



Clinical Case Report Competition

Utopia Academy

Spring 2011

First Place Winner

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The effects of massage therapy on thoracic outlet syndrome symptoms: A case report

Abstract:

The efficacy of massage therapy on alleviating Thoracic Outlet Syndrome (TOS) symptoms were examined in an otherwise healthy 33 year old male client. All massage therapy sessions were 60 to 75 minutes performed by the same student intern therapist and occurred over a 10 week period. Orthopaedic testing revealed that the client was positive on the left side for Wright's hyper-abduction test implicating a brachial plexus compression by pectoralis minor. Serratus anterior was also found to be causing symptoms when tested with a manual muscle test (MMT) and through palpation. After five massage therapy sessions aimed at decreasing the hypertonicity of tight structures in the client's left chest and arm with accompanying stretching and strengthening exercises and hydrotherapy, the client's symptoms had decreased. After 10 treatments, the client's symptoms only presented themselves during times of strenuous work and when fatigued. The client felt better circulation in the limb and less pain overall.

Introduction:

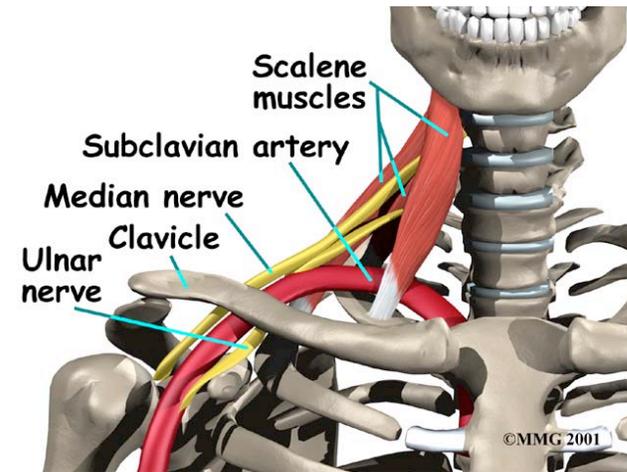
Overview of pathology:

Thoracic outlet syndrome (TOS) is a condition caused by the compression of the brachial plexus and sometimes accompanying compression of the subclavian artery (and or subclavian vein) in several areas in the anterior body (Rattray, 2000). Impingement these structures occurs most commonly in several places, including, between the anterior and middle scalenes ("interscalene triangle"); beneath the pectoralis minor and in the costoclavicular space (Magee, 2008). The presence of a bony anomaly such as a cervical rib which narrows the interscalene triangle can also lead to brachial plexus compression (Rattray, 2000).

TOS is more common in women (Sucher, 2009). The cause of this condition is influenced by the complexity of the anatomy of the thoracic outlet. In this region of the body, the spinal nerves of the brachial plexus are in very close proximity to ribs, muscles, tendons and the vasculature including subclavian vein and artery (Goodman, 2009). The syndrome causes neuropraxia where conduction of the nerve is disrupted at the compression point with no axonal demyelination (Rattray, 2000). If left untreated, the syndrome can progress causing further damage to the axons (Goodman, 2009).

TOS is divided into three categories: "neurogenic" (compression of the brachial plexus), "vascular" (compression of the associated vasculature) and "disputed" (non-specific TOS with chronic pain and symptoms of brachial plexus involvement) (Goodman, 2009). Neural involvement is much more common in TOS, about 95% of cases, whereas vascular involvement is about 5% of cases (Goodman, 2009). Symptoms and signs of TOS may be bilateral or unilateral and presentation varies depending on which structures are being compressed (Rattray, 2000). The symptoms of this condition are generally "vague" and "difficult to interpret" (Goodman, 2009). With a neuronal compression, people with TOS may experience paresthesia and hyperesthesia such as numbness and tingling especially on the ulnar side of the hand and into the forearm. Paresthesia often comes first, followed by pain (Dawson et al., 1990).

Diagram 1: Thoracic Outlet Anatomy



from website: westvanphysio.com

Factors causing Brachial Plexus Compression include:

- Trigger points in surrounding musculature (subclavius is commonly affected)
- Poor posture such as scoliosis or hyperkyphosis (Rattray, 2000)
- Hypertonic Scalene muscles
- Presence of a cervical rib
- Long transverse processes in the C-spine
- Abnormalities in the clavicles
- Compression by Pectoralis minor

(Goodman, 2009)

Symptoms commonly reported include, “diffuse, aching or throbbing pain in the upper limb, predominantly the shoulder and in the forearm and hand”, and less commonly pain may occur in the neck or chest or head (Szabo, 1989). Motor weakness and a decrease of fine motor skills in the hand from the compression of C8 to T1 is also seen (Rattray, 1990). As for vascular compression, ischemia and “compromised” circulation causing pain, pallor, possible cyanosis and a cooler limb are seen (Turner et al., 1990).

Economic Burden:

TOS has economic impacts in that it prevents people from being able to do their jobs and also causes pain and discomfort exacerbating the ‘pain-tension cycle’. This condition is seen in a number of people: the elderly population who more commonly present with osteoarthritis causing poor posture; people with jobs where they have to lift their arms above their heads such as window washers, painters and gardeners are at greater risk for TOS with pectoralis minor involvement.

Traditional Management:

Several sources recommend that treatment to relieve these compressions need to be done for at least six months to a year, including massage, exercises and modifications to activities of daily living (ADL) (Szabo, 1989; Dawson et al., 1990 etc). Postural and breathing exercises and stretching are important for the initial treatment of TOS, followed by strengthening exercises for the shoulder girdle musculature (Goodman, 2009). These are considered “conservative” measures. Surgery is also performed in some cases where the symptoms are severe or TOS recurs constantly. “Scalenectomy” and “clavicle resection” are examples of surgical interventions used (Goodman, 2009).

Client history:

A male client, named as John Doe for the purpose of this paper, age 33, presented with unilateral arm discomfort. John believed that his arm discomfort began around the time he started practicing full-time massage therapy at age 25. The sensations were unilateral on the left side and occurred in the upper extremity (pectoral area, posterior shoulder), parascapular area, arm and hand. The symptoms are described as, “nagging, low-level, diffuse pain in the arm” and weakness (and sometimes numbness) in the fingers, especially the 3rd, 4th & 5th digits. (*Please see **Appendix A** for chart notes illustrating affected area).

The intensity and frequency of the symptoms had increased to be of aggravation to John especially in the past 6 months. He decided to seek out chiropractic care in December of 2010 and after four sessions noticed little improvement. He also sought out a treatment from an RMT who focuses on releasing adhered fascial structures in the body. He had one treatment prior to taking part in this case study but agreed to suspend other treatments during the duration of this study. The client did not do hydrotherapy such as contrast arm baths for muscle health on a regular basis as a self-care measure prior to this case study.

John graduated as an RMT in 2003. He has been practicing massage therapy on average four days per week since that time. In the past two years his productive hours have averaged twenty-two, 50-minute treatments per week. He uses a lot of Swedish techniques, passive stretching and trigger point therapy. John is an active individual who does cardiovascular exercise in the form of guided indoor cycling or running twice weekly and also practices yoga, emphasizing stretching and alignment three times per week. John has an athletic history also, starting at a young age, he played fastpitch baseball, hockey and basketball avidly into his late 20s. Lately, while not playing in leagues, he plays tennis in the summer and basketball for fun. He practices regular meditation and deep breathing exercises daily in the morning and before bed. The client appeared to be in good physical condition. John has suffered no major traumas except a broken distal radius on the right side two years ago in a ski accident.

The client’s symptoms were becoming more prevalent at work and causing him moderate discomfort. He described that the symptoms were decreasing his ability to do his job and feel comfortable. The client described that worst pain (about 5 out of 10 on the pain scale) was recreated during “pushing” techniques such as deep tissue strokes. At best he said it felt about 1 out of 10 on the pain scale when he was not massaging. Of interest was that symptoms were always present even at rest, even if very subtle. He also noted that the limb on the left was sometimes palpably cooler in the morning. John’s own ideas about the recreation of symptoms while performing massage therapy was that he needed to stop doing repetitive strokes and relying on the same techniques. He claimed to be aware of using good biomechanics while working. He did not take any form of medication for this condition or otherwise.

Assessment & Treatment Overview:

Ten treatments were performed between February 16 and March 20. For the first visit a thorough assessment was done. Altered sensation during dermatome testing resulted on the left side for nerve roots C4 through C7, some pain during myotome testing occurred on the left side for C7 and T1 myotomes, a positive result for Wright's hyperabduction test on the left side and the pain and re-creation of neurological symptoms during the Serratus Anterior MMT, were the most notable results from orthopaedic testing. The clients' posture presented with a slightly depressed left shoulder and more obvious internal rotation on the left side also. Please see Author's photos in **Appendix B**.

A synopsis of all of the orthopaedic testing conducted and results are entailed in the following chart (Table 1); testing protocols are described in *Orthopaedic Physical Assessment*, 5th, Edition (Magee et al, 2009)

Table 1: Orthopaedic testing & results (initial visit)

| Test-type: | Results: | Notes: |
|---|--|---|
| Dermatome testing | C4 – slight “burning” sensation noted on left side | All other Dermatomes for C-spine appeared normal |
| | C5 – similar to C4 but more subtle (left side again) | |
| | C6/C7 sensation of touch fingers longer on left than right | |
| Myotome testing | pain experienced with elbow extension/wrist flexion (C7) on left | Muscles were strong for all Myotome tests for the C-spine |
| | weaker finger abduction/adduction (T1) on left | |
| Manual Muscle Testing | | |
| Biceps | Normal (Grade 5) | |
| Triceps | Normal (Grade 5) | |
| Pectoralis Major | Normal (Grade 5) | |
| Levator Scapula | Normal (Grade 5) | |
| Rhomboids | Normal (Grade 5) | |
| Serratus Anterior | Normal (Grade 5) | Client experienced Pain/Recreation of symptoms in left arm |
| Empty Can Test | Negative | Tests for supraspinatus tendonitis |
| Speed’s test | Negative | Tests for biceps tendonitis |
| Wright’s (hyperabduction) test | Positive on left side only | Decreased in radial pulse & neurological symptoms re-created by test |
| Adson’s test | Negative | |
| Costoclavicular Syndrome (Military Brace) test | Negative | |
| Pronator Teres Test | Negative | |
| Upper Limb Tension Tests | Negative | No neurological symptoms were re-created, although client felt fascial & muscle tension |
| Supine to Sit test | Pelvis slightly posteriorly rotated on right side | Slight functional leg-length discrepancy present (left leg 2 mm shorter based on this test) |

Based on the clients’ health history and positive orthopaedic tests, the possibility of a brachial plexus compression such as in TOS was likely. Since there was dermatome and myotome involvement too, some nerve root irritation was present in the cervical spine. The effects of massage therapy on complaints of this nature can help alleviate compression of tight structures on neural and vascular tissue.

Goals for treatments were to alleviate compression on the brachial plexus using myofascial release, neuromuscular techniques (NMT), Swedish massage, hydrotherapy, stretching and strengthening exercises of the shoulder girdle and upper back and neck. Major areas to decrease hypertonicity and elongate included: pectoralis minor, serratus anterior, scalenes, deltoids, biceps brachii, triceps brachii and forearm flexor and extensor muscles.

Methods:

Ten treatments were performed starting on Wednesday February 16, 2011, on a twice weekly basis, with a one-week break before the final treatment. The first treatment entailed a full-hour of history assessment through questioning and orthopaedic assessment followed by a 60-minute hands-on session. All treatments were performed by the same student intern therapist of Utopia Academy, Marcia Moncur, under the supervision (for questions and guidance) of Rosanna Durante, RMT.

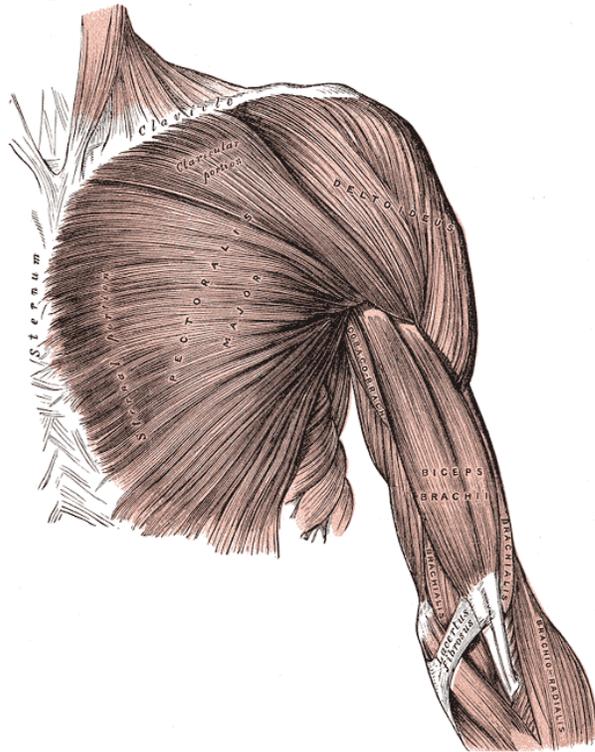
All treatments were performed on a massage table in either a prone, sidelying or supine position, depending on what structures needed to be accessible. General principles of massage such as treating proximal to distal to proximal; superficial to deep to superficial etc., were followed to minimize negative impacts from massage such as “kick-back” pain and improve therapeutic outcomes. Testing methods used for assessment were done at the initial visit and then at visits five and ten to establish a baseline of information and then decipher changes. The client was also asked a series of survey questions at treatments 4 and 8 about perceived treatment effects (please see **Appendix C**). A brief description of the ten treatments performed is outlined in **Table 2** to follow.

Table 2: Treatment Synopses

| Treatment Number | Tx Description |
|-------------------------|---|
| Tx 1 | Orthopaedic assessment & pectoralis major & minor release |
| Tx 2 | More pectoralis minor tx and anterior body myofascial release |
| Tx 3 | Latissimus dorsi myofascial release & stretch; initial work on serratus anterior |
| Tx 4 | Trigger Point (TrP) release infraspinatus & supraspinatus; scapulothoracic joint mobilizations; glenohumeral joint mobilizations; further release of serratus ant; suboccipital muscles release and cervical spine joint mobilizations |
| Tx 5 | Orthopaedic assessment – some symptoms recreated with palpation of serratus anterior; Wright’s hyperabduction test negative . NMT of latissimus dorsi; cross-hands myofascial release of serratus anterior. |
| Tx 6 | Treated compensatory arm with myofascial arm pull and general Swedish techniques to increase circulation. Addressed upper left arm – myofascial release of deltoids, biceps, triceps (and pectoralis major) |
| Tx 7 | Forearm treatment bilaterally, but most time spent on left. NMT of tight forearm musculature. Deep muscle separations of pronator teres, flexors (especially flexor digitorum superficialis, flexor carpi radialis and flexor carpi ulnaris to increase blood circulation and tissue pliability |
| Tx 8 | Symptoms present for client during work past two days. Latissimus dorsi & serratus ant release; mobilizations of the clavicle |
| Tx 9 | Anterior neck treatment – sternocleidomastoid, scalene release |
| Tx 10 | Myofascial arm pull. General Swedish to increase blood circulation of whole arm and anterior chest on left. Neck stretch. |

*Note: unless otherwise specified, all therapeutic techniques were performed on the left side. Please see attached charting in **Appendix A** for a thorough account of treatment and assessment activities.

Diagram 2: Anterior View of Chest & Arm Musculature



-Drawing illustrating musculature of the anterior body, namely sternocleidomastoid; scalenes; pectoralis major (pectoralis minor underneath); serratus anterior, deltoids, biceps and proximal attachments of the forearm flexors.

Drawing by Henry Gray (1821–1865).
Anatomy of the Human Body. 1918. Found on the internet.

Table 3: Homecare Synopses

| Treatment Number | |
|-------------------|--|
| Txs 1 – 5 | <p>Hydrotherapy: pre-warm upper latissimus dorsi and serratus anterior prior to stretching for 10 minutes with thermafore</p> <p>Stretching: Sidebody stretch (modified “child’s pose”) to elongate latissimus dorsi and serratus anterior</p> <p>Strengthening: Lying flat on belly, hands clasped behind head with elbows wide; back extension – emphasis on extension of middle & lower trapezius; hold 5 breaths x 4 sets</p> |
| Txs 6 – 10 | <p>Hydrotherapy: cool wash to arms with cloth before getting into warm bed to increase blood circulation</p> <p>Stretching: lying on a foam roller with arms abducted & moving through full ROM (“snow angel” movements); slowly and with breath for one minute x 3 sets</p> <p>Strengthening: Rhomboid “rows” with a resistance band; 15 repetitions x 3 sets</p> |

Results:

After 4 massage therapy treatments, when asked about treatment effects, the client described that he felt, “less pain; feeling of greater mobility & release of tension”. He also described that he felt, “less irritation and pain in left limb while performing massage therapy”. When asked about pain scale he said that pain went from a 5 out of 10 to a 3 out of 10 on the pain/discomfort scale (‘0’ being no pain and ‘10’ being excruciating pain). After 8 treatments, the client explained that he felt “noticeably better with less discomfort during work with greater stamina doing massage treatments and also that he was able to do more txs with less discomfort”. Please see **Appendix C** for a list of survey questions answered by the client after treatments 4 and 8.

Some changes occurred with regards to orthopaedic testing are summarized in **Table 4**. Most notable changes were that the serratus anterior MMT no longer elicited a recreation of symptoms and that Wright’s hyperabduction test was negative after the treatments were complete. When Wright’s hyperabduction test was done at treatment 5, it was negative also, compared to treatment 1 when it was positive with three successive attempts. The myotome and dermatome testing illustrated that there were still some sensory and motor impairments coming from cervical nerve roots even after 10 treatments, although less so at C4 than at the initial visit.

Table 4: Orthopaedic testing & results (final visit)

| | | |
|---------------------------------------|--|--|
| Dermatome testing | C4 – felt less sensation on left side (*subtle difference) | All other Dermatomes for C-spine appeared normal |
| | C5 – slight “burning” sensation notes on left side | |
| | C6/C7 decreased sensation on ulnar side of hand on left | |
| Myotome testing | Diffuse pain experienced with elbow extension/wrist flexion (C7) on left | Muscles were strong for all Myotome tests for the C-spine |
| | weaker finger abduction/adduction (T1) on left | |
| Serratus Anterior | Normal (Grade 5) | No pain experienced or recreation of symptoms |
| Wright’s (hyperabduction) test | Negative | Pulse diminished slightly but not as much as first assessment & no neurological symptoms noted |

The client’s body exhibited some changes after the ten treatments were complete. Please see the author’s photos **Appendix B** with observation notes. Photographs comparing the client’s body at initial visit and final visit presented in **Appendix B**.

Discussion:

Diffuse and sometimes “vague” symptoms make TOS a difficult diagnosis. Many people likely do not seek medical help or treatment or even understand what they are experiencing. It can be a troubling and even disabling condition, especially when numbness and weakness occur in the hand, limiting motor capabilities. In this case, Wright’s hyperabduction test implicated that pectoralis minor was causing compression of the brachial plexus. MMT and palpation showed that serratus anterior was also involved in the creation of symptoms. The trigger point referral pattern of serratus anterior closely matches the distribution of the area of complaint. Hypertonicity and some “ropey-ness” also existed in triceps, biceps and forearms, which was also contributing to the symptoms. When alleviating the tension in pectoralis minor did not cause symptoms to resolve completely, it was evident that other structures also needed to be addressed. The use of NMT, stretching, myofascial release, trigger point release and Swedish techniques to elongate, decrease tissue tension and increase blood circulation in serratus anterior and later triceps, biceps, deltoids and forearm muscles, caused a nearly complete resolution of symptoms in the clients’ arm.

John said that he didn’t recall experiencing these types of symptoms prior to practicing massage therapy on a regular basis. Of interest is that this condition is common in baseball players due to the throwing motion (Magee, 2008). John had spent about 15 years playing league baseball and also hockey and basketball at a competitive level. It is possible that these activities could have caused the initial issues in his upper chest such as hypertonicity and irregular position of the left clavicle. During treatments it was noticed that the left clavicle was less mobile than the right one and was therefore treated with clavicle mobilizations to increase its mobility. John is also a left-handed person making this his dominant side for most activities including massage therapy. It is clear upon structural observation that John’s left arm and shoulder muscles were more prevalent than the right. In the future, strengthening exercises should be emphasized on the right side, possibly doubling the sets. This could help correct the imbalance.

The types of techniques John used at work seemed to be aggravating his TOS due to a lot of deep tissue techniques requiring “pushing” with arms stretched out in front of the body. Long days of massage made his symptoms worse than any other activity. TOS is uncomfortable because symptoms can linger even at rest, due to neurological involvement. While the tension in pectoralis minor resolved quickly, serratus anterior was more stubborn to decrease the hypertonicity of. It required several long sessions of fingertip kneading and stretching to make a noticeable difference to the tone of the muscle. The goal was to work up deeply into the axially, eventually reaching the 2nd rib and gently traction this rib inferiorly. John noticed instant positive results in his arm discomfort after the first treatment of serratus anterior. Serratus stabilizes the scapula and is activated during a “push-up” motion. Through John’s work and activities this muscle had become quite strong but also shortened and contained trigger points.

John needs to continue receiving massage therapy at least twice monthly, aimed at decreasing the hypertonicity of serratus anterior and pectoralis minor and also arm and

forearm muscles to help nerve conduction and blood circulation. This is especially true due to his full-time employment as an RMT to ensure he can continue to do his job. Further cervical spine treatment needs to happen also, to alleviate and decompress nerve root irritation in this area which was still present based on dermatome and myotome testing upon completion of the case study.

Conclusion:

It was found that TOS symptoms can be alleviated by decreasing tension in the pectoralis minor and serratus anterior muscles. Pectoralis minor is a common area of impingement on the brachial plexus, while serratus anterior has a trigger point referral pattern that closely matches the distribution of TOS symptoms. Therefore, tightness, trigger points or shortening of the serratus anterior should be assessed as a possible contributing factor in TOS symptoms.

References:

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Appendix B:

Author's Photographs

Photo 1: Anterior View of Client's body – initial visit



Observations:

- fascia appears to be tighter in the left pectoralis area and pulling the tissues laterally
- left shoulder is slightly depressed
- left shoulder more internally rotated
- left arm more flexed at elbow (can't see in this photo)

Photo 2: Anterior View of Client's body – final visit



Observations:

- Left pectoralis area appears to be less restricted than initial visit
- Chest has a more balanced appearance from one side to the other
- Shoulders appear more symmetrical (left shoulder not as internally rotated or anteriorly placed)

Photo 3: Client in supine position: comparison of shoulder posture – initial visit



Observations:

- musculature in left shoulder appears hypertrophied compared to right
- left glenohumeral joint sits anteriorly compared to right

Photo 4: Client in supine position: comparison of shoulder posture – final visit



Observations:

- musculature in left shoulder appears hypertrophied compared to right
- left and right glenohumeral joints appear level

Appendix C: Client Survey Questions

Post-massage sessions with Marcia after 4 treatments:

1. Was there a difference in pain or sensation post-treatment?
John, “yes; less pain; feeling of greater mobility & release of tension”
2. Was there a particular technique or treatment that started to make the most difference?
The Latissimus release & Serratus ant release.
3. How were your symptoms performing massage at work since your last treatment?
This accounted for 2 days of work. He felt more comfortable. Felt less irritation & pain in left limb while working. Went from a 5/10 to a 3/10 pain/discomfort scale.
4. Have you noticed any negative effects from treatments?
No negative effects noticed.
5. Do you think massage therapy is benefiting your condition?
Yes.
6. Do you have any further comments about the txs or the effects you are experiencing?
Feels excited to continue with the tx plan & feels more reassured that he is getting some relief from this long-term condition & understands more where the pain is coming from

Post-massage sessions with Marcia after 8 treatments:

1. Was there a difference in pain or sensation post-treatment?
Yes
2. Was there a particular technique or treatment that felt like it made a lot of difference?
The work on Serratus anterior
3. How were your symptoms performing massage at work since your last tx?
Arm felt noticeably better; less discomfort during treatments; greater stamina; able to do more treatments with less discomfort
4. Have you noticed any negative effects from treatments?
No negative effects noticed.
5. Do you think massage therapy is benefiting your condition?
Yes.
6. Do you have any further comments about the treatments or the effects you are experiencing?
Client is eager to continue
7. How has your homecare compliance been? A: Pretty good; doing exercises daily