Massage Therapists' Association of British Columbia

Clinical Case Report Competition

West Coast College of Massage Therapy, Victoria Campus

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First Place Winner

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The effects of massage therapy on increasing thoracic expansion and improving symptoms in an asthmatic patient

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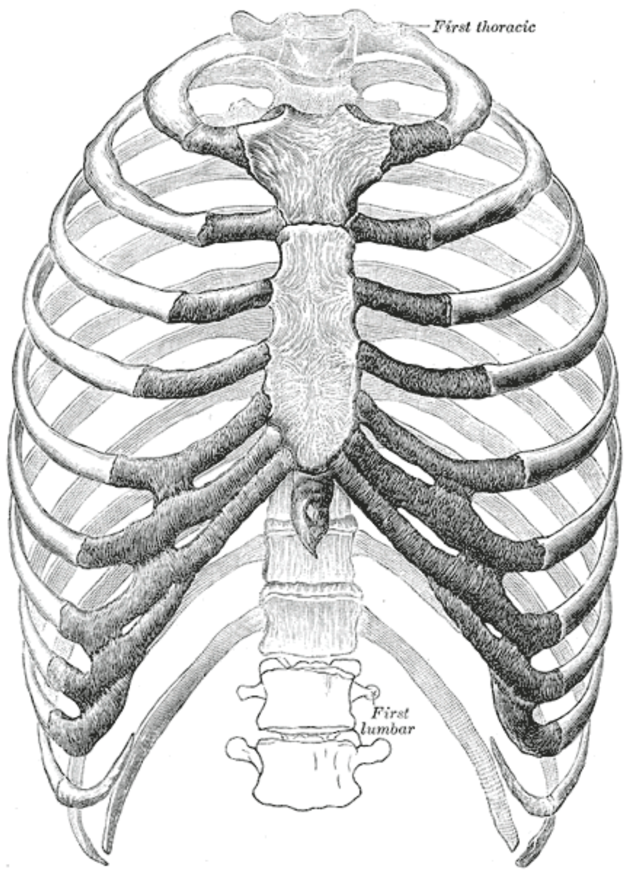
The Effects of Massage Therapy on Increasing Thoracic Expansion and Improving Symptoms in an Asthmatic Patient.



(*Gray's Anatomy of the Human Body*, 20th ed. 1918.)

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To the author's knowledge, no conflict of interest exists. Informed consent was received from the patient prior to treatment.

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Abstract

Objective: To determine the effects of massage therapy, in conjunction with dietary and lifestyle changes on improving respiratory function in a 21 year old female student with adult-onset asthma. The main goals of treatment are to increase thoracic diaphragm expansion, decrease restrictions in the accessory muscles of respiration, decrease asthma symptoms and decrease dependence on prescribed medications.

Methods: A series of 12, one hour massage treatments were performed over a two and a half month time period. Techniques used include Myofascial Release, Trigger Point Release, Swedish massage, and postural re-education. Progress was measured using a daily asthma symptoms journal, postural examination, cervical spine and shoulder ranges of motion, chest expansion measurements, and rib motion palpation.

Results: This study showed an increase in thoracic expansion to within normal levels. The patient subjectively reported a decrease in asthma symptoms and increased ability to take a full breath into the diaphragm. In addition, the patient's digestion was improved with dietary changes and increased diaphragmatic movement.

Conclusion: Massage therapy, and specifically myofascial release, is a useful modality for helping to increase the mobility and congruency of movement at the thorax. In conjunction with receiving massage therapy treatments, a change in diet and lifestyle was beneficial to the overall success of this study and to the well being of the subject.

Keywords: Asthma, massage therapy, respiratory function, diaphragm, myofascial release, muscles of respiration, bronchodilator.

Introduction

Asthma is "a reversible obstructive lung disease characterized by inflammation and increased smooth muscle reaction of the airways to various stimuli" (Goodman, Fuller, 2009). It is a fairly common disorder, affecting an estimated 300 million people worldwide, with 250,000 annual deaths attributed to the disease (World Health Organization, 2007). Typically, asthma is categorized into two main types according to their cause. Extrinsic, or allergic asthma, is the most commonly found type in children and young adults, has known triggers, such as food intolerances or environmental antigens, and has a strong genetic component. In contrast, intrinsic or non-allergic asthma has a more idiopathic nature and an adult-onset, but is believed to involve a hypersensitivity to bacteria or viruses from a primary infection to the bronchi, sinuses or tonsils. Furthermore, this type of asthma is more likely to develop into a long term chronic condition, and may eventually lead to more severe forms of Chronic Obstructive Pulmonary Disease (COPD) (Goodman, Fuller, 2009).

In the pathogenesis of asthma, thickening of the bronchiole walls, epithelial cell damage, smooth muscle spasm, edema, and increased mucous production are a few of the common physiological manifestations that develop into a chronic condition. Primarily, this degeneration process is perpetuated by the leukotrienes released from airway epithelial cells as they break down. Generally, signs and symptoms are attack-remitting, have varying degrees of severity, and include coughing, wheezing, shortness of breath, a constricting sensation in the chest, prolonged expiratory phase, pallor, and restlessness (Goodman, Fuller, 2009).

Pharmaceutical treatment of asthma involves taking an inhaled bronchodilator such as salbutamol (also known as albuterol) for acute attacks and an inhaled corticosteroid for daily management of bronchial inflammation (Canadian Pharmacists Association [CPA], 2008). Contraindicated medications for patients with asthma include non-steroidal anti-inflammatory drugs (NSAIDs), Aspirin, and beta blockers as exacerbation of symptoms is a side effect (Randal, 2001)

Although pharmaceutical treatment is often necessary to control symptoms, avoidance of known triggers plays a key role in decreasing the frequency and severity of asthma attacks. This involves diligence in both extrinsic and intrinsic asthma patients with reducing exposure to bronchial irritants such as the dust mite allergen, cigarette smoke, pollens, and animal dander (Rattray, Ludwig, 2000). In addition, psychological stress has been attributed to an increase in symptoms (Chen E., Hanson M.D., Paterson L.Q., Griffin M.J., Walker H.A., Miller G.E., 2006) which suggests that there is a strong benefit for the patient to make lifestyle changes that reduce such stress.

There are many dietary factors involved with increased asthma symptoms. In particular, meat products which are high in arachidonic acid, a known inflammatory mediator, are best avoided by asthma patients as an increase in bronchial inflammation is likely to occur (Calabrese, Triggiani, Marone, and Mazzarella, 2000). Anecdotal evidence also suggests that hypersensitivities to food additives such as monosodium glutamate, sulphites, tartrazine, and other food dyes may also occur in asthmatics (Reus KE, Houben GF, Stam M, Dubois AE. 2000). Finally, the effects of alcoholic beverages on asthma has been studied with varying results, though a connection between sulphite additives in many wine and beer products, and an increase in asthma symptoms has been found. (Vally, H., de Klerk, N., Thompson, P.J., 2000) This suggests that avoidance of heavily processed foods and moderation of the intake of meat products may help decrease asthma symptoms.

Respiration involves utilization of muscles, bones, joints, and fascia. Structurally, ribs not only provide stability to the thoracic spine but protect the lungs and allow them to expand in all three planes of movement via the costovertebral joints. For example, from ribs 1-6, this movement is in the sagittal plane and is referred to as “pump handle” motion. From ribs 7-10 the movement is in the coronal plane and is referred to as “bucket handle” motion. Lastly, rib movement from ribs 11-12 is in the transverse plane and referred to as “calliper” motion (Magee, 2008). Though these are guidelines outlined by Magee, there may be some variation, overlap or asymmetries in the type of motion present from person to person. These asymmetries in thoracic movement can be palpated and may indicate areas of myofascial restriction.

Though respiration is a generally automatic function, thoracic expansion depends on other skeletal muscles, many of which are only used when extra force is required. The primary muscle of respiration is the diaphragm, which, if dysfunctional, may cause severe breathing restrictions or fatality. Movement of the diaphragm is dependent on the shape of the thorax, rib functionality, and overall posture. Because of these variations, the attachment points for the diaphragm are different from person to person, but the origin is generally the lower six ribs (Vizniak, Richer, Carter, 2010). In addition to allowing the lungs to expand, diaphragmatic movement helps stimulate peristalsis in the gastrointestinal tract due to its effect on intra-abdominal pressure, and if depleted, may be a contributing factor in constipation (Rattray, Ludwig, 2000). To review all of the muscles of respiration, see **Table 1 in Appendix B.**

The fascial system, or the connective tissue "glue" of the body which surrounds all organs and muscles and runs in a variety of distinguishable "lines" throughout the body, can affect expansion of the ribcage and the balance between muscles that provide support to the ribcage. Imbalances in almost any of the fascial lines may indirectly affect respiration, but those with particular involvement in the mechanics of breathing are the Deep Front Line (DFL), Lateral Line (LL), Deep and Superficial Front Arm Lines (DFAL, SFAL), Superficial Front Line (SFL) and the Spiral Line (SPL) (Myers, 2009).

Foremost, the DFL's role in respiration is defined by its "core" connections to the transverse abdominus (TVA), diaphragm, quadratus lumborum (QL), and scalenes, and is responsible for "stabilizing the chest while allowing for the expansion and relaxation of breathing". The QL and scalenes form the lateral portion of the DFL and suspend the ribcage between them, forming an opposition of forces (Myers, 2009).

Next there is the Lateral Line, which is responsible for stabilizing the trunk on the legs, keeping the trunk steady during movement of the arms, and controlling lateral movement of the trunk. A "shoelace" pattern of fascia in the Lateral Line travels on the lateral side of the ribcage and involves the internal and external obliques, intercostals and splenii muscles of the cervical spine. Dysfunction of the lateral line causes numerous postural compensations in the trunk, such as excessive lateral flexion, lateral shift of the ribcage on the pelvis, and shoulder restriction. Specifically, it may include restriction in lateral movement of the ribcage during inspiration (Myers, 2009).

The next culprits in breathing restriction are the Arm Lines, especially the Deep and Superficial Front Arm Lines (DFAL, SFAL). Specifically, the DFAL may restrict movement of the upper ribs or place excessive drag on the cervical spine and shoulder girdle via the pectoralis minor and its associated fascia. This is usually manifested as the “rounded shoulder” posture commonly seen in those who spend many hours a day in a seated position. As for the SFAL, the main concern lies within the pectoralis major and latissimus dorsi muscles, which form a broad attachment around the ribcage and, when shortened, may restrict shoulder movement and indirectly affect ribcage biomechanics. Though it is not a primary concern, attention should be paid to this line to address secondary compensations in shoulder mobility (Myers, 2009).

Next, the Supercifial Front Line (SFL), with its connection from the SCM down through the sternum and rectus abdominus, is a major player in breathing restriction. Especially around the attachments on the lower anterior ribs, there may be adhesions of the rectus abdominus present that can restrict breathing. Further up the line, where the Sternocleidomastoid is involved, the typical head forward posture may be seen, which is directly related to a shortening of the SFL and may affect the SCM’s ability to bring the sternum and rib cage upward and outward, allowing for easy breathing. Finally, this line may have an emotional connection, as shortening of the SFL may be utilized as a protective mechanism in many cases, with habitual tension present in the rectus abdominus. Since asthma often has a psychological connection, this is an important aspect to assess when considering myofascial treatment of breathing restrictions in the SFL (Myers, 2009).

Lastly, the Spiral Line (SPL), though less of a concern in the biomechanics of respiration, must be evaluated for its involvement as postural compensations may indirectly affect ribcage mobility. The SPL covers the body in all planes of movement and therefore is related to most of the other fascial lines. The most common problem associated with the SPL that can affect respiration is the imbalance between serratus anterior, which attaches on the lateral ribcage, and the rhomboids, causing the scapula to be pulled away from the spine and locking the rhomboids in a lengthened position. This imbalance may encourage a kyphotic posture that can further disrupt proper breathing biomechanics. Furthermore, imbalances in the internal and external oblique complex may cause a rotation of the ribs on the pelvis, which can also place an asymmetry on ribcage movement (Myers, 2009).

Massage therapy treatment of asthma can be an effective way of reducing stress placed on accessory muscles of respiration, as well as improving function in the diaphragm itself (Rattray, Ludwig, 2000). Understanding the different fascial lines and how they can affect respiration is also important when developing a treatment plan. In this case study, the objective will be to assess and treat restrictive tissues of the thorax, and therefore increase the ability for the thorax to expand. Though expansion will be the main objective, the effects of massage therapy on decreasing asthmatic symptoms will also be tested. Treatment plans will essentially follow the outline given by Rattray for treating asthma.

Case History

The subject of this study is a 21 year old female student, who, in the summer of 2010, contracted a lung infection which, after persisting for around six to seven months, was eventually diagnosed as asthma by her medical doctor in February, 2011. She is 5'10" and 220lbs, has a low activity level and gets about five to six hours of sleep per night. Since acquiring asthma, the subject has noticed a decrease in energy, decreased ability to sleep and increase in weight gain by approximately 20lbs. Her main source of exercise is walking to and from work and school. Symptoms usually appear at about mid-morning, or after about five to ten minutes of brisk walking, and manifest as a "wheezy" or "heavy" feeling in the chest. The subject also reports dizziness and lightheadedness with occasional tension-type headaches. Blood pressure taken on the initial treatment was 110/60.

Stress, both psychological and physical, is the main trigger of the subject's symptoms, but she also notices an increase in symptoms with exercise, temperature and humidity changes, strong scents, and animal dander. Aggravating factors include the intake of approximately one cigarette and three alcoholic beverages a day, on average. The subject also describes her eating habits as "sporadic". In addition to respiratory symptoms, the subject complains of constipation, varying in severity with approximately one bowel movement (BM) every three to four days.

Medications prescribed for the subject are Ventolin, a salbutamol bronchodilator inhaler, and Flovent, a corticosteroid inhaler, both prescribed with a dosage of two times a day. Prior to taking these medications, the patient would wake up approximately five times per night, which is now decreased to two times per night since they were prescribed. For more detailed information regarding the subject's dietary habits, sleep patterns, medication use, and daily symptoms, see the Subjective Daily Symptoms Journal in **Appendix C.**

Musculoskeletal complaints of the subject include pain, with an "achey" quality and tension with cervical spine, shoulder girdle, and lumbar spine movement. The subject believes this is due to postural imbalances as well as respiratory compensation. Often, the subject experiences muscle spasms in the levator scapula muscle on the right side, and reports a "snapping" sound with movement of both scapulae. She also reports hypermobility of her lower ribs, and believes there could also be "deformities" present there which has been discovered by her own palpation.

The subject's goals for treatment are to decrease asthma symptoms, especially during exercise, to increase movement at the diaphragm, to decrease the physical stress placed on the neck and shoulders, and decrease pain in the lower back. She would also like to practise postural education via the Alexander technique, and make changes in dietary and lifestyle habits, such as introducing a raw foods diet, cessation of smoking, and increase in cardiovascular activity to a frequency of three to four days a week. These lifestyle and postural changes are not prescribed by the author, but will be included in the study for their relevance.

Assessment

Initially, a plum line postural assessment (Rattray, Ludwig, 2000) was performed to assess the possible impact of the subject's posture on restriction of movement at the thorax. An objective "soft eye scan" and palpation exam showed a slight superior position of the entire left extremity, with a visible shortening of the gap between the left iliac crest and 12^{th} rib. In addition, a slight bilateral posterior rotation of the innominates was present. In the upper body, the right shoulder girdle was more superior in comparison to the left. As well, an exaggerated thoracic kyphosis, anterior rotated shoulder and head forward posture was observed. Lastly, Standing Flexion and Gillet's Test (Magee, 2009) performed to rule out any involvement in the sacroiliac joints that could be contributing to lower back pain.

Next, the active range of motion (AROM) of the cervical spine was assessed to make note of any restrictions. In addition, AROM assessment of the glenohumeral joint was performed to assess shoulder girdle restriction that could be impeding thoracic function. For normal AROM ranges of the cervical spine as outlined by Magee, see **Appendix A.** Subjective information was gathered from the subject regarding pain quality and fascial "pull" during each motion.

To specifically assess ribcage mobility, chest expansion measurements were taken and rib motion was assessed by palpation before and after every treatment. Normal ranges for costovertebral expansion between inspiration and expiration in adults are 3 to 7.5cm (approximately 1 to 3 inches). Costovertebral expansion is measured at three levels; the axilla, the xiphoid or nipple line, and the tenth rib (Magee, 2008). In this study, the third measurement was taken lower, at the twelfth costovertebral joint, to avoid the subject's breast tissue and assess fascia of the upper abdominal attachments to the ribcage. Normal expansion for this area is from 3 to 4 inches (WCCMT Systemics 1, 2010). **Figure 1.0** below shows the areas measured and their normal ranges.

Rib motion during inspiration and expiration was palpated and any asymmetries were recorded as a difference in left and right. This test is performed with the subject in supine, and the therapist's hands placed lightly on the upper ribs (ribs 1 to 4), middle ribs (ribs 5 to 8) and lower ribs (ribs 9 to 12).The subject then inhales and exhales while the therapist palpates any restrictions (Magee, 2008). Both lateral and anterior portions of these rib sections are palpated to assess different lines of fascia as discussed earlier.

Lastly, a Subjective Daily Symptoms Journal (see **Appendix C**) was utilized for a two week time period between treatments three and four and then again for another two week time period between treatments six and ten. The purpose of this journal was to help the subject keep track of her daily symptoms and see if there was any correlation between diet, sleep, exercise, smoking, stress levels and the occurrence of symptoms and need for medications. Stress levels were rated on a 1-10 scale with one being low stress, 5 being moderate stress, and 10 being the highest level of stress.

Treatment Methods

The main goals of treatment for this case study were to increase costovertebral expansion to within normal ranges at the upper, middle, and lower ribcage, decrease pain and tension in the cervical spine, shoulder girdle, and lower back, improve general posture, decrease asthma symptoms, decrease need for bronchodilator medication and generally increase the well-being of the subject.

Treatment frequency would have ideally been twice a week for five weeks for a total of ten treatments but due to the subject and therapist's scheduling differences that was not possible. Instead, the treatment plan ended up in three phases; three initial assessment/treatment sessions over a two week period, three treatments over a month's time period where the subject recorded her first section of the Subjective Daily Symptoms Journal, and seven treatments over a month's time period where a second journal section was completed. The final treatment plan ended up being 12 treatments over a two and half month time period, with the first session on May 12th, 2011 and the last session on August 5th, 2011. Each treatment session was approximately one hour long and included a pre and post assessment.

Myofascial Release (MFR) was the main technique used in this study, as emphasis was on determining and releasing specifically restrictive tissues. As well, Swedish massage was used for relaxation, increased circulation and "flushing" of tissues. Occasionally, Trigger Point Release (TPR) was used after Swedish massage techniques to decrease hypertonicity and pain referral in certain muscles. Specific areas treated in each session and homecare given (see **Appendix A** for more information) will be briefly described in **Table 2** below.

Table 2 – Areas Treated and Homecare Given from Treatments 1-12

Treatment #	Areas Treated	Homecare Given
1 - May 12th 2011	Posterior thorax, lower back.	**Breathing Exercise**. The purpose of this was to bring awareness into the subject's own breathing patterns and assess which area of the ribcage caused the most difficulty. **Frequency:** 1x/day, when in a relaxed state.

		Intensity: Upper ribs for five breaths, middle ribs for five breaths, and lower ribs (diaphragm) for ten breaths. **Duration:** Each inhale and exhale lasting for five seconds (Rattray, Ludwig, 2000).
2 - May 16th 2011	Lateral and posterior cervical spine, upper chest	1. **Breathing Exercise modification**: Upper ribs for five breaths, middle ribs for five breaths, and lower ribs (diaphragm) for three breaths (five was too difficult for subject). 2. **Self MFR** to the anterior cervical spine and chest. Performed with head in full extension, but supported with gentle, relaxed breathing throughout. The subject was instructed on how to anchor tissue and gently move the neck into the tissue barrier. **Frequency:** 1x/day **Intensity:** Light pull at edge of tissue barrier. **Duration:** Hold each for minimum of one minute or until "pull" releases.
3 - May 19th 2011	Lateral and anterior cervical spine, scalenes, trapezius.	Start Subjective Daily Symptoms Journal. (See **Appendix A**)
4 - June 9th 2011	Lateral and anterior cervical spine, upper chest, right pectoralis minor, right serratus anterior, latissimus dorsi, and intercostals.	**Pectoralis minor stretch.** **Frequency:** 2x/day **Intensity:** Light pull at edge of tissue barrier. **Duration:** Hold for minimum of 30 seconds.
5 - June 23rd 2011	Latissimus dorsi, serratus anterior, and intercostals.	**Latissimus dorsi and serratus anterior stretches.** **Frequency:** 2x/day **Intensity:** Light pull at edge of tissue barrier. **Duration:** Hold each for minimum of 30 seconds.

6 - July 7th 2011	Lateral and anterior cervical spine, upper chest, upper back, scalenes and levator scapula.	**Levator scapula stretch with preheat** **Frequency:** 2x/day **Intensity:** Light pull at edge of tissue barrier. Use a towel to cover heat pack. **Duration:** Preheat 10 minutes. Hold each stretch for a minimum of 30 seconds.
7 - July 8th 2011	Chest – sternum, xiphoid, lateral ribcage, abdomen and diaphragm.	**Abdominal stretch over swiss ball.** **Frequency:** 2x/day, with relaxed breathing into diaphragm. **Intensity:** Light pull at edge of tissue barrier. **Duration:** Hold each for minimum of 30 seconds.
8 - July 11th 2011	Upper chest, sternum, xiphoid, lateral ribs, intercostals, abdomen, diaphragm.	**Abdominal stretch over swiss ball** (see above)
9 - July 15th 2011	Upper chest, sternum, intercostals, quadratus lumboroum, pectoralis major.	**Quadratus lumborum stretch.** **Frequency:** 2x/day, with relaxed breathing into diaphragm. **Intensity:** Light pull at edge of tissue barrier. **Duration:** Hold for minimum of 30 seconds.
10 - July 20th 2011	Upper chest, sternum, xiphoid, lateral ribcage, abdomen, diaphragm, intercostals, thoracolumbar fascia and right quadratus lumborum.	**Abdominal stretch over swiss ball** (see above)
11 - July 25th 2011	Upper chest, pectoralis minor and major, lateral and posterior	**Quadratus lumborum stretch** (see above)

	ribs, intercostals, quadratus lumborum, diaphragm.	
12 - August 5th 2011	Upper chest, lateral ribs, xiphoid and sternum, posterior ribs, quadratus lumborum, intercostals, diaphragm.	**Latissimus dorsi and pectoralis minor stretches.** **Frequency:** 2x/day, with relaxed breathing into diaphragm. **Intensity:** Light pull at edge of tissue barrier. **Duration:** Hold each for minimum of 30 seconds.

Specific treatment of the neck.

MFR techniques were applied to the neck along the lateral, anterior and posterior portions. The majority of restriction was palpated along the lateral and anterior portions, following the scalene and SCM fibre directions. Most effective were small crosshands techniques (Rattray, Ludwig, 2000) anchoring just off the mastoid process and mobilizing in an inferior direction from the mastoid down to the clavicle. Passive movement of the whole head was used to move into these fascial holds. In addition, the SCM was picked up and pulled away from the underlying fascia and also gently mobilized in an inferior direction. Petrissage techniques such as kneading and muscle stripping (Rattray, Ludwig, 2000) were applied to the scalenes and splenii musculature. Many trigger points were found in the scalenes near the origin of the anterior and middle scalenes as well as their insertion on the first rib. Interestingly, ischemic compression of trigger points at the scalene insertion caused the subject to experience a “heavy” feeling in the chest similar to the impending feeling of an asthma attack (Treatment #4). These trigger points were held, within the subject’s comfort level, until the “heavy” sensation had disappeared, although the subject reported some residual sensation for the rest of the day after the session and had to use her inhaler for relief. For a visual representation of the cervical spine treatment and location of trigger points, refer to **Figure 2** below.

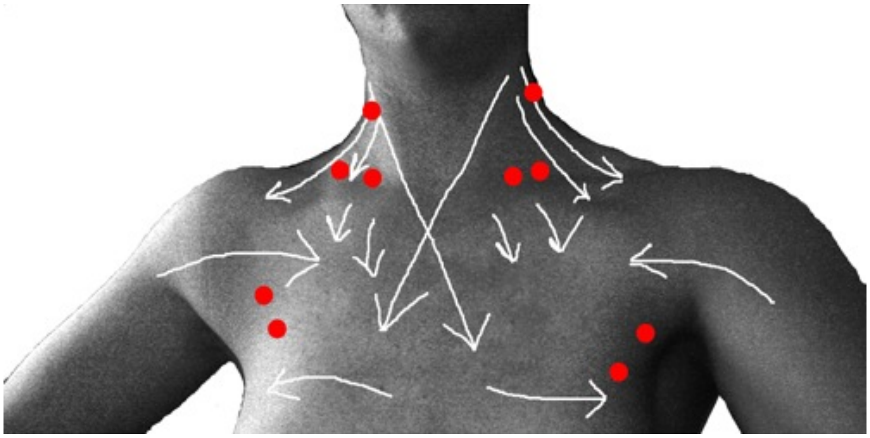

Figure 2 - Specific treatment of the neck. (Photo by author).

Specific treatment of the chest and diaphragm.

Myofascial shearing (Rattray, Ludwig, 2000) was applied off the clavicle in an inferior direction. As well, crosshands were applied over the entire clavipectoral fascia in a lateral direction to counteract anterior rotation of the shoulders and kyphotic posture. The arm was brought into 90 degrees of abduction and slight extension to aid with fascial holds of the clavipectoral fascia. With MFR to upper chest in Treatment #2, a pain referral into the viscera of the lower right and lower left quadrants was felt by the subject. Concentration of techniques was on the right side of the upper chest as rib motion palpation showed the most restriction there. In addition, a crosshands was applied in a superior-inferior direction along the sternum to open up the SFL (Treatment #7). This technique also caused the subject to experience a "heavy" sensation in the chest similar to the scalene trigger point referral and, when applied again in Treatment #9, caused a pain referral into the subject's throat area.

Laterally, the latissimus dorsi was picked up and mobilized in a posterior direction away from the serratus anterior (Treatment #5). At the xiphoid and lower ribs, shearing was applied in an inferior direction. Interestingly, with shearing off the lower right ribs, there was a pain referral into the subject's right lung and with general shearing off the lower ribs there was the same "heavy" sensation in the chest (Treatment #7). Positioning of the subject's arm into full abduction on the side being treated made breathing during these techniques easier for her.

Swedish techniques such as kneading and muscle stripping were applied to the pectoralis minor, serratus anterior and intercostals where some tenderness was found. In the right pectoralis minor, trigger points with a local referral were treated with ischemic compression (Travell, Simon). Finally, treatment of the diaphragm was performed, slowly sinking into the tissue on the subject’s exhale and treating it on the inhale (Rattray, Ludwig, 2000). Treatment of the right side diaphragm was performed first as it was assessed to be more restricted using rib motion palpation. With treatment of the right side diaphragm, referral pain was felt into the same side QL (Treatment #7). In a subsequent treatment (Treatment #8) of the left side diaphragm, the “heavy” sensation in the chest occurred once again. In addition, fasciculations in the left side diaphragm, right side gluteals, and ringing in the right ear was felt with treatment of the diaphragm in Treatment #10. For a visual representation of treatment of the chest and diaphragm, refer to **Figure 3a and 3b** below.

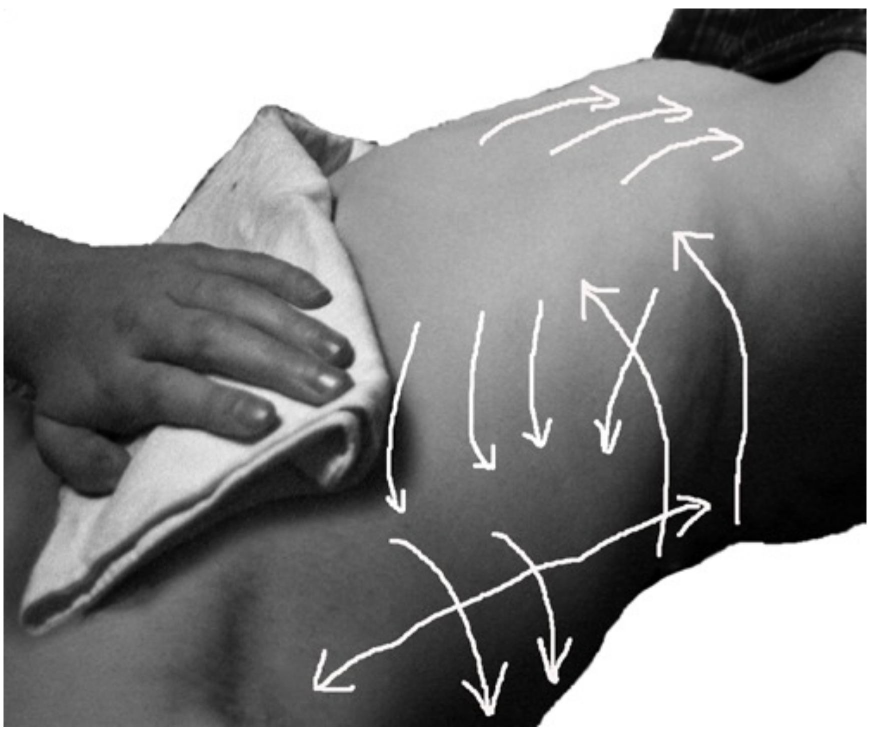

Figure 3a - Specific MFR strokes to the lateral chest. (Photo by author).

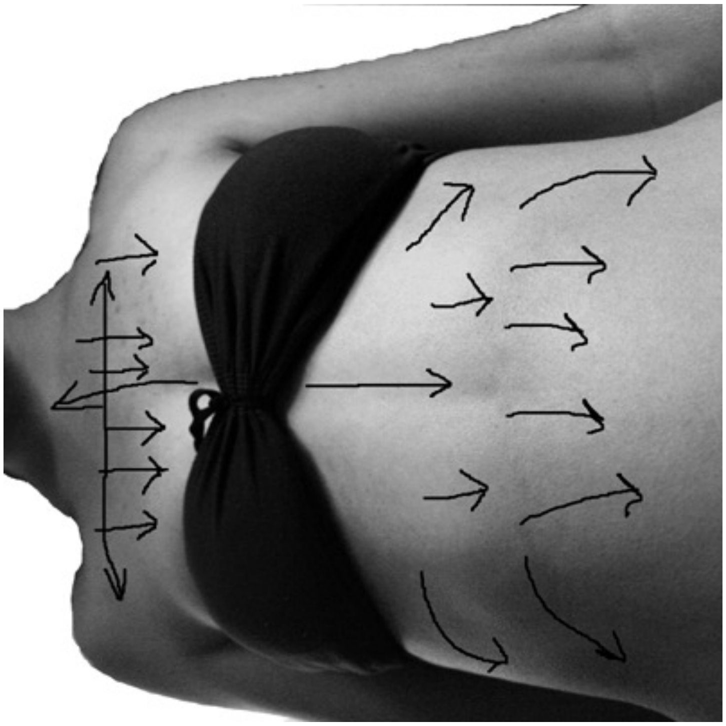

Figure 3b – Specific MFR strokes to the anterior chest and abdomen. (Photo by author).

Specific treatment of the lower back.

Treatment to the lower back was indicated as the subject complained of muscle spasms and pain, especially on the right side, and rib motion palpation showed the most restriction in the right lower ribs, suggesting a possibly shortened QL. MFR treatment involved shearing in a lateral direction away from the spine, and crosshands in a superior-inferior direction along the fibre direction of QL. Swedish petrissage techniques were applied to bring circulation into the area and muscle stripping was performed to reduce hypertonicity of the QL. No specific trigger points were determined in the QL, but repeated muscle stripping was applied in the area to reduce pain and hypertonicity. See **Figure 4** below for a visual representation of treatment to the lower back.

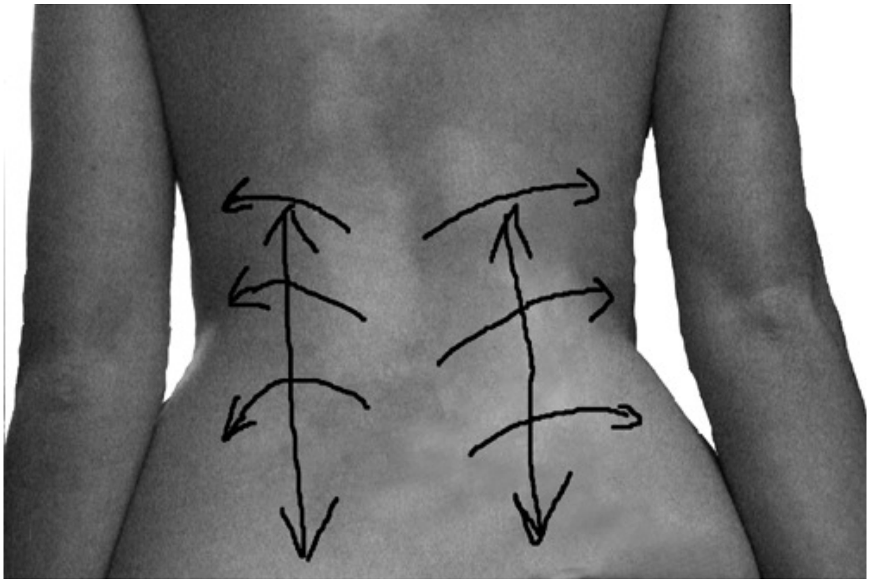

Figure 4 – Specific treatment of the lower back. (Photo by author).

Overall, the treatment plan was similar to what was formulated in the initial session. Due to scheduling differences, consistent treatment of the neck at the beginning of the treatment plan was difficult to achieve, so more treatments were spent on the neck than originally planned. Actual treatment of the diaphragm also started later in the treatment plan than expected, and the lower back received more treatment than what was originally planned.

Results

The subject's posture, though not extensively measured in this case study, showed improvements between the 1^{st} and 12^{th} treatments. Anterior rotation of the shoulders was reduced and head carriage was more upright. However, superior translation of the left extremity, posterior rotation of the innominates and a slight hyperkyphosis was still present.

Palpation of the cervical spine musculature revealed hypertonicity and tenderness in the levator scapula, scalenes, and SCM. Over the course of the treatment plan, with continued MFR and muscle stripping, there was decrease in hypertonicity and the subject reported a decrease in tenderness.

AROM testing of the cervical spine also showed some improvement from the 4th to 6th treatments (See **Table 3** below). Post treatment improvements are shaded. Long term improvements with cervical spine rotation and flexion were seen when retested at the beginning of the 12th treatment. Results for AROM of the shoulder are not shown as it was only performed twice throughout the treatment plan. For normal values of AROM for the cervical spine, see **Appendix A.**

Table 3 – AROM testing of the cervical spine

Treatment	Pre AROM (in degrees)	Post AROM (in degrees)
2	Flex: 45 Ext: 70 Sb R: 40 Sb L: 40 Rot R: 70 Rot L: 70	Flex: 55 Ext: 75 Sb R: 50 Sb L: 50 Rot R: 75 Rot L: 75
3	Flex: 45 Ext: 70 Sb R: 50 Sb L: 40 Rot R: 70 Rot L: 60	Flex: 45 Ext: 75 Sb R: 50 Sb L: 45 Rot R: 75 Rot L: 70
4	Flex: 45 Ext: 70 Sb R: 45 Sb L: 50 Rot R: 70 Rot L: 60	Flex: 45 Ext: 75 Sb R: 50 Sb L: 55 Rot R: 75 Rot L: 65
6	Flex: 45 Ext: 70 Sb R: 40 Sb L: 45	Flex: 60 Ext: 75 Sb R: 50 Sb L: 50

	Rot R: 60 Rot L: 70	Rot R: 70 Rot L: 75
12	Flex: 60 Ext: 70 Sb R: 40 Sb L: 40 Rot R: 80 Rot L: 80	No Data

Costovertebral expansion testing was the most improved outcome measure in this case study. By the 12th treatment, all measurements were within normal ranges. If treatments were not consistent, there was a noticeable decrease in thoracic expansion. See **Figure 6** below for post treatment (Tx) results.

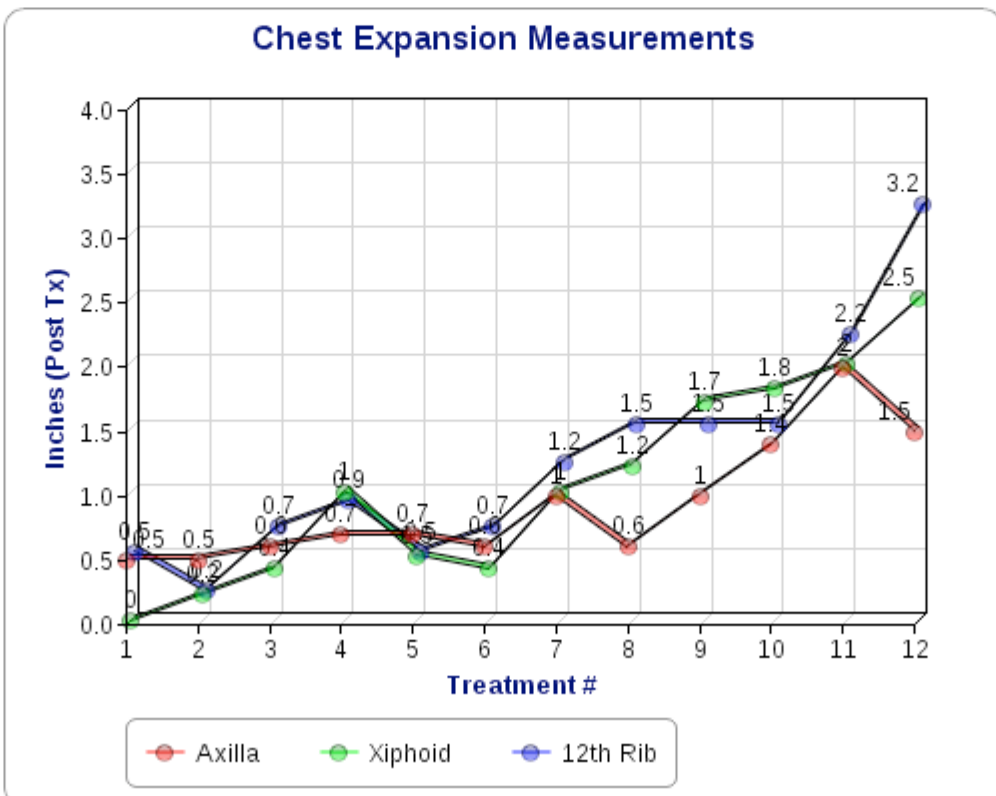

Figure 6 – Costovertebral (Chest) Expansion Measurement Results

Rib motion also showed some improvement over the course of the treatment plan, though consistent assessment of rib motion did not begin until the 6th treatment. By the end of the 12th treatment however, the middle and lower ribs had equal movement bilaterally. See **Table 4** below for rib motion results. Results are expressed as a difference between left (L) and right (R) and any significant changes are shaded.

Table 4 - Rib Motion Palpation Results (Treatments 6-12)

Treatment	Upper	Middle	Lower
6	Pre: L = R Post: L = R	Pre: L > R Post: L > R	Pre: L = R Post: L = R
7	Pre: L = R Post: L = R	Pre: L > R Post: L > R	Pre: L > R Post: L > R
8	Pre: L > R Post: L > R	Pre: R > L Post: R > L	Pre: R > L Post: L > R
9	Pre: L = R Post: L = R	Pre: L > R Post: L = R	Pre: L > R Post: L = R
10	Pre: L > R Post: R = L	Pre: L > R Post: R > L	Pre: L > R Post: L > R
11	Pre: L < R Post: L = R	Pre: L > R Post: L = R	Pre: L = R Post: L = R
12	Pre: R > L Post: R > L	Pre: L = R Post: L = R	Pre: L > R Post: L = R

Lastly, the Subjective Daily Symptoms Journal did not show a direct correlation between the subject's symptoms and her diet, exercise, sleep, and smoking habits. On days where asthma attacks or greater than normal symptoms occurred, there was no real difference in diet or amount of sleep acquired the previous night. However, an increased use of the subject's bronchodilator medication was evident on days where the subject exercised a greater amount than normal. For more details, see **Appendix C**. To view the Case Management Plan for this case study, see **Appendix E.**

Discussion

Overall, the treatment plan for this case study was effective in increasing thoracic expansion. However, due to the original plan of two treatments a week for 5 weeks not being possible, treatment efficiency was therefore lower than originally expected. Actual effect on asthma symptoms was inconclusive, most likely due to inadequate completion of the Subjective Daily Symptoms Journal and inconsistency of the treatment plan. Although the Journal proved to be an ineffective way of measuring the subject's symptoms, the subject reported that it was a helpful exercise as it made her more aware of what she was eating and how much sleep she was getting. In addition, the subject reported having to use her bronchodilator medication less often towards the end of the treatment plan. Though this shows a positive result, the subject should keep taking her medication at the advice of her medical doctor and especially when exercising to prevent any attacks from occurring.

Most effective was the use of MFR to treat specific restrictions on the anterior thorax. Particularly, releasing fascia of the Superficial Front Line over the sternum was effective. Also effective was the actual diaphragm treatment itself, as within three treatments focussing on the diaphragm, major gains in costovertebral expansion were made. The subject also reported "easier" breathing into the abdomen, with less stress placed on the upper chest and neck musculature.

The exact effect of homecare given throughout the treatment plan is difficult to determine. The subject reported that the abdominal stretches felt most effective on her breathing patterns. Further stretching of the latissimus dorsi and serratus anterior, as well as scalenes, levator scapula and pectorals is recommended for the subject to correct postural imbalances and allow for more ROM of the shoulder and cervical spine.

Continued treatment recommendations for the subject are regular cervical spine treatments, preferably once a week, and chest/diaphragm treatments twice a month. Treatment to the latissimus dorsi and serratus anterior would also help by increasing shoulder abduction. In addition, treatment and stretching of the lower back, in particular QL, would be beneficial to the subject as the right QL still shows hypertonus and is still a possible cause of restriction of the right ribcage. Lastly, expert advice from a registered nutritional practitioner regarding the use of dietary changes for management of asthma symptoms is also recommended.

Suggested modalities for a repeat study include use of a peak flow meter and monitoring of respiration rate to more accurately assess respiratory function. More specific orthopaedic assessment of costovertebral and thoracic spine mobility, with Muscle Energy Technique corrections to any thoracic fixations and respiratory rib dysfunctions (Magee, 2008) would also be beneficial.

Conclusion

Massage therapy is an effective modality in treating tissue restrictions of the thoracic cavity. In particular, myofascial release to the anterior thorax and trigger point release of the diaphragm can increase the ability for the thorax to expand with diaphragmatic breathing. The effect of massage therapy on improving asthmatic symptoms was not clear in this case study and more research is recommended. As well, more research regarding nutritional factors in asthma is also recommended.

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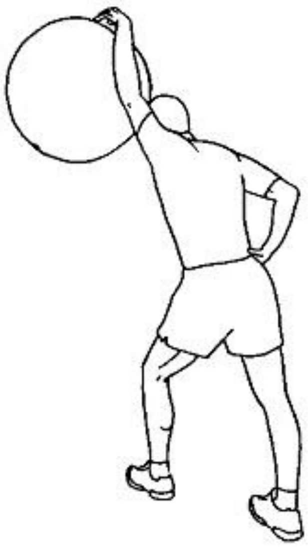
Appendix A - Remedial Exercise and Normal AROM Values

Remedial Exercises

Pectoralis Minor Stretch:



(Source: http://2.bp.blogspot.com/_Ifk_MhvbWKw/TKDgAzHcZ1I/AAAAAAAAAJI/RPDL-W81eTg/s1600/pectoralis+minor+stretch.jpg)

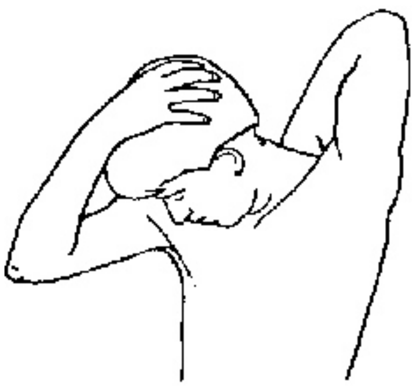
Latissimus Dorsi Stretch:

(Source: http://www.chinesemedicinecure.com/How-To-Stretch-With-Stretching-Pictures)

Serratus Anterior Stretch (Camel Pose):

(Source: http://www.bikramhotyoga.ca/index.php/ustrasana-camel-pose/)

Levator Scapula Stretch:



(Source: http://www.drjanepetermeier.com/stretching-exercise.html)

Abdominal Stretch:

(Source: http://www.livestrong.com/article/330632-the-best-ab-stretches/)

Quadratus Lumborum Stretch (Triangle Pose):

(Source: http://www.bikramhotyoga.ca/index.php/trikanasana-triangle-pose/)

AROM of the Cervical Spine – Normal Values (Magee, 2009)

Flexion: 80-90 degrees

Extension: 70 degrees

Lateral Flexion: 20-45 degrees

Rotation: 70-90 degrees

Appendix B- Muscles of Respiration

Table 1 – Muslces of Respiration (Adapted from Magee, D. J. (2008). Thoracic (Dorsal) Spine. *Orthopedic physical assessment* (5. ed., pp. 482). Philadelphia: Saunders)

	Primary	Secondary
Inspiration	Diaphragm Levator costarum External intercostals Internal intercostals (anterior)	Scalenes Sternocleidomastoid Trapezius Serratus anterior/posterior Pectoralis major/minor Subclavius
Expiration	Interal obliques External obliques Rectus abdominus Transverse abdominus Transversus thoracis Transverse intercostals Internal intercostals (posterior)	Serratus posterior inferior Latissimus dorsi Quadratus lumborum Iliocostalis lumborum

Appendix C- Subjective Daily Symptoms Journal

The following was completed by the subject from May 19th-June 2nd and then again from July 6th to July 20th

Asthma Symptoms/General Health Diary

-In the SLEEP section, note approximately when you got to sleep (s) and when you woke up (w) especially if you awoke multiple times in one night.
-In the MEDS section, indicate when the inhaler was used (t) and what the dosage was (d).
-In the EXERCISE section, indicate what the activity was (a) and the length of time it was performed (l).
-In the BM's section, indicate how many bowel movements you had today.
-In the FOOD section, note what foods you ate (f) for breakfast, lunch and dinner and approximately what time (t) they were consumed at.
-In the C section, indicate how many cigarettes you smoked today.
-In the Attacks section, indicate if you suffered from an asthma attack today, the intensity (i, mild, moderate or severe) and the duration (d)
-Indicate your overall Stress Level today on a 1-10 scale, 1 being no stress, 10 being extremely high stress.

Sleep (s/w) –
Meds (t/d) –
Exercise (a/l) –
BM's (#)-
Food: B (f/t) -
L (f/t) -
D (f/t) -
C (#) -
Attacks (i/d) -
Stress Level (1-10) –