Osteopathic Self-Treatment to Promote Health and The Body's Ability to Fight COVID-19

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CASE REPORT

In the growing pandemic of COVID-19, the reality many face includes insufficient testing, limited personal protective equipment (PPE), and high risk of infection to those on the front lines providing essential care. With a lack of effective treatment and no vaccine in sight, a high rate of morbidity and mortality looms.

Osteopathic manipulative treatment (OMT) has been shown in numerous studies to support the body's own healing mechanisms, including beneficial effects on respiratory infections.

Based on well-established osteopathic principles, the osteopathic self-treatment (OST) aims to promote optimal respiration, circulation (venous, arterial, and lymphatic), immune function, balance of the autonomic nervous system, reduced stress, and improved homeostasis.

This OST provides exercises designed to remove obstacles to the body's own functions and therefore promote improved health. It is warranted for those at risk of infection or those already testing positive. There is particular utility in these approaches for patients that must self-isolate and socially distance such as during the 2020 COVID-19 pandemic.

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Introduction

Optimal respiration and circulation is vital to health. In states of health, normal physiologic function of the respiratory and circulatory systems drives oxygenation of body tissues and the delivery of nutrients and hormones as well as the removal of waste throughout the body. Additionally, the pressure gradients created by proper respiratory and circulatory mechanisms contribute to optimal flow within the lymphatic system to support immune function.[1,2,3] In the setting of disease, including acute infection, the importance of these physiologic functions becomes paramount for the body to mount an adequate immune response and allow the body to reclaim a state of health.

The incorporation of osteopathic manipulative treatment (OMT) into the treatment of respiratory infections in both ambulatory and inpatient settings has been shown to improve patient outcomes in a variety of measures when compared to conventional care alone. Benefits of OMT include decreased length of hospitalization, decreased in-hospital mortality rates for elderly patients, lower ventilator-dependent respiratory failure rates, and shorter duration of intravenous antibiotic treatment for bacterial pneumonia.[4, 5] This evidence, coupled with historical data on the efficacy of OMT as part of treatment during the 1917 influenza pandemic, provides a compelling argument for the continued application of OMT into patient care in similar settings.[6, 7]

The rapid spread of the highly infectious and lethal severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has proved dangerous for both healthcare providers and the patients they are treating. Challenges for preventing the spread of the illness include: a lack of sufficient testing (to know who is at greatest risk of spreading the virus), the risk of asymptomatic transmission of the virus, and a lack of adequate personal protective equipment (PPE) for health care workers, those with known coronavirus disease 2019

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(COVID-19), and the essential community workers at greatest risk of becoming infected and/or infecting others. These challenges, coupled with the use of social distancing to slow the spread of disease, have led to the halt of non-emergent, non-essential outpatient medical care like OMT in many regions of the country and worldwide.

In the absence of effective antiviral medications, a viable vaccine, and adequate PPE necessary for physicians to provide more hands-on care in clinical settings, we suggest the incorporation of osteopathic principle-based self-treatment (OST) as an alternative to physician-delivered OMT.

The support of optimal circulation, immune system function and homeostasis that the application of osteopathic principles lends to the body is more important now than ever in both maximizing the innate immune system function in those at risk for, or currently fighting, COVID-19 infection, as well as helping to maintain health in those not yet affected.

Background

Key definitions from the *Glossary of Osteopathic Terminology*[8]:

- *Osteopathic Manipulative Treatment*: The therapeutic application of manually guided forces by an osteopathic physician to improve physiologic function and/or support homeostasis that has been altered by somatic dysfunction.
- *Somatic Dysfunction:* Impaired or altered function of related components of the body framework system: skeletal, arthrodial and myofascial structures, and their related vascular, lymphatic and neural elements.
- *Homeostasis:* The level of well-being of an individual maintained by internal physiologic harmony that is the result of a relatively stable state or equilibrium among the interdependent body functions.
- *Respiratory-Circulatory model:* One of the five models of osteopathic care that articulates how an osteopathic practitioner seeks to influence a patient's physiologic processes. The goal of the respiratory-circulatory model is to improve all of the diaphragm restrictions in the body. Diaphragms are considered to be 'transverse restrictors' of motion, venous and lymphatic drainage and cerebrospinal fluid.
- *Thoracic inlet:* The anatomic thoracic inlet consists of T1 vertebra, the first ribs, and their costal cartilages and the superior end of the manubrium.
- *Transitional region:* Areas of the axial skeleton where structure changes (can) significantly lead to functional changes; transitional areas commonly include the following: occipitocervical region (OA); typically the OA-AA-C2 region is described. Cervicothoracic region (CT); typically C7-T1. Thoracolumbar region (TL); typically T10-L1. Lumbosacral region (LS); typically L5-S1.

Respiratory-Circulatory Model

The respiratory-circulatory model (RCM) utilizes a treatment approach with the goal to optimize the venous, lymphatic, and arterial flow to improve health. A prominent contributor, Gordon Zink, DO, presented an efficient and effective osteopathic approach to maximize health utilizing this approach. Key restrictions, or somatic dysfunctions (SDs), were identified throughout the body, with some of the most important found at the transition zones of the body. The transition zones of the lumbopelvic, thoracolumbar, cervicothoracic, and occipitoatlantal regions are areas subject to higher stress and potential for dysfunction and are also closely associated with the transverse diaphragms of the body (urogenital and pelvic diaphragms, thoracoabdominal diaphragm, Sibson's fascia and the tentorium cerebelli respectively). Dysfunction in these transition zones impairs the body's respiratory and circulatory functions.

Key Concepts and Body Regions to be Addressed

The Thoracic Inlet

The thoracic inlet, the most superior aspect of the bony rib cage, is formed by the ring structure of the bilateral first ribs and their articulations with the first thoracic vertebra and the manubrium. This region is clinically important, as the major vascular and lymphatic structures that supply and provide drainage routes for blood and lymphatic from the head and neck, to the trunk and appendages, traverse or are closely located in the thoracic inlet.[9] The thoracic inlet is a key anatomic site in Zink's approach to the RCM, and, regarding the lymphatic system, it has often been termed the site of "terminal drainage".[3, 9(p87), 10-12]

The Thoracoabdominal Diaphragm

The thoracoabdominal diaphragm, often referred to as the abdominal diaphragm, is widely attached across the xyphoid process of the sternum, the lower six ribs, T12, L1-2 or L3.[9(p9)] The myofascial connections of the thoracoabdominal diaphragm are widespread, from the mediastinum to the pelvis and lower extremity, through the lower extremity and psoas muscles. The pump-like function of the thoracoabdominal diaphragm creates negative intrathoracic pressure to pull oxygenated air into the lungs and assist in venous and lymphatic return to central circulation.[13] Somatic dysfunction in this region can lead to disruption of the pressure gradients within the thorax needed for adequate respiratory-circulatory

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function to prevent venous and lymphatic stasis in the trunk and extremities.[3,14]

The Autonomic Nervous System

The autonomic nervous system, often described as the involuntary manager, affects almost all tissues, controls the moment by moment activity of viscera, and functions to maintain homeostasis. While optimally there is a balance in the body between the sympathetic (fight or flight) and parasympathetic (feed and breed) systems, dysfunctions can occur where a body may seem to be inappropriately in a state of increased 'tone' of one system or another. Sustained hyperactivity of sympathetic or parasympathetic tone has been shown to have negative effects on target tissues, and can result in conditions affecting every organ system secondary to their interrelated nature.[15 (p64)]

A primary goal of OMT is to facilitate the normal compensatory mechanisms of the individual's body. To promote inner health and optimally balance the sympathetic nervous system, we look for and address somatic dysfunctions in the thoracolumbar region (T1-L2). To balance the parasympathetic nervous system, we look for dysfunctions in the cranio-sacral regions, specifically SD that might affect cranial nerves III, VII, IX, X, and sacral roots 2-4.

Importance of Breath

The alternating intrathoracic pressures created with inhalation and exhalation and the piston-like movement of the thoracoabdominal diaphragm constitute important mechanisms for promoting venous and lymphatic return.[15(p259)] This is especially important for those patients spending a significant amount of time lying supine, where the pumping benefit of the lower limb musculature is correspondingly reduced. Removing restrictions at the top (cervicothoracic junction, i.e. the thoracic inlet) and bottom (thoracolumbar junction) as well as any major restrictions throughout the thorax allows optimal motion. Improving the inhalation/exhalation motion of the thoracic cage maximizes the negative intrathoracic pressure to help pull the fluids from the periphery (on a macro-level think head/neck, limbs) back into central circulation.[3,13]

In addition to the mechanical benefits of unimpeded diaphragmatic breathing, review of the current literature suggests that exercises such as mindfulness and slow deep breathing may improve health in a variety of areas, including reducing markers of inflammation and improving immune responses to vaccination,[16] decreasing markers of physiologic stress,[17], and modulation of the autonomic nervous system.[18] A proposed mechanism for the influence on these and other measures of health by deep breathing is respiratory vagal nerve stimulation.[19]

Methods

The Thoracic Inlet

The thoracic inlet is influential in key anatomic structures due to its position at the cervicothoracic junction. In addition to the major circulatory vessels present here, the anatomic thoracic inlet is the location of terminal lymphatic drainage for the entire body. Superior to these structures resides Sibson's fascia, the suprapleural membrane, an extension of the endothoracic fascia that extends above the apices of the lungs. This structure functions as the cervicothoracic diaphragm. Finally, many muscles span the region of, or attach to the bony structures of the anatomic thoracic inlet, including the anterior and middle scalenes, sternocleidomastoid, levator scapulae, upper trapezius, intercostal muscles, the subclavius muscles, and the first digitation of the serratus anterior muscle.

Tissue tension, muscular imbalance, or bony displacement of any of the above structures results in restriction of the vascular and lymphatic structures coursing through the inlet, compromising both respiratory and circulatory function. The application of osteopathic self-treatment to the thoracic inlet allows for the removal of impediments to circulation and terminal lymphatic drainage to maximize the respiratory-circulatory function of the body.

Self-Treatment of the Thoracic Inlet

The simplest and most feasible self-treatment techniques for patients utilize simple range of motion and stretching techniques to achieve improvement of motion in key anatomic regions without requiring the patient to self-monitor for indications of tissue change that require more precise palpatory skill. The thoracic inlet can be treated by addressing two segments: the first rib portion and the first thoracic vertebra (T1). Self-treatment of the first rib focuses on range of motion exercises that mobilize the first rib to remove bony restriction on circulatory structures. (*Figures 1 and 2*).

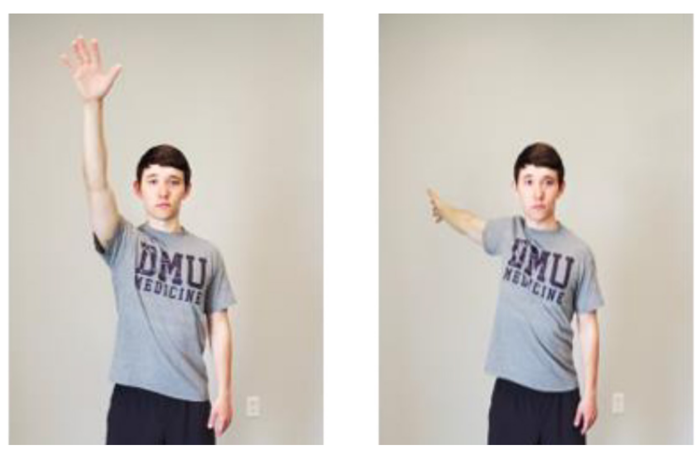

Figure 1. *1st Rib and Collarbone-Base of the Neck (Thoracic Inlet): Arm circles*

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Figure 2. *1st Rib and Collarbone-Base of the Neck (Thoracic Inlet): Shoulder blade*

The T1 component of the inlet can be treated with self-stretching to address cervical spine range of motion restrictions caused by unbalanced tissue tension in the cervical and upper thoracic musculature (*Figure 3*).

Additionally, self-stretching of the anterior/lateral (sternocleidomastoid) and posterior neck muscles, as well as postural retraining of the neck, can help to reduce musculotendinous tension and postural contributions to dysfunction of the thoracic inlet *(See Figures 4-7)*.

Thoracolumbar Region: Thoraco-Abdominal Diaphragm

The thoracoabdominal diaphragm, or simply the diaphragm, is the large sheet-like muscle separating the thoracic and abdominal cavities. The diaphragm's attachments are extensive, composed of three regions: sternal (xyphoid process), costal (lower six ribs) and thoracolumbar (T11-L2/3). Restriction of motion at the thoracolumbar junction can create dysfunction in the abdominal diaphragm. The potential for the resulting tourniquet-like effect on the inferior vena cava and descending aorta where they traverse the diaphragm, can compromise circulatory efficiency in the entire body. In response to decreased circulatory efficiency, the body is forced to compensate by increasing the work done by the heart to drive circulation and the recruitment of accessory muscle used for costal motion in respiration. It is crucial from a respiratory-circulatory standpoint that the diaphragm be free of dysfunction.

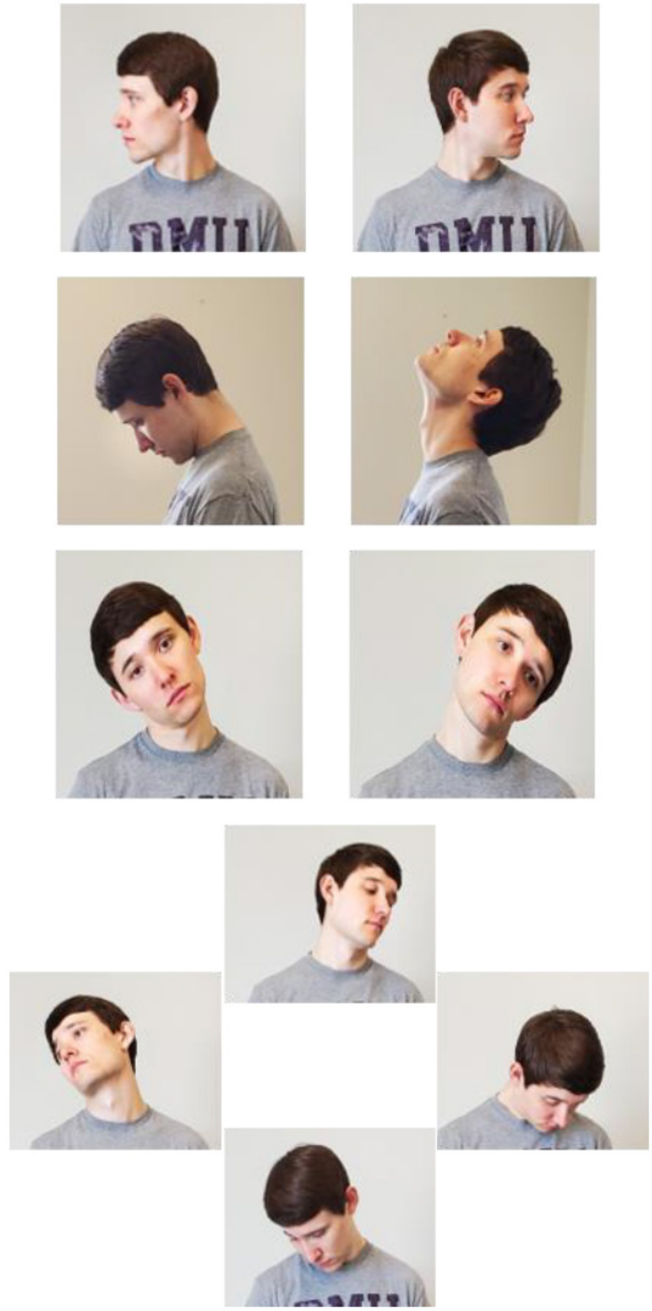

Figure 3. *First Thoracic Vertebra-Base of the Neck (Thoracic Inlet): Neck range of motion*

Self-Treatment of the Thoracolumbar Junction

The thoracolumbar junction can be addressed with self-treatment in two ways. First, the patient can mobilize this transitional zone by performing rotational stretches, stretching the latissimus dorsi, and utilizing the prone-press up *(see Figures 8-10).* The combination of these maneuvers has been theorized to decrease regional restriction and again encourage efficient respiratory-circulatory function.

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Figure 4. Front of Neck (SCM) Muscle Stretch

Figure 5. Upper Back (Levator Scapula) Stretch

Figure 6. Upper Shoulder (Upper Trapezius) Stretch

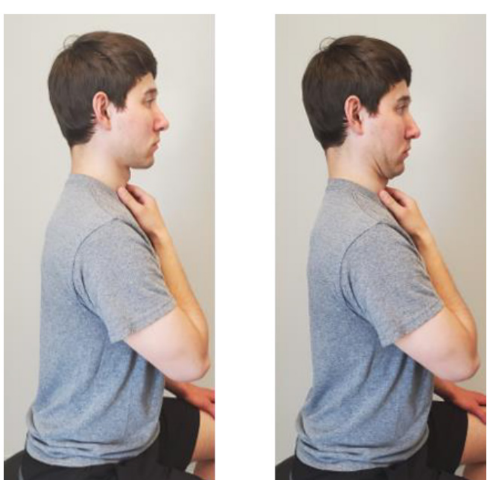

Figure 7. Head-Neck Posture Training (by Strengthening the Deep Neck Flexor Muscles)

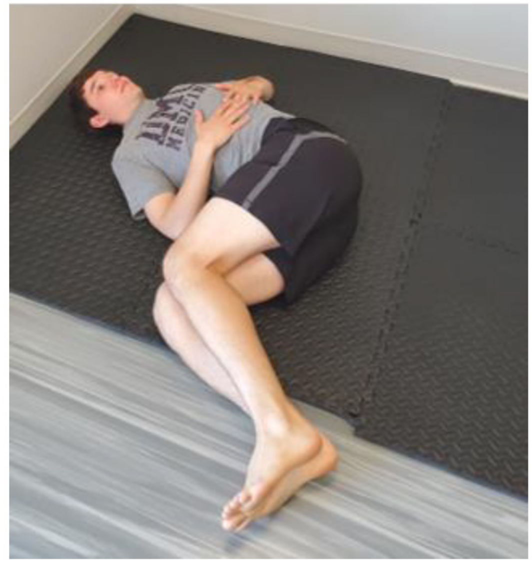

Figure 8. Bottom of Rib Cage (Thoracolumbar Junction) Stretch

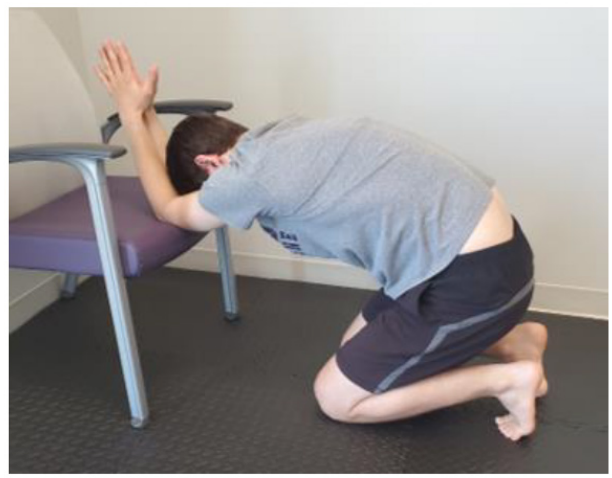

Figure 9. Under Arm/Back (Latissimus Dorsi) Muscle (or "Prayer Position") Stretch

Figure 10. Face Down (Prone) Press-up

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Lumbopelvic Region: Pelvic and Urogenital Diaphragm

The lumbopelvic diaphragm, composed of the pelvic and urogenital diaphragms, contains the musculature of the pelvic floor, the superficial membranous pelvic fascia, and endopelvic fascia between the viscera of the pelvis. Fascial, muscular, and articulatory restriction of the lumbo-pelvic transition area limits the ability of the sacrum to move between its contacts with the ilia during respiration. Restriction of the sacrum results in elevated tissue tension in the pelvis that can cause restriction in the lumbopelvic diaphragm and limit motion farther up the spinal column via the attachments of the sacrum to the posterior longitudinal ligament and the dura.

Muscular tightness in major muscles in the lumbopelvic region can lead to significant restriction of the sacroiliac joints and tension in the pelvic diaphragms. Key muscles implicated in these patterns include the abdominal muscles, psoas, piriformis, gluteus maximus, and the latissimus dorsi.[20(p340)] Rotation of the innominates of the pelvis leads to further restriction of the lumbopelvic region.

Self-Treatment of the Lumbopelvic Region

This region can be addressed by performing rotational stretches for the transition zone, utilizing self-stretches to the above muscles specifically, and by performing more general regional mobilization maneuvers to self-correct innominate rotations *(see Figures 11-15)*.

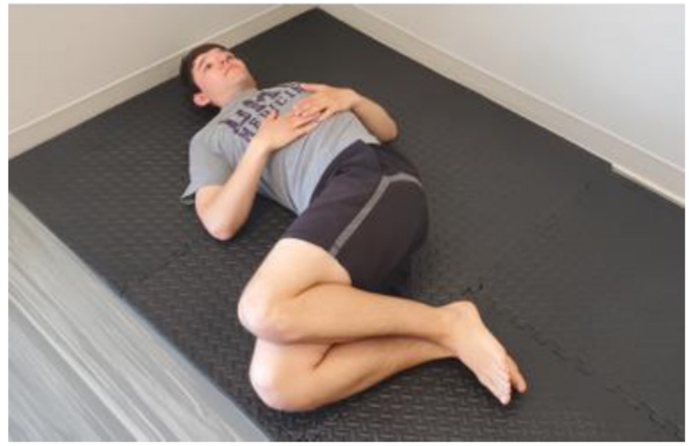

Figure 11. Bottom of the Spine (Lumbosacral Junction)

Figure 12. Ribs to Pelvis (Quadratus Lumborum) Muscle Stretch

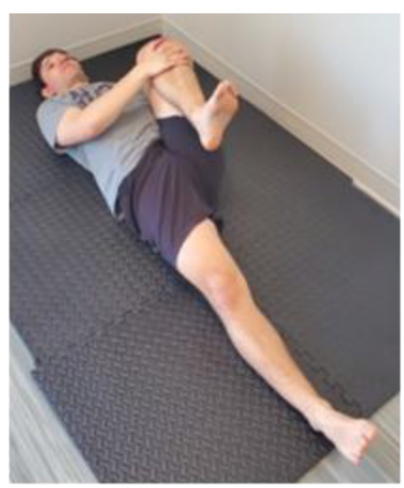

Figure 13. Knee to chest

The Cranial Diaphragm Composed of the Tentorium Cerebelli

The dura of the cranium is made up of the tentorium cerebelli (considered a diaphragm within the skull), the falx cerebri, and falx cerebelli, all of which attach to the bones of the skull. They provide important functions for supporting the brain and house the venous sinuses. Because of the intimate connections between the dura and the cranial bones, displacement of the cranial bones as a result of tissue tension in the cervical paraspinal musculature and muscles attaching to the cranial bones, primarily the occiput and temporal bones, results in increased tension to the dura which in turn can limit the ability of the venous sinuses to drain as part of the global respiratory-circulatory function.

Self-Treatment of the Cranial, Cervical, and Upper Shoulder/Thoracic Regions

Treatment of the head directly is outside the scope of this OST protocol. Reduction in tissue tension in the muscles of the cervical and upper shoulder/thoracic regions may reduce tension in the head and neck as a whole to encourage increased circulatory efficiency

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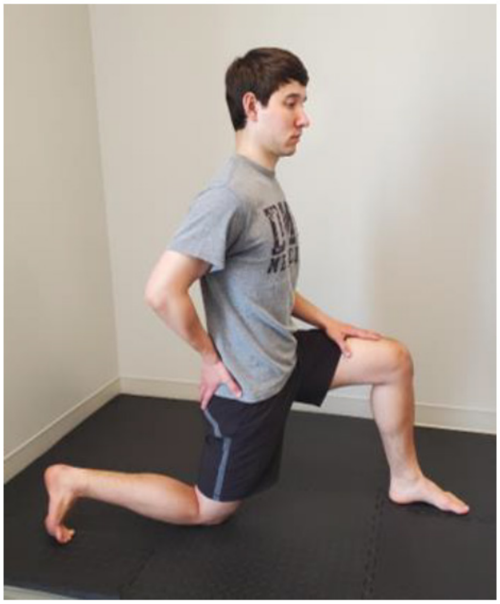

Figure 14. Front of Hip (Psoas) Muscle Stretch

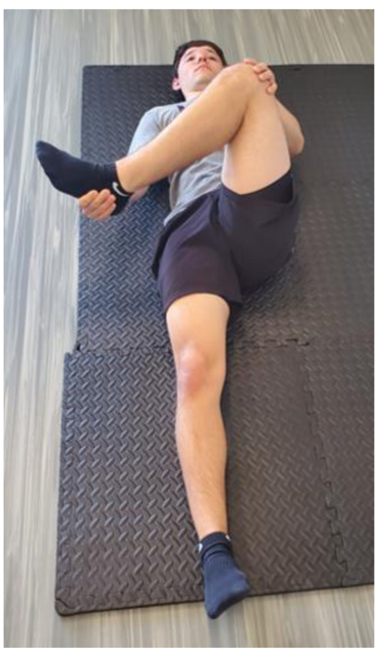

Figure 15. Spine to Hip (Piriformis) Muscle Stretch

Figure 16. Self-correction of occiput – atlas joint (OA)

Figure 17. Self-correction of atlas – axis (AA) Joint

to and from the head and neck. This is achieved in the OST by stretching the sternocleidomastoid, levator scapula, upper trapezius, and posture retraining for the deep neck flexors *(see Figures 4-7)*. Additionally, tension in the cervical paraspinal musculature may be reduced by mobilization of the occipito-atlantal and atlanto-axial joints of the cervical spine *(see Figures 16 and 17).*

Thoracic Spine and Rib Cage

As discussed above, optimal motion of the rib cage is imperative for both the maximal movement of air, as well as the negative intra-thoracic pressure gradients that assist in the return of venous and lymphatic circulation. Additionally, there exists a close anatomic relationship between the sympathetic chain ganglia and the rib heads' articulations with the thoracic spine. Addressing

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dysfunctions of these anatomic structures can assist with balancing the autonomic nervous system.

Self-Treatment of the Thoracic and Rib Cage Region

Spinal mobilizing techniques *(Figure 18)* can improve motion of the spine, maximize respiratory motion, and even provide a 'stimulating effect' for the sympathetic nervous system, similar to some of the rib-raising approaches.

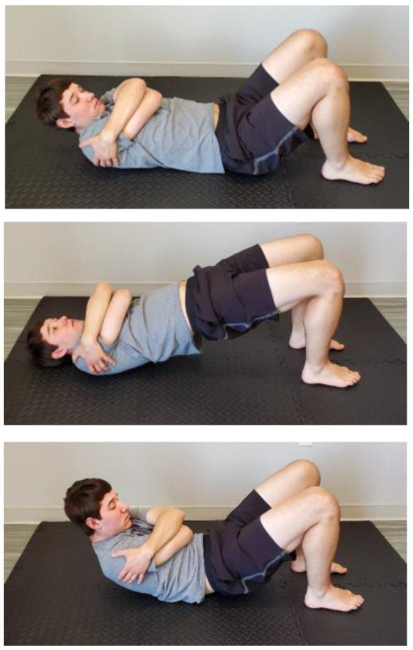

Figure 18. *Spinal Stimulation – Thoracic and Rib Areas*

Lymphatics

The lymphatic system is a network of endothelial vessels distributed throughout the body in close proximity to circulatory vasculature. It functions in maintaining tissue fluid homeostasis, the dissemination of immune cells, and the reabsorption of lipids.[21] The flow of lymph through the tissues of the body toward terminal drainage at the thoracic inlet is driven by pressure differentials created by interstitial pressure and intrinsic pumps of the body, including arterial pulse pumps, skeletal muscle contractions during movement, intestinal motion, and the generation of negative pressure in the thorax by the transverse motion of the diaphragms of the body.

Lymph pump techniques directed at increasing the movement of lymph toward terminal drainage are an established part of the osteopathic approach to patient care.[15(p203), 22(p175), 23(p72)] In the setting of acute illness, where the immune function of the lymphatic system is of elevated importance and where patients may be less active than in during states of health, addressing the lymphatics with OMT becomes important. These physician-performed techniques can be modified for incorporation into OST.

Self-Treatment of the Lymphatics

To encourage lymphatic flow and drainage in the head and neck, patients may perform gentle effleurage and kneading techniques to the anterior and lateral neck *(Figure 19)*. To augment the flow of lymph driven by skeletal muscle pumps, the pedal (Dalrymple) lymphatic pump can be modified for patients to perform on their own *(Figure 20)*.

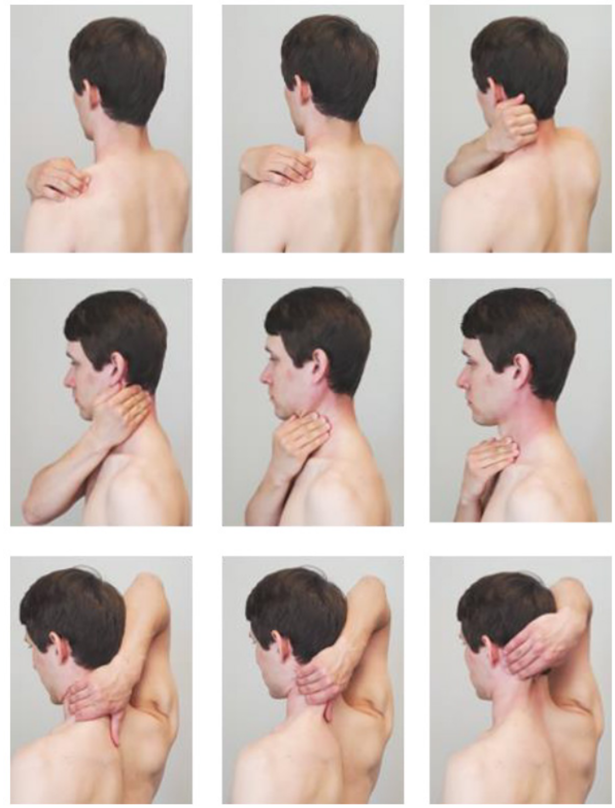

Figure 19. *Gentle Self-Massage of the Neck and Upper Shoulder*

Figure 20. *Self-Pedal Pumps*

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Breathing Exercises

In addition to the mechanical benefits with full inhalation and exhalation, deep breathing exercises have been shown to help with reducing stress and improving cardiovascular parameters.[24] This can be an important means of reducing anxiety associated with the COVID-19 pandemic and mitigating the negative effects of stress on the body *(Figure 21).*

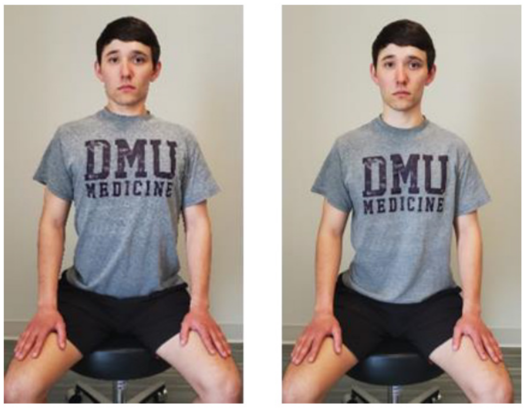

Figure 21. *Box Breathing*

Discussion

With a goal of promoting improved respiration, circulation, immune function, homeostasis, and overall inner health, we propose the above OST to promote the body's ability to fight-off COVID-19 infection.

There are numerous manuscripts detailing OMT for respiratory and infectious disease processes, notably describing some of the impressive benefits OMT provided to patients surviving the 1917 influenza pandemic. To our knowledge, this is the first paper focused on OST for COVID-19, a unique pandemic posing significant infection risk to patients, caregivers, and the community. Self-treatment for those at greatest risk, and those who are COVID-19 positive (but not hospitalized on a ventilator), should help promote their body's innate ability to mount a response to the disease.

Owing to the current medical pandemic, we did not feel it was appropriate to wait for a prospective designed research project, which would significantly delay our ability to provide this information to the public.

The OST protocol recommended above is safe for non-disabled individuals, and can be modified in innumerable ways for those who have difficulty achieving one or more of the exercises. The OST should be performed pain-free. There should be no pain with any of the exercises or stretches, and any pain experienced should result in reducing the particular activity or position until it can be performed pain-free. If unable to modify the particular exercise to allow for pain-free achievement, it may be necessary to discontinue that exercise. For patients with hypermobility concerns, it is important to avoid damaging your tissues with over-stretching. With these conditions, the focus should be on identifying restrictions and attempting to restore symmetry.

Conclusion

We are facing the growing pandemic of COVID-19 for which the medical and national disaster systems are grossly unprepared and ill-equipped to handle. For those at risk of infection, or those already testing positive and self-quarantining, current standard and public health recommendations include increased hydration, frequent hand washing, social distancing, and/or sheltering in place.

In addition to these recommendations, we propose an osteopathic self-treatment (OST) protocol designed to optimize overall health and recovery. Based on well-established osteopathic principles, the osteopathic self-treatment (OST) aims to promote optimal respiration, circulation (venous, arterial, and lymphatic), immune function, balance of the autonomic nervous system, reduced stress, and improved homeostasis.-

OMT has been shown in numerous studies to support the body's own healing mechanisms, including beneficial effects on respiratory conditions and infections. Further testing to evaluate the effect of OST on these conditions and overall health promotion is warranted.

Visual Aids for Osteopathic Self-Treament

The authors have created an osteopathic self-treatment (OST) handout and video that have been made available for physicians to share with their patients and directly for the public on the Des Moines University website. These resources are written for the public, with layperson descriptions demonstrating how to perform the OST. Pictures from the handout are utilized as figures throughout the manuscript, however detailed descriptions of the exercises/stretches are left in the handout. These resources can be found online at www.dmu.edu/covid-19/exercises

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