

# Collected Scientific Research Relating to the Use of Osteopathy with Immune regulation

## Important:

1) Osteopathy involves helping people's own self-healing abilities to work better, rather than focussing primarily on particular conditions.

2) Each person is different, and osteopathy treats them differently.

Therefore people respond to osteopathic treatment in different ways. Treatments that work for one person cannot be guaranteed to work for another person in the same way. The fact that there is scientific research supporting a treatment in a group of people does not mean that it will always work in the same way (which is probably true of all research).

A number of things make research into osteopathy challenging. These include the two aspects of osteopathy mentioned above, and also the lack of major commercial interests to provide funding in expectation of financial returns. At the same time, there is an emerging body of research demonstrating the usefulness of osteopathic treatment.

Please note: there is room for debate about the classifications used for these studies. Please let John Smartt know if you believe that any of these classifications are incorrect.

# These studies are from peer-reviewed journals

Number of studies: 22

## Clinically and statistically significant results

Number of studies: 21

## Systematic reviews

Number of studies: 1

Nelson EA, Mani R, Thomas K, Vowden K 2014 **Intermittent pneumatic compression for treating venous leg ulcers (Cochrane review)** Cochrane Database of Systematic Reviews May 12 [http://www.cochrane.org/CD001899/WOUNDS\\_intermittent-pneumatic-compression-for-treating-venous-leg-ulcers](http://www.cochrane.org/CD001899/WOUNDS_intermittent-pneumatic-compression-for-treating-venous-leg-ulcers).

**BACKGROUND:** Intermittent pneumatic compression (IPC) is a mechanical method of delivering compression to swollen limbs that can be used to treat venous leg ulcers and limb swelling due to lymphoedema. **OBJECTIVES:** To determine whether IPC increases the healing of venous leg ulcers. To determine the effects of IPC on health related quality of life of venous leg ulcer patients. **SEARCH STRATEGY:** For this update we searched the Cochrane Wounds Group Specialised Register (searched 10 December 2010); the Cochrane Central Register of Controlled Trials (CENTRAL) (The Cochrane Library 2010, Issue 4); Ovid MEDLINE (2007 to November Week 3 2010); Ovid MEDLINE (In-Process and Other Non-Indexed Citations December 09, 2010); Ovid EMBASE (2007 to 2010 Week 48); and EBSCO CINAHL (2007 to 3 December 2010). **SELECTION CRITERIA:** We included randomised controlled trials (RCTs) that compared the effects of IPC with control (sham IPC or no IPC) or made comparisons between IPC treatment regimens, in venous ulcer management. **DATA COLLECTION AND ANALYSIS:** Both review authors reviewed titles and abstracts and agreed on full studies to be retrieved. One review author extracted data and assessed studies for risk of bias and this was checked by a second review author. **MAIN RESULTS:** We identified seven randomised controlled trials (including 367 people in total). Only one trial was at low risk of bias having reported adequate randomisation, allocation concealment and blinded outcome assessment. In one trial (80 people) more ulcers healed with IPC than with dressings (62% versus 28%;  $p=0.002$ ). Four trials compared IPC plus compression with compression alone. The first of these trials (45 people) found increased ulcer healing with IPC plus compression than with compression alone (risk ratio for healing 11.4, 95% Confidence Interval 1.6 to 82). The remaining three trials (122 people) found no evidence of a benefit for IPC plus compression compared with compression alone. One small trial (16 people) found no difference between IPC (without additional compression) and compression bandages alone. One trial (104 people) compared different ways of delivering IPC and found that rapid IPC healed more ulcers than slow IPC (86% versus 61%). **AUTHORS' CONCLUSIONS:** IPC may increase healing compared with no compression, but it is not clear whether it increases healing when added to treatment with bandages, or if it can be used instead of compression bandages. Rapid IPC was better than slow IPC in one trial. Further trials are required to determine whether IPC increases the healing of venous leg ulcers when used in modern practice where compression therapy is widely used.

Noll DR 2016 **The Potential of Osteopathic Manipulative Treatment in Antimicrobial Stewardship: A Narrative Review.** J Am Osteopath Assoc Sep 1;116(9):600-8 <http://jaoa.org/article.aspx?articleid=2546796>

"The contemporary management of infectious diseases is built around antimicrobial therapy. However, the development of antimicrobial resistance threatens to create a post-antibiotic era. Antimicrobial stewardship attempts to reduce the development of antimicrobial resistance by improving their appropriate use. Osteopathic manipulative treatment as an adjunctive treatment has the potential for enhancing antimicrobial stewardship by enhancing the human immune system, shortening the duration of antimicrobial therapy, reducing complications, and improving treatment outcomes. The present article reviews the evidence published in the literature since this unique treatment approach was first developed more than 100 years ago. The evidence suggests that adjunctive osteopathic manipulative treatment has great potential for enhancing antimicrobial stewardship and should be further investigated."

Yao S, Hassani J, Gagne M, George G, Gilliar W. 2014 **Osteopathic manipulative treatment as a useful adjunctive tool for pneumonia.** J Vis Exp May 6;(87) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4173698/>

"Under the current Infectious Disease Society of America/American Thoracic Society guidelines, standard-of-care recommendations include the rapid administration of an appropriate antibiotic regiment, fluid replacement, and ventilation (if necessary). Non-standard therapies include the use of corticosteroids and statins; however, these therapies lack conclusive supporting evidence (4). (Figure 1) Osteopathic Manipulative Treatment (OMT) is a cost-effective adjunctive treatment of pneumonia that has been shown to reduce patients' length of hospital stay, duration of intravenous antibiotics, and incidence of respiratory failure or death when compared to subjects who received conventional care alone (5). The use of manual manipulation techniques for pneumonia was first recorded as early as the Spanish influenza pandemic of 1918, when patients treated with standard medical care had an estimated mortality rate of 33%, compared to a 10% mortality rate in patients treated by osteopathic physicians (6). When applied to the management of pneumonia, manual manipulation techniques bolster lymphatic flow, respiratory function, and immunological defense by targeting anatomical structures involved in these systems (7,8, 9, 10). The objective of this review video-article is three-fold: a) summarize the findings of randomized controlled studies on the efficacy of OMT in adult patients with diagnosed pneumonia, b) demonstrate established protocols utilized by osteopathic physicians treating pneumonia, c) elucidate the physiological mechanisms behind manual manipulation of the respiratory and lymphatic systems. Specifically, we will discuss and demonstrate four routine techniques that address autonomic, lymph drainage, and rib cage mobility: (1) Rib Raising, (2) Thoracic Pump, (3) Doming of the Thoracic Diaphragm, and (4) Muscle Energy for Rib 1."

Hodge LM, Downey HF. 2011 **Lymphatic pump treatment enhances the lymphatic and immune systems.** Exp Biol Med Oct;236(10):1109-15 <http://www.ncbi.nlm.nih.gov/pubmed/21865405>

"The osteopathic medical profession has long advocated the use of osteopathic lymphatic pump treatments (LPT) to improve lymphatic circulation, reduce edema and combat infectious disease. However, until recently, there was no scientific evidence that LPT enhances function of the lymphatic and immune systems. This review discusses the physiological functions of the lymphatic system, the ability of LPT to increase lymph flow under normal and experimental conditions, the clinical benefits of LPT, current research models for the study of LPT and the potential mechanisms by which LPT enhances lymphatic and immune function."

Walkowski S, Singh M, Puertas J, Pate M, Goodrum K, Benencia F, 2014 **Osteopathic Manipulative Therapy Induces Early Plasma Cytokine Release and Mobilization of a Population of Blood Dendritic Cells**. PLoS One Mar, Vol. 9 Issue 3, p1-12. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3948629/>

"Recently, it has been shown in human patients suffering chronic low back pain, that OMT [osteopathic manipulative therapy] is able to modify the levels of cytokines such as IL-6 and TNF- $\alpha$  in blood upon repeated treatment. Further, experimental animal models show that lymphatic pump techniques can induce a transient increase of cytokines in the lymphatic circulation. Taking into account all these data, we decided to investigate in healthy individuals the capacity of OMT to induce a rapid modification of the levels of cytokines and leukocytes in circulation. Human volunteers were subjected to a mixture of lymphatic and thoracic OMT, and shortly after the levels of several cytokines were evaluated by protein array technology and ELISA multiplex analysis, while the profile and activation status of circulating leukocytes was extensively evaluated by multicolor flow cytometry."

"A significant decrease in the proportion of a subpopulation of blood dendritic cells was detected in OMT patients. Significant differences were also detected in the levels of immune molecules such as IL-8, MCP-1, MIP-1 $\alpha$  and most notably, G-CSF. Thus, OMT is able to induce a rapid change in the immunological profile of particular circulating cytokines and leukocytes."

Hernandez-Reif M, Ironson G, Field T, Hurley J, Katz G, Diego M, Weiss S, Fletcher MA, Schanberg S, Kuhn C, Burman I. 2004 **Breast cancer patients have improved immune and neuroendocrine functions following massage therapy**. J Psychosom Res Jul;57(1):45-52 <https://www.ncbi.nlm.nih.gov/pubmed/15256294>

#### OBJECTIVES:

Women with breast cancer are at risk for elevated depression, anxiety, and decreased natural killer (NK) cell number. Stress has been linked to increased tumor development by decreasing NK cell activity. The objectives of this study included examining massage therapy for women with breast cancer for (1) improving mood and biological measures associated with mood enhancement (serotonin, dopamine), (2) reducing stress and stress hormone levels, and (3) boosting immune measures.

#### METHODS:

Thirty-four women (M age=53) diagnosed with Stage 1 or 2 breast cancer were randomly assigned postsurgery to a massage therapy group (to receive 30-min massages three times per week for 5 weeks) or a control group. The massage consisted of stroking, squeezing, and stretching techniques to the head, arms, legs/feet, and back. On the first and last day of the study, the women were assessed on (1) immediate effects measures of anxiety, depressed mood, and vigor and (2) longer term effects on depression, anxiety and hostility, functioning, body image, and avoidant versus intrusive coping style, in addition to urinary catecholamines (norepinephrine, epinephrine, and dopamine) and serotonin levels. A subset of 27 women (n=15 massage) had blood drawn to assay immune measures.

#### RESULTS:

The immediate massage therapy effects included reduced anxiety, depressed mood, and anger. The longer term massage effects included reduced depression and hostility and increased urinary dopamine, serotonin values, NK cell number, and lymphocytes.

#### CONCLUSIONS:

Women with Stage 1 and 2 breast cancer may benefit from thrice-weekly massage therapy for reducing depressed mood, anxiety, and anger and for enhancing dopamine, serotonin, and NK cell number and lymphocytes."

Shor-Posner G, Miguez M, Hernandez-Reif M, Perez-Then E, Fletcher MA 2004 **Massage treatment in HIV-1 infected Dominican children: a preliminary report on the efficacy of massage therapy to preserve the immune system in children without antiretroviral**

"Objectives: More than 1.4 million children are living with HIV and global access to antiretrovirals is not yet readily available. Massage therapy, which has been shown to improve immune function in HIV+ adults and adolescents, may provide an important complementary treatment to boost immune status in young children living with HIV disease, especially those without access to antiretroviral medications. No studies have been conducted, however, that specifically target massage therapy to enhance immune function in HIV+ children.

Design: Clinical trial with eligible, consented HIV+ children randomized to receive either massage therapy or a friendly visit (controls).

Settings/Location: CENISMI/Robert Reid Cabral Hospital, Santo Domingo, Dominican Republic.

Subjects: HIV+ children ages 2–8 years.

Intervention: Massage therapy sessions (20 minutes, twice weekly, for 12 weeks), conducted by trained nurses, following a structured protocol of moderate pressure stroking and kneading of muscles, using a nonscented oil. The friendly visit control group, (reading, talking, playing quiet games), met with the nurse twice weekly for 12 weeks.

Outcome Measures: At the initial evaluation, and following the 12-week intervention, blood was drawn to determine absolute helper (CD4/T4) and suppressor (CD8/T8) counts.

Results: Children in the control arm had a greater relative risk of CD4 count decline (>20%) than massagetreated children (RR = 5.7, p = 0.03). Lymphocyte loss was also more extensive in the controls (p < 0.02), and more of the control group than the massage group lost >50 CD8 lymphocytes (p = 0.03).

Conclusions: The efficacy of massage therapy in maintaining immunocompetence may offer a viable alternative to the thousands of children worldwide without antiretroviral access."

Jackson KM, Steele TF, Dugan EP, Kukulka G, Blue W, Roberts A. 1998 **Effect of lymphatic and splenic pump techniques on the antibody response to hepatitis B vaccine: a pilot study.** J Am Osteopath Assoc Mar;98(3):155-60 <http://www.ncbi.nlm.nih.gov/pubmed/9558831>

"Osteopathic manipulative treatment (OMT) facilitates the movement of lymphatic fluid and may enhance the immunologic response to infection or injected antigen. In this investigation, two groups of volunteers were vaccinated with recombinant hepatitis B vaccine, given at 0, 5, and 25 weeks. The experimental group (n = 20) received OMT (lymphatic and splenic pump) three times per week for 2 weeks after each vaccination. Control subjects (n = 19) received vaccine but no OMT. Resultant serum antibody levels were measured by enzyme immunoassay. Fifty percent of subjects in the treatment group achieved protective antibody titers (> or = 10 mIU/mL) on the 13th week with an average titer of 374 mIU/mL. Only 16% of the control subjects had positive antibody responses, with average titers of 96 mIU/mL. At all time points from week 6 on, the average anti-hepatitis B titer was higher in the treatment group than in the control group. These data suggest an enhanced immunologic response in subjects who received OMT."

Joan G. Turner DSN RN CIC1, Ann J. Clark PhD RN2, Dorothy K. Gauthier PhD RN3, Monica Williams BA MA4 1998 **The effect of therapeutic touch on pain and anxiety in burn patients** Journal of Advanced Nursing Jul;28(1):10-20 <https://www.ncbi.nlm.nih.gov/pubmed/9687125>

The purpose of this single-blinded randomized clinical trial was to determine whether therapeutic touch (TT) versus sham TT could produce greater pain relief as an adjunct to narcotic analgesia, a greater reduction in anxiety, and alterations in plasma T-lymphocyte concentrations among burn patients. Therapeutic touch is an intervention in which human

energies are therapeutically manipulated, a practice conceptually supported by Rogers' (1970) theory of unitary human beings. Data were collected at a university burn centre in the south-eastern United States. The subjects were 99 men and women between the ages of 15 and 68 hospitalized for severe burns, and they received either TT or sham TT once a day for 5 days. Baseline data were collected on day 1, data were collected before and after treatment on day 3, and post-intervention data were collected on day 6. Instruments included the McGill Pain Questionnaire, Visual Analogue Scales for Pain, Anxiety and Satisfaction with Therapy, and an Effectiveness of Therapy Form. Blood was drawn on days 1 and 6 for lymphocyte subset analysis. Medication usage for pain in mean morphine equivalents, and mean doses per day of sleep, anxiety and antidepressant medications were recorded. Subjects who received TT reported significantly greater reduction in pain on the McGill Pain Questionnaire Pain Rating Index and Number of Words Chosen and greater reduction in anxiety on the Visual Analogue Scale for Anxiety than did those who received sham TT. Lymphocyte subset analyses on blood from 11 subjects showed a decreasing total CD8+lymphocyte concentration for the TT group. There was no statistically significant difference between groups on medication usage.

**Measel JW 1982 The effect of the lymphatic pump on the immune response: 1. Preliminary studies on the antibody responses to pneumococcal polysaccharide assayed by bacterial agglutination and passive hemagglutination J Am Osteopath Assoc 82:28-31**

"The effect of the lymphatic pump on the immune response of normal male medical students by two serologic tests to pneumococcal polysaccharide was investigated. Analysis of serum from experimental and control groups indicated that the lymphatic pump (experimental) group had a greater immune response, which was statistically different from that of the control on the basis of testing for polysaccharides by passive hemagglutination. The same increased immune response was seen on tests of bacterial strains 4, 6, and 8 assayed by bacterial agglutination. This study suggests that the lymphatic pump has some effect on the immune system."

**Saggio G, Docimo S, Pilc J, Norton J, Gilliar W. 2011 Impact of osteopathic manipulative treatment on secretory immunoglobulin a levels in a stressed population. J Am Osteopath Assoc Mar;111(3):143-7 <http://www.ncbi.nlm.nih.gov/pubmed/21464262>**

"High levels of human secretory immunoglobulin A (sIgA) have been shown to decrease the incidence of acquiring upper respiratory tract infections. Osteopathic manipulative treatment (OMT) has been shown to improve cardiac indices, increase lymph flow rates through the thoracic duct, and decrease sympathetic tone in postoperative patients and those in intensive care. Therefore, we hypothesized that OMT may also increase sIgA levels in people under high levels of emotional and psychological stress, thereby enhancing immunity and potentially preventing subsequent infections."

"This study demonstrates the positive effect of OMT on sIgA levels in persons experiencing high stress. Results suggest that OMT may then have therapeutic preventive and protective effects on both healthy and hospitalized patients, especially those experiencing high levels of emotional or physiological stress and those at higher risk of acquiring upper respiratory tract infections."

Castillo R, Schander A, Hodge LM 2018 **Lymphatic Pump Treatment Mobilizes Bioactive Lymph That Suppresses Macrophage Activity In Vitro** J Am Osteopath Assoc July 2018, Vol. 118, 455-461 <http://jaoa.org/article.aspx?articleid=2686417>

"Context: By promoting the recirculation of tissue fluid, the lymphatic system preserves tissue health, aids in the absorption of gastrointestinal lipids, and supports immune surveillance. Failure of the lymphatic system has been implicated in the pathogenesis of several infectious and inflammatory diseases. Thus, interventions that enhance lymphatic circulation, such as osteopathic lymphatic pump treatment (LPT), should aid in the management of these diseases.

Objective: To determine whether thoracic duct lymph (TDL) mobilized during LPT would alter the function of macrophages in vitro.

Methods: The thoracic ducts of 6 mongrel dogs were cannulated, and TDL samples were collected before (baseline), during, and 10 minutes after LPT. Thoracic duct lymph flow was measured, and TDL samples were analyzed for protein concentration. To measure the effect of TDL on macrophage activity, RAW 264.7 macrophages were cultured for 1 hour to acclimate. After 1 hour, cell-free TDL collected at baseline, during LPT, and after TDL was added at 5% total volume per well and co-cultured with or without 500 ng per well of lipopolysaccharide (LPS) for 24 hours. As a control for the addition of 5% TDL, macrophages were cultured with phosphate-buffered saline (PBS) at 5% total volume per well and co-cultured with or without 500 ng per well of LPS for 24 hours. After culture, cell-free supernatants were assayed for nitrite (NO<sub>2</sub><sup>-</sup>), tumor necrosis factor  $\alpha$  (TNF- $\alpha$ ) and interleukin 10 (IL-10). Macrophage viability was measured using flow cytometry.

Results: Lymphatic pump treatment significantly increased TDL flow and the flux of protein in TDL (P<.001). After culture, macrophage viability was approximately 90%. During activation with LPS, baseline TDL, TDL during LPT, and TDL after LPT significantly decreased the production of NO<sub>2</sub><sup>-</sup>, TNF- $\alpha$ , and IL-10 by macrophages (P<.05). However, no significant differences were found in viability or the production of NO<sub>2</sub><sup>-</sup>, TNF- $\alpha$ , or IL-10 between macrophages cultured with LPS plus TDL taken before, during, and after LPT (P>.05).

Conclusion: The redistribution of protective lymph during LPT may provide scientific rationale for the clinical use of LPT to reduce inflammation and manage edema."

Zein-Hammoud M, Standley PR. 2015 **Modeled Osteopathic Manipulative Treatments: A Review of Their in Vitro Effects on Fibroblast Tissue Preparations.** J Am Osteopath Assoc Aug 1;115(8):490-502 <https://jaoa.org/article.aspx?articleid=2422100>

"Although modeled RMS [repetitive motion strain] produced a delayed inflammatory response and reduction in cellular proliferation, both modeled CS [counter strain] and MFR [myofascial release] reversed those effects."

"Herein, we have shown proof of concept that both clinical CS and clinical MFR may equivalently reverse RMS injury in patients in manners that affect cytokine and NO signaling as well as cellular proliferation."

"Further, these findings suggest that dose-dependent and prophylactic MFR may potentially regulate inflammation and wound healing responses in patients."

"If clinically translatable, our results suggest that although RMS would clinically reduce the ability to regenerate and repair muscles, MFR would enhance these effects. "

Schander A, Padro D, King HH, Downey HF, Hodge LM. 2013 **Lymphatic pump treatment repeatedly enhances the lymphatic and immune systems.** Lymphat Res Biol Dec;11(4):219-26 <http://www.ncbi.nlm.nih.gov/pubmed/24364845>

"Clinically, it can be inferred that LPT [lymphatic pump technique] at a rate of 1 pump per sec for a total of 4 min can be applied every 2 h, thus providing scientific rationale for the use of LPT to repeatedly enhance the lymphatic and immune system."

Creasy C, Schander A, Orlowski A, Hodge LM. 2013 **Thoracic and abdominal lymphatic pump techniques inhibit the growth of *S. pneumoniae* bacteria in the lungs of rats.** *Lymphat Res Biol Sep*;11(3):183-6 <http://www.ncbi.nlm.nih.gov/pubmed/24024572>

"Our data demonstrate that LPT [lymphatic pump technique] may protect against pneumonia by inhibiting bacterial growth in the lung; however, the mechanism of protection is unclear. Once these mechanisms are understood, LPT can be optimally applied to patients with pneumonia, which may substantially reduce morbidity, mortality, and frequency of hospitalization."

Schander A, Downey HF, Hodge LM. 2012 **Lymphatic pump manipulation mobilizes inflammatory mediators into lymphatic circulation.** *Exp Biol Med (Maywood) Jan*;237(1):58-63 <http://www.ncbi.nlm.nih.gov/pubmed/22169162>

This re-distribution of inflammatory mediators during LPT [lymphatic pump technique] may provide scientific rationale for the clinical use of LPT to enhance immunity and treat infection.

Hodge LM, Bearden MK, Schander A, Huff JB, Williams A Jr, King HH, Downey HF 2010 **Lymphatic pump treatment mobilizes leukocytes from the gut associated lymphoid tissue into lymph.** *Lymphat Res Biol Jun*;8(2):103-10 <http://www.ncbi.nlm.nih.gov/pubmed/20583872>

"Lymphatic pump techniques (LPT) are used clinically by osteopathic practitioners for the treatment of edema and infection; however, the mechanisms by which LPT enhances lymphatic circulation and provides protection during infection are not understood. Rhythmic compressions on the abdomen during LPT compress the abdominal area, including the gut-associated lymphoid tissues (GALT), which may facilitate the release of leukocytes from these tissues into the lymphatic circulation. This study is the first to document LPT-induced mobilization of leukocytes from the GALT into the lymphatic circulation."

"LPT mobilizes leukocytes from GALT, and these leukocytes are transported by the lymphatic circulation. This enhanced release of leukocytes from GALT may provide scientific rationale for the clinical use of LPT to improve immune function."

Huff JB, Schander A, Downey F, Hodge LM 2010 **Lymphatic Pump Treatment Augments Lymphatic Flux of Lymphocytes in Rats** *Lymphat Res Biol Dec*; 8(4): 183–187 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3025762/>

#### "Background

Lymphatic pump techniques (LPT) are used by osteopathic practitioners for the treatment of edema and infection; however, the mechanisms by which LPT enhances the lymphatic and immune systems are poorly understood.

#### Methods and Results

To measure the effect of LPT on the rat, the cisterna chyli (CC) of 10 rats were cannulated and lymph was collected during 4 min of 1) pre-LPT baseline, 2) 4 min LPT, and 3) 10 min post-LPT recovery. LPT increased significantly ( $p < 0.05$ ) lymph flow from a baseline of  $24 \pm 5 \mu\text{l}/\text{min}$  to  $89 \pm 30 \mu\text{l}/\text{min}$ . The baseline CC lymphocyte flux was  $0.65 \pm 0.21 \times 10^6$  lymphocytes/min, and LPT increased CC lymphocyte flux to  $6.10 \pm 0.99 \times 10^6$  lymphocytes/min ( $p < 0.01$ ). LPT had no preferential effect on any lymphocyte population, since total lymphocytes, CD4+ T cells, CD8+ T cells, and B cell numbers were similarly increased. To determine if LPT mobilized gut-associated lymphocytes into the CC lymph, gut-associated lymphocytes in the CC lymph were identified by staining CC lymphocytes for the gut homing receptor integrin  $\alpha 4\beta 7$ . LPT

significantly increased ( $p < 0.01$ ) the flux of  $\alpha 4\beta 7$  positive CC lymphocytes from a baseline of  $0.70 \pm 0.03 \times 10^5$  lymphocytes/min to  $6.50 \pm 0.10 \times 10^5$  lymphocytes/min during LPT. Finally, lymphocyte flux during recovery was similar to baseline, indicating the effects of LPT are transient.

## Conclusions

Collectively, these results suggest that LPT may enhance immune surveillance by increasing the numbers of lymphocytes released in to lymphatic circulation, especially from the gut associated lymphoid tissue. The rat provides a useful model to further investigate the effect of LPT on the lymphatic and immune systems."

Hodge LM, King HH, Williams AG Jr, Reder SJ, Belavadi T, Simecka JW, Stoll ST, Downey HF. 2007 **Abdominal lymphatic pump treatment increases leukocyte count and flux in thoracic duct lymph.** *Lymphat Res Biol* 5(2):127-33. <http://www.ncbi.nlm.nih.gov/pubmed/17935480>

"LPT [lymphatic pump technique] significantly increased both thoracic duct lymph flow and leukocyte count, so lymph leukocyte flux was markedly enhanced. Increased mobilization of immune cells is likely and important mechanism responsible for the enhanced immunity and recovery from infection of patients treated with LPT."

Meltzer KR, Standley PR. 2007 **Modeled repetitive motion strain and indirect osteopathic manipulative techniques in regulation of human fibroblast proliferation and interleukin secretion.** *J Am Osteopath Assoc* Dec;107(12):527-36 <http://www.ncbi.nlm.nih.gov/pubmed/18178762>

"To investigate human fibroblast proliferation and interleukin secretory profiles in response to modeled repetitive motion strain (RMS) and modeled indirect osteopathic manipulative techniques (IOMT). The authors hypothesized that the RMS model would increase fibroblast proliferation and proinflammatory interleukin secretion, while the IOMT model would reverse these effects."

"Human fibroblasts were exposed in vitro to one of three conditions: (1) an 8-hour RMS; (2) a 60-second IOMT; or (3) an 8-hour RMS followed by a 60-second IOMT. Data on fibroblast proliferation and interleukins present in conditioned media were obtained immediately after RMS, at 24 hours after RMS (24RMS), at 24 hours after IOMT (24IOMT), and at 24 hours after RMS and IOMT (24RMS+IOMT). Cytokine protein array and enzyme-linked immunosorbent assay were used in data analysis. Fibroblast proliferation was also measured colorimetrically with a cell proliferation assay."

"An in vitro strain model that simulates RMS has different effects on fibroblast proliferation and interleukin secretion than does an in vitro model that simulates IOMT. Modeled RMS appears to cause a reduction in fibroblast proliferation and a delayed inflammatory response. Modeled IOMT not only fails to induce this response, it also reverses inflammatory effects in cells that have been strained repetitively. Data from the present study suggest that fibroblast proliferation and expression/secretion of proinflammatory and anti-inflammatory interleukins may contribute to the clinical efficacy of indirect osteopathic manipulative techniques."

Hodge LM, King HH, Williams AG Jr, Reder SJ, Belavadi T, Simecka JW, Stoll ST, Downey HF. 2007 **Abdominal lymphatic pump treatment increases leukocyte count and flux in thoracic duct lymph.** *Lymphat Res Biol* 5(2):127-33. <http://www.ncbi.nlm.nih.gov/pubmed/17935480>

"LPT [lymphatic pump technique] significantly increased both thoracic duct lymph flow and leukocyte count, so lymph leukocyte flux was markedly enhanced. Increased mobilization of immune cells is likely and important mechanism responsible for the enhanced immunity and recovery from infection of patients treated with LPT."

# Mixed results (significant for some outcomes, not others)

Number  
of studies:  
1

## Other reviews

Number of studies: 1

Noll DR, Johnson JC, Brooks JE. 2008 **Revisiting Castlio and Ferris-Swift's experiments on direct splenic stimulation in patients with acute infectious disease.** J Am Osteopath Assoc Feb;108(2):71-9 <http://www.ncbi.nlm.nih.gov/pubmed/18303061>

"In 1934, Yale Castlio, DO, and Louise Ferris-Swift, DO, published the results of a within-subjects experiment on direct splenic stimulation in patients with acute infectious disease (N=100). Their results, which used rudimentary statistical analyses, are still cited as evidence that osteopathic manipulative treatment augments immunity."

"Contemporary statistical analysis confirms a modest posttreatment increase in leukocytes, a decrease in erythrocytes, a decrease in the Arneth index, and an increase in reticulocytes after the application of direct splenic stimulation for patients diagnosed with acute infectious disease. Contemporary reanalysis also confirms statistically significant posttreatment changes in the immune function tests. Findings were less conclusive for the leukocyte differential cell counts and for the effect of varying the number of splenic compressions."

"Analysis of Castlio and Ferris-Swift's 1934 data using contemporary statistical methods supports many of their original conclusions. However, faults in study design common to that era limit the article's applicability for modern researchers. Additional research on splenic pump techniques using contemporary study designs and statistical methods is recommended."