphragms, are the regions where disorders most often occur along with changes in the activity of the autonomous system. These are important regions for transport and flux of tissue fluids and air as they produce differences in pressures in different cavities of the body. There are body rotation pressure compensation patterns which connect spine with adequate diaphragms and fascia system that connects all those regions, creating a path for vessels [13].

### ***Diagnosis of fascia patterns according to Zink***

Zink – American osteopath – was the first researcher to describe fascia system evaluation patterns and therapy based on so called fascia patterns. Fascia serves as support for lymphatic vessels, venous and arterial vessels and nerves and it is crucial for their good function. Twisted, with reduced elasticity, with adhesions will impede lymph flow. Zink described four body regions where changes in fascia tension occur [13].

- occiput-atlas
- cervico-thoracic
- thoracic-lumbar
- lumbo-sacral.

The regions described by Zink between head, thorax and pelvis along with their corresponding diaphragms are the areas where disorders most often occur with concomitant changes in the activity of the autonomous system.

The four diaphragms described earlier are essential for transport of tissue fluid and air as they are responsible for pressure conditions in different cavities of the body. The pressure compensation pattern at body rotation connect spine with adequate diaphragm and link all those regions with a fascia system which constitutes a path for vessels.

Zink described a “common compensation pattern” with its cycle of rotational tension of the fascia system, attuned to the physiological function of the organism. In other words, if diaphragms rotate in alternate directions, this indicates that there is physiological compensation.

Another less common compensation pattern is an uncommon physiological pattern that is opposite to the pattern described above.

If the fascia system acts during testing in different way than as in physiological compensation patterns described above it means that it is non-physiological compensation pattern that will result in dysfunction of the respiratory and circulatory pattern and will lead to disease. Adequately selected therapeutic techniques can have beneficial effect on the systems and affect the disease process [14].

### **Types of osteopathic treatment.**

Lymphatic treatment can be divided into two groups:

Table 1. Relationships between different regions according to Zink in respiratory-circulatory compensation patterns

Link	Spine level	Corresponding diaphragm	Activity of the autonomous system
Upper cervical column	CO-C3	Tentorium of the cerebellum	parasympathetic
Cervico-thoracic	C7-Th1	Upper thoracic inlet, Sibson fascia	sympathetic
Thoracic-lumbar	Th12-L1	Respiratory diaphragm	sympathetic
Lumbo-sacral	L5-S1	Pelvic diaphragm	parasympathetic

- a. techniques eliminating restrictions to the lymph flow
- b. techniques promoting and improving lymph flow [10].

In clinical practice the techniques from the both groups are alternately employed during treatment, always starting from the techniques eliminating restrictions.

The therapeutic protocol can be described as follows:

1. The technique consisting in mobilization of ribs or inhibition of sympathetic system in Th1-L2 region. The objective is to normalize the sympathetic activity which affects lymphatic vessels. Ribs mobilization improves respiratory function.
2. Treatment of the upper thoracic inlet. This is the most important region for the whole lymphatic system function as here lymphatic ducts run into thoracic veins and to the area of neck sinuses.
3. Relaxation of respiratory diaphragm. This improves its function and ability to create differences in pressure conditions between the thorax and the abdominal cavity.
4. Relaxation of pelvic area improves lymph return from the lower limbs and pelvis into the upper regions.
5. Fascia technique applied to lower and upper limbs.
6. Stimulation techniques that improve lymph drainage: pumping technique, manual drainage of the affected areas, drainage of the interior organs etc.

This is a general overview and the procedures can differ depending on the specific complaints of the patients.

### **Examples of the techniques used in selected regions**

#### **Techniques eliminating restrictions to lymph flow.**

1. Upper thoracic inlet fascia release.

Anatomically, it is the region between the first two ribs, upper thoracic vertebrae, sternum, collar bones. Fascia of the scalene muscles, long muscle of neck connect to form a functional diaphragm for the thoracic inlet. This also serves as a diaphragm for the right and left thoracic lymphatic ducts which run through it twice. Tissue of the region is often under strain due to bad breathing habits (upper-rib cage), faulty posture with head in the anterior position etc.

2. Normalization of sympathetic tonus.

The techniques consisting in ‘lifting’ ribs reduce venous blood stasis in major lymphatic vessels as well as stimulate sympathetic ganglions in the area of heads of ribs and thereby reduce activity of the system. The techniques improve mobility range of the thorax and respiratory function [10].

3. Technique of releasing respiratory diaphragm.

Therapy of the respiratory diaphragm requires also therapy of the cervical column due to its innervations by the phrenic nerve formed from cervical nerves C3-C5. Correct diaphragm structure and tonus improves its lymph pumping ability towards venous sinus.



Fig. Upper thoracic inlet fascia release.



Fig. Normalization of sympathetic tonus.



Fig. Technique of releasing respiratory diaphragm.



Fig. Techniques releasing fascia of the upper limbs.

4. Releasing pelvic diaphragm technique.

The two layered diaphragm supports interior organs. As it works along with the thoracic diaphragm, it creates optimal pressure conditions in the abdomen.

5. Techniques releasing fascia of the limbs.

**Techniques promoting lymphatic drainage.**

1. Pumping techniques.

Their objective is to increase the difference of pressures between thorax and abdominal cavity during normal breathing.

Pectoral traction

The objective is to improve lymph flow through relaxation of thoracic muscles, especially pectoralis minor. They affect the first 6 ribs during inhalation by increasing negative intrathoracic pressure and thoracic capacity. 1 cm increase of its circumference increases its capacity from 200 to 400 cc [15]. The technique is effective and can be used in postoperative wards.

2. Thoracic pumping technique.

It improves breathing efficacy and clears bronchi. It is beneficial in patients with lower limb swelling, mastitis, chronic bronchitis [15].

3. Abdominal cavity pump

The technique affects abdominal cavity. It consists of alternate stimulation of the diaphragm. It also has indirect effect as it massages chest and cisterna chyli.

4. Pedal pump

Foot region is considered as a sort of diaphragm. The collapse of feet arches can affect thoracic diaphragm function [10].



Fig. Pumping techniques. Pectoral traction.



Fig. Thoracic pumping technique.



Fig. Abdominal cavity pump.



Fig. Pedal pump.

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## WYKORZYSTANIE TECHNIK OSTEOPATYCZNYCH W LECZENIU DYSFUNKCJI UKŁADU LIMFATYCZNEGO

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### **Streszczenie**

Od narodzin osteopatii układ limfatyczny był jednym z kluczowych rejonów zainteresowań osteopaty. Mimo braku szczegółowej wiedzy na temat tego układu na przełomie XIX/XX wieku obserwacje kliniczne zmuszały klinicystów do zajęcia się tym obszarem naszego ciała. Nie znano w tamtych czasach dzisiejszych technik drenażowych, ale stworzono całą gamę technik osteopatycznych, które w bardzo skuteczny sposób oddziaływały na jego funkcję.

W głównej mierze techniki osteopatyczne opierają się na likwidacji ograniczeń w przepływie limfy i oddziaływaniu na układ nerwowy, szczególnie układ współczulny, który zawiaduje pracą naczyń limfatycznych. Stosowane są również techniki osteopatyczne drenażowe służące mobilizacji limfy.

Celem pracy jest przedstawienie podejścia osteopatycznego w wspomaganiu leczenia niewydolności układu limfatycznego ze zwróceniem szczególnej uwagi na całość powiązań układu mięśniowo-szkieletowego z układem limfatycznym oraz układem nerwowym.

**Słowa kluczowe:** obrzęk chłonny, osteopatia, angiologia.