

Thoracic Outlet Syndrome Home Study Course

1 CE Hour

Text, Examination, and Course Guide

Presented by the:

Center for Massage Therapy Continuing Education

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Instructions for the Thoracic Outlet Syndrome home study course

Thank you for investing in the Thoracic Outlet Syndrome home study course, a 1 CE hour course designed to further your knowledge in the principles and practice of treating clients with signs and symptoms of thoracic outlet syndrome. This guide will contain all of the instructions you will need to complete this course. This is a 1 CE hour course, so that means it should take you approximately 1 hour to read the text and complete the multiple choice exam and course evaluation.

The following are steps to follow in completing this course:

- 1. Read and review the exam and text in this file. The exam is provided for review before testing online and is the same as the online exam.**
- 2. When you are ready to test online, access the online examination by logging in to your account at <https://www.massagetherapyceu.com/login.php>.**
- 3. Complete your examination and print your certificate. The exam is open book and there is no time limit for completion.**

You must pass the exam with a 70% or better to pass this home study course. You are allowed to access and take the exam up to 3 times if needed. There is no time limit when taking the exam. Feel free to review the text while taking the test. This course uses the text *Thoracic Outlet Syndrome, an excerpt from Condition-Specific Massage*, by Celia Bucci. All of the answers can be found in the text. It is advised to answer the exam questions in the study guide before testing online. That way, when you are testing you do not have to go back and forth through the online exam.

If you have any questions please feel free to contact us at 866-784-5940, 712-490-8245, or info@massagetherapyceu.com. Most state boards require that you keep your “proof of completion” certificates for at least four years in case of audit. Thank you for taking our Thoracic Outlet Syndrome home study course.

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It is the responsibility of the practitioner to determine the appropriateness of the techniques presented in terms within the scope of practice. This information is in no way meant to diagnose or treat medical conditions. Written medical opinions are always the best way to resolve any questions regarding contra-indications to or advanced treatment of thoracic outlet syndrome.

Thoracic Outlet Syndrome Exam

1. What is the thoracic outlet?
 - A. The space between the base of the anterior lateral neck and the axilla
 - B. The space between the base of the posterior lateral neck and the axilla
 - C. The space between the base of the anterior lateral neck and the sternum
 - D. The space between the base of the posterior lateral neck and the vertebrae
2. Signs and symptoms of neurogenic thoracic outlet syndrome include:
 - A. Swelling and ischemia
 - B. Aching, pain, burning, and numbness
 - C. Pale or bluish skin in the hand
 - D. Weak or absent pulse in the affected arm
3. All of the following are differentiating conditions commonly confused with or contributing to thoracic outlet syndrome EXCEPT:
 - A. Cervical spondylosis
 - B. Tendinitis
 - C. Iliotibial band syndrome
 - D. Diabetes
4. If edema is present, how should you work?
 - A. Work directly on the site, moving fluids away from the nearest proximal lymph nodes
 - B. Work proximal to the site, moving the fluid away from the nearest proximal lymph nodes
 - C. Work directly on the site, moving the fluid toward the nearest proximal lymph nodes
 - D. Work proximal to the site, moving the fluid toward the nearest proximal lymph nodes
5. Clients with thoracic outlet syndrome may also present with _____.
 - A. Hyperkyphosis
 - B. Herniated L1 disc
 - C. Patellofemoral syndrome
 - D. Iliotibial band syndrome
6. What is the average active ROM of horizontal abduction of the posterior deltoid in clients with symptoms of thoracic outlet syndrome?
 - A. 25 degrees
 - B. 35 degrees
 - C. 45 degrees
 - D. 55 degrees
7. When treating symptoms of thoracic outlet syndrome, where is the best place to begin?
 - A. With the client prone, on the affected side
 - B. With the client supine, on the unaffected side
 - C. With the client seated, on the unaffected side
 - D. With the client supine, on the affected side

8. Trigger points in the sternocleidomastoid (SCM) may cause:
 - A. Burning and numbness down the center of the sternum
 - B. Vertigo, nausea, or ringing in the ears
 - C. Pain and numbness down the posterior arm
 - D. Ear and sinus infections

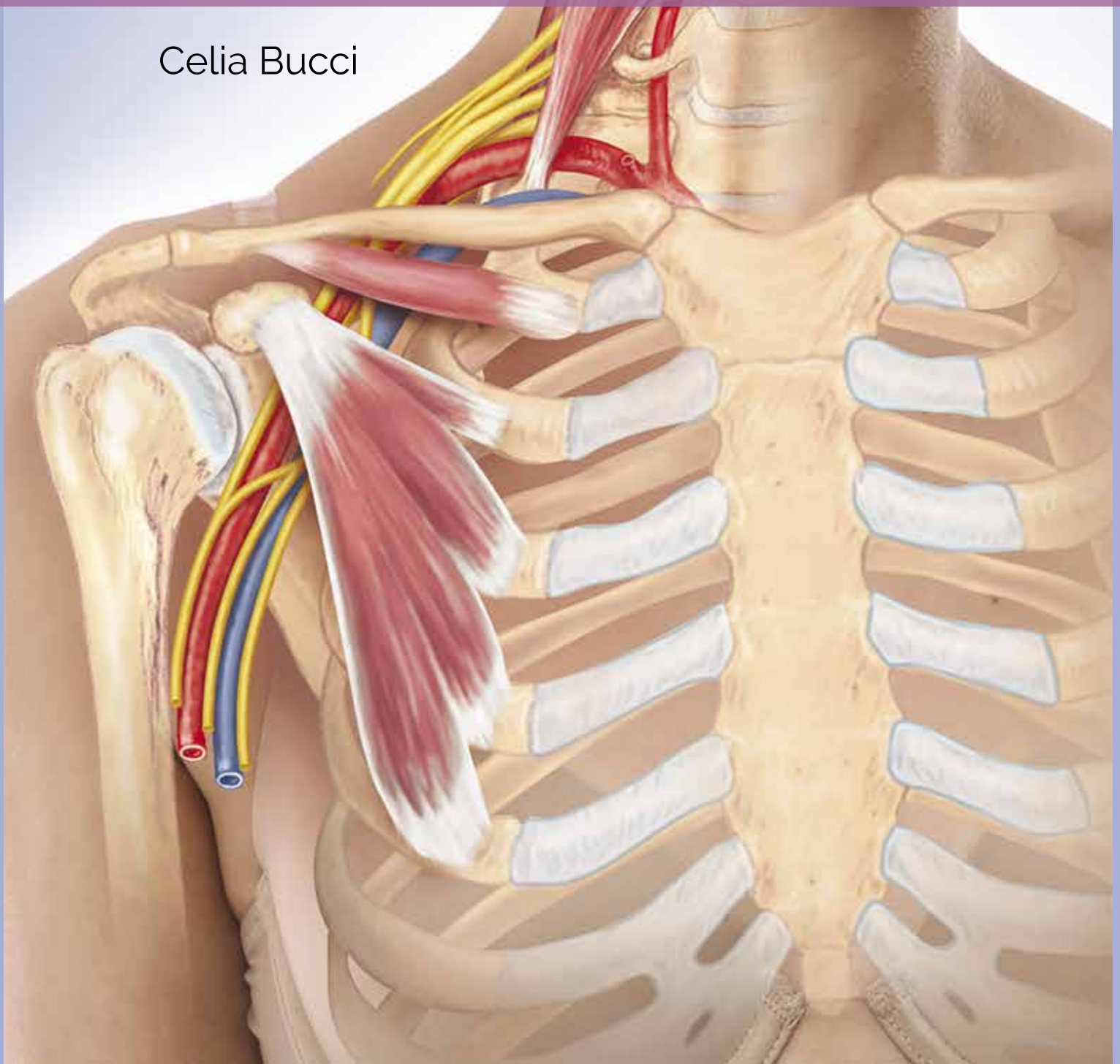
9. Client self-care for thoracic outlet syndrome should include stretching of which of the following muscles?
 - A. Scalenes
 - B. Middle trapezius
 - C. Rhomboids
 - D. Pronator teres

This completes the Thoracic Outlet Syndrome exam. Proceed to the next page to view the text.

Condition Specific Massage Therapy

SECOND EDITION

Celia Bucci



Chapter 6:

Thoracic Outlet Syndrome

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Thoracic Outlet Syndrome

Understanding Thoracic Outlet Syndrome

The thoracic outlet is the space between the base of the anterior lateral neck and the axilla (Fig. 1). A neurovascular bundle that includes the brachial plexus, the subclavian artery, and the subclavian vein passes through the thoracic outlet. Thoracic outlet syndrome refers to a collection of symptoms that occur when any of these structures become compressed. The symptoms are often vague, and there is no true consensus about the cause or diagnosis. The condition is called neurogenic thoracic outlet syndrome when the nerves are compressed, and vascular thoracic outlet syndrome when the blood vessels are compressed. Neurogenic thoracic outlet syndrome is most common, although occasionally, both occur simultaneously.

The nerve roots of the brachial plexus exit the spine between C5 and T1. These roots merge to form the superior, middle, and anterior trunks. Each trunk splits into anterior and posterior divisions, which then regroup to form the posterior, lateral, and medial cords; these later split into the branches that innervate the arm. Compression of the nerves slows the transmission of impulses; this can result in pain, burning, numbness, and tingling in the shoulder, axilla, lateral thorax, and down the arm to the hand. The subclavian artery, subclavian vein, and cervical lymph trunk also pass through the thoracic outlet. Compression of these structures can result in decreased blood supply to the arm, insufficient venous return, and lymphatic congestion, causing swelling in the arm, pale or cool skin, and a weakened pulse.

When thoracic outlet syndrome has muscular contributing factors, postures and activities that shorten myofascial tissues and decrease the space through which the nerves and vessels pass may cause symptoms. There are three primary areas where muscular compression of the contents of the thoracic outlet occurs: between the anterior and middle scalenes (anterior scalene syndrome), beneath the clavicle and subclavius (costoclavicular syndrome), and beneath the pectoralis minor (pectoralis minor syndrome). Because common postures like working at a computer for extended periods often result in a head-forward posture, flexion and internal rotation of the shoulder, pronation of the forearm, and extension of the wrist, compression may occur at more than one of these sites, as well as beneath the pronator teres or in the carpal tunnel. Compression occurring at more than one site along the path of a peripheral nerve is called a double crush.

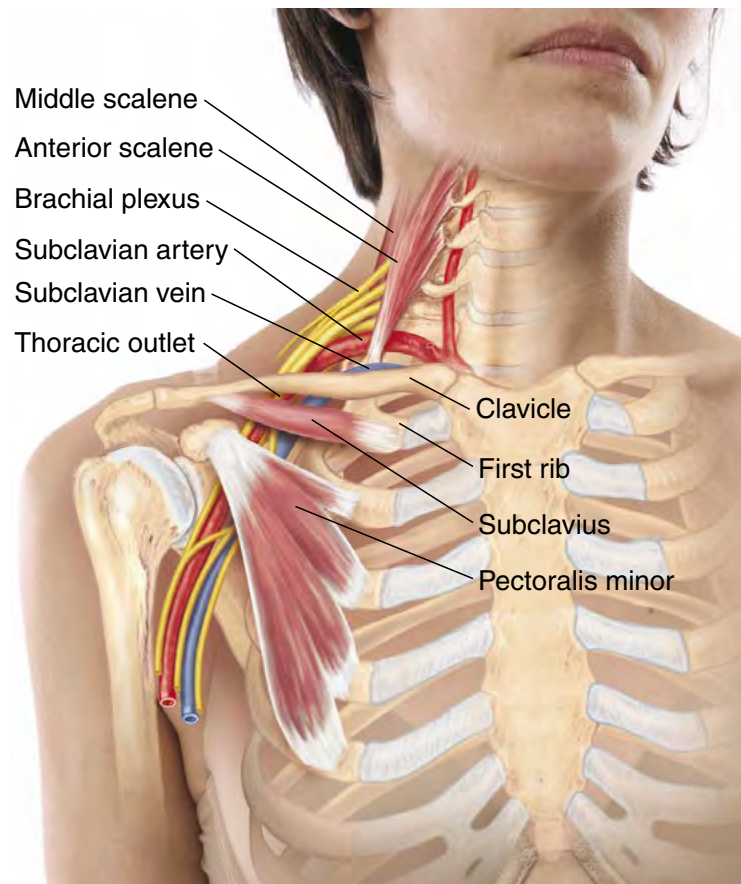


Figure 6-1 The thoracic outlet.

COMMON SIGNS AND SYMPTOMS

The symptoms of thoracic outlet syndrome usually begin gradually. Symptoms are commonly unilateral but may be bilateral. The signs and symptoms of neurogenic thoracic outlet syndrome include aching, pain, burning, numbness, or tingling in the shoulder, neck, arm, or hand of the affected side. Untreated, reduced innervation may lead to loss of tone, initially in the thenar muscles and eventually in the muscles of the arm and hand, causing reduced strength and fine motor skills. Atrophy may occur in advanced cases.

With vascular thoracic outlet syndrome, the client may experience the symptoms described above in addition to swelling, ischemia, and pain in the arm and hand or sensitivity to temperatures in the hand and fingers. The skin of the hand may be pale or bluish. Symptoms may mimic those of Raynaud's syndrome, namely cold fingers and pallor. The client may have a weak or absent pulse in the affected arm. Black spots on the hand and fingers may be present when decreased circulation affects the health of those tissues. In the worst-case scenario, vascular compression can be caused by blood clots, or can result in blood clots if left untreated. A client with these symptoms should be assessed by a medical professional prior to massage.

Because postural imbalance is often a contributing factor, the client may also have neck pain, chest pain, jaw pain, or frequent tension headaches. Note, however, that chest pain that refers to the jaw, throat, and arm may also be symptoms of a cardiac problem, which requires medical assessment prior to performing massage therapy. See Table 1 for conditions commonly confused with or contributing to thoracic outlet syndrome. Raising the arm above the head often intensifies the symptoms, particularly when lifting heavy objects. Lying down or gently moving the head and shoulder into a neutral position may reduce symptoms, particularly in the early stages of the syndrome.

Many people suffering from thoracic outlet syndrome are awakened from sleep by pain or tingling, often because they sleep with the head resting on the raised arm (Fig. 2). Disturbed sleep can contribute to a cycle in which fatigue exacerbates symptoms and produces anxiety and depression, which may in turn disturb sleep.

POSSIBLE CAUSES AND CONTRIBUTING FACTORS

Thoracic outlet syndrome is not a clearly defined condition but a collection of signs and symptoms associated with various contributing factors. Anatomically, a small percentage of people have a cervical rib—a bony prominence that emerges from the C7 transverse process and meets the lateral aspect of the first rib (Fig. 3). Cervical ribs are often unilateral but can be bilateral. The presence of a cervical rib, which can be palpated or seen on an X-ray, alters the path of the nerves and vessels as well as the shape of the surrounding soft tissues. In some



Figure 6-2 Sleeping on one side with the arm raised above the head.

cases, the C7 transverse process is unusually large, and while it does not form a complete cervical rib, its increased size can displace the tissues around it. Other bony prominences that may develop in the cervical or axillary region as a result of orthopedic disorders can also elicit symptoms. Hyperkyphosis, scoliosis, a subluxed cervical vertebra, or a herniated cervical disc can alter the anatomy of the thoracic outlet and may contribute to symptoms. For example, scoliosis in the thoracic spine will affect the balance of the cervical vertebrae to which the scalenes are attached, potentially shortening the scalenes, which may lead to trigger points and compression of the nerves and vessels passing through the thoracic outlet.

Symptoms of thoracic outlet syndrome may also develop with the use of crutches or any other device or posture that puts pressure on the structures in the axillary region. Weak shoulder muscles may cause a drooping of the shoulder, which causes the clavicle to fall upon the first rib, resulting in compression. Previous traumas including whiplash, rotator cuff injuries, or a fractured clavicle or humerus that were not successfully treated may result in adhesions, scar tissue, compensating patterns, and trigger points that contribute to thoracic outlet symptoms.

The most common postural imbalances that contribute to the symptoms of thoracic outlet syndrome are identical to those of hyperkyphosis. The main difference is that with thoracic outlet syndrome, these postural imbalances have led to the compression of nerves and vessels, causing numbness, tingling, and swelling whereas the symptoms of hyperkyphosis are primarily pain and reduced ROM. Holding postures that include extension and rotation of the neck; head-forward posture; and abduction, flexion, and internal rotation of the shoulder also contribute to the symptoms of this syndrome. People who work at a computer for long periods, teachers who write frequently on a blackboard, cashiers, house painters, and those in any profession in which the neck and shoulders are held in a static position or in which repetitive actions involve flexion and rotation of the shoulder, particularly above the head, are at risk. Athletes whose activities involve forced movement of the shoulder, such as tennis, golf, and volleyball players, are also at risk.

Hypertonicity and trigger points in the anterior and middle scalenes, subclavius, and pectoralis minor are the most common contributing factors and are the focus of the treatment described in this chapter. Any increase in the tone of these muscles can decrease the amount of space through which the brachial plexus and accompanying vessels travel. However, because of the frequent involvement of postural and respiratory abnormalities, nearly all of the muscles attached to the cervical vertebrae, scapulae, or ribs or those that cross the glenohumeral joint may be hypertonic or may develop trigger points. Referral patterns for trigger points in the latissimus dorsi, serratus anterior, and serratus posterior superior can be confused with the symptoms of thoracic outlet syndrome and may be the result of postural deviations that contribute to thoracic outlet syndrome. Other muscles that are not directly involved but may be peripherally involved include the coracobrachialis, anterior deltoid, biceps, upper and middle trapezius, levator scapulae, and SCM because of their attachment sites and their roles in postural imbalances.

Neurogenic thoracic outlet syndrome is a peripheral neuropathy. Systemic disorders including diabetes, hyperthyroid, and rheumatoid arthritis may contribute to the development of peripheral neuropathies. Smoking cigarettes—although not a cause of thoracic outlet syndrome—exacerbates the inflammatory process and can intensify symptoms. In addition, because thoracic outlet syndrome may involve the muscles of res-

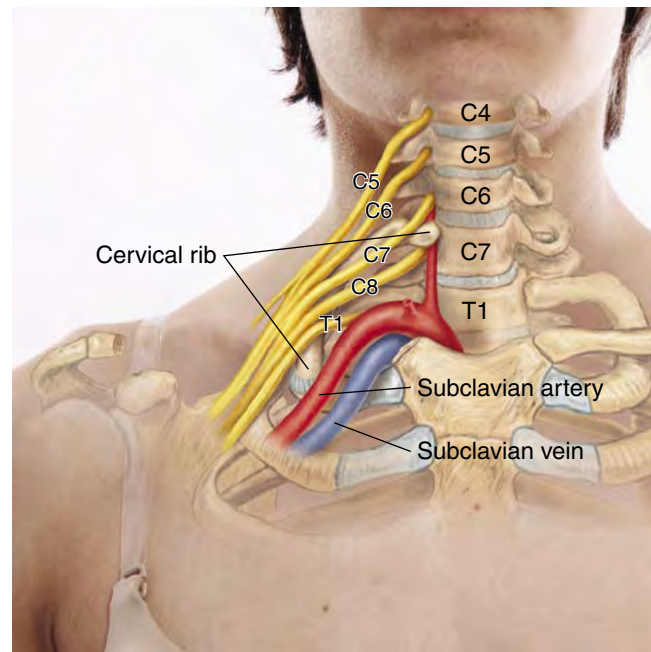


Figure 6-3 Cervical rib.

piration, the repeated deep inhalation and exhalation associated with smoking, along with chronic respiratory disorders and coughing, can contribute to hypertonicity in these muscles. Thoracic outlet syndrome may also develop during pregnancy because of increased fluid and postural changes, but this usually resolves itself following delivery. Alcoholism, poor nutrition, vitamin B deficiency, and general stress may also contribute to or exacerbate symptoms.

Because so many factors may potentially contribute to thoracic outlet syndrome, it is important to understand the client's health history before proceeding with treatment. Many of the conditions listed above have contraindications for massage therapy or require adjustments to treatment. Refer the client to their health care provider for medical assessment if you suspect any systemic condition. If the client has been diagnosed with a condition that requires special consideration when planning massage, discuss treatment with the client's health care provider and adjust accordingly. Table 1 lists conditions commonly confused with or that contribute to thoracic outlet syndrome.

Table 6-1: Differentiating Conditions Commonly Confused with or Contributing to Thoracic Outlet Syndrome

CONDITION	TYPICAL SIGNS & SYMPTOMS	TESTING	MASSAGE THERAPY
Herniated disc C4-5	Symptoms may increase when coughing, laughing, and straining Weak deltoid Shoulder pain Usually no radiating pain or paresthesia	Kemp's test Spurling's test CT scan Myelography MRI	Massage is indicated with caution and proper training. Acute inflammation and acute injury are contraindications. Work with the health care team.
C5-6	Weak biceps and wrist extensors Pain and paresthesia in radial distribution		
C6-7	Weak triceps and finger extensors Pain and paresthesia down posterior arm into third digit		
C7-T1	Weak hand grip Pain and paresthesia in ulnar distribution		
Cervical spondylosis (cervical arthritis)	Neck pain that may radiate to the shoulder or arms Loss of or abnormal sensation in the shoulder or arms Weak arms Stiff neck that gradually worsens Loss of balance Headache Loss of bladder or bowel control	X-ray CT scan MRI Myelogram EMG	Massage is indicated with caution. In cases of nerve impingement or spurs that irritate nerves, work with a health care provider. Position client to reduce symptoms, and do not remove protective muscle splinting.

Table 6-1: Differentiating Conditions Commonly Confused with or Contributing to Thoracic Outlet Syndrome (continued)

CONDITION	TYPICAL SIGNS & SYMPTOMS	TESTING	MASSAGE THERAPY
Nerve root compression (radiculopathy)	Muscle spasm, weakness, or atrophy Pain around the scapula on the affected side Neck pain Pain radiates to extremities Pain worsens with lateral flexion or rotation or when sneezing, coughing, laughing, or straining	Spurling's test Valsalva's test Neurological exam to test reflexes, sensation, and strength	Massage is indicated if cause and location are understood. Take care not to increase compression or reproduce symptoms.
Tendinitis (biceps, forearm, or rotator cuff)	Local inflammation and point tenderness No muscle wasting	Pain on full passive stretch of the joint that the tendon crosses; pain with resisted activity	See Tendinitis
Pronator teres syndrome	Pain in forearm, worsened by elbow flexion/extension Absence of pain during the night	Resisted pronation of the forearm (excluding resistance to the wrist) Tinel's sign at the median nerve as it passes under the pronator teres	Massage is indicated
Hypothyroid condition	Weakness, fatigue, intolerance to cold, constipation, unintentional weight gain, brittle hair and nails, dry skin, puffy skin, hoarse voice, sleep disturbance, and mood swings	Physical exam T ₃ , T ₄ , and Serum TSH laboratory tests	Massage is indicated when no other contraindicated condition, such as a circulatory complication, is present.
Rheumatoid arthritis	Fatigue, loss of appetite, low-grade fever, bilateral nonspecific muscle pain, rheumatic nodules, periods of flares and remission	Physical exam Blood tests X-ray	Massage is indicated in nonacute stages. Work with health care team.
Angina pectoris	Chest pain Pain in arms, neck, jaw, shoulder, or back in addition to chest pain Nausea Fatigue Shortness of breath Anxiety Sweating	Physical exam Risk factors Blood test Electrocardiogram Stress test Chest X-ray Echocardiogram CT scan	Trigger points in pectoralis major may mimic some symptoms of angina pectoris. If the client presents with risk factors or the symptoms listed here, refer them to a health care provider prior to treatment. When risk factors are present, massage is indicated only if cleared by a primary health care provider, and if client is able to perform normal activities of daily living.
Diabetes	Frequent urination, frequent thirst, increased appetite, fatigue, nausea	Physical exam Fasting blood sugar test	Massage is indicated when tissues and circulation are not compromised.

Table 6-1: Differentiating Conditions Commonly Confused with or Contributing to Thoracic Outlet Syndrome (continued)

CONDITION	TYPICAL SIGNS & SYMPTOMS	TESTING	MASSAGE THERAPY
Cervical stenosis	<p>Pain, weakness, and numbness in the shoulders, arms, and legs</p> <p>Clumsy fine motor skills</p> <p>Balance disturbance</p>	<p>Physical exam</p> <p>X-ray</p> <p>MRI</p> <p>CT scan</p> <p>Myelogram</p> <p>Bone scan</p>	<p>Massage is indicated with caution. Work with a health care provider. Client may receive corticosteroid injections or may be using anti-inflammatory medication.</p>
Tumors (axillary, first rib, pancoast, nerve sheath, and spinal cord)	<p>Signs and symptoms vary depending on type and location of tumor. General characteristics for tumors affecting the thoracic outlet include the following:</p> <p>Pain, often severe and constant, in shoulder and scapula that radiates to the arm and hand</p> <p>Weakening, atrophy, and numbness or tingling in the arm and hand</p> <p>Paraplegia</p>	<p>CT scan</p> <p>MRI</p> <p>Pet scan</p> <p>CBC</p> <p>Biopsy</p> <p>Chest X-ray</p>	<p>Refer client to health care provider if you suspect a tumor. Work with the health care provider if a tumor has been diagnosed. Recommendations for massage depend on the type and location of the tumor.</p>
Shoulder injuries (impingement, rotator cuff tears, and adhesive capsulitis)	<p>Often gradual onset with spontaneous resolution</p> <p>Minor pain at rest; acute pain with activity, which may radiate down the arm</p> <p>Pain often worse at night, disrupting sleep</p> <p>Weakness, reduced ROM in shoulder</p> <p>Tenderness and swelling in shoulder</p> <p>Gradual loss of ROM</p>	<p>Physical exam</p> <p>X-ray</p> <p>MRI</p>	<p>Massage is indicated. Work with the health care team.</p>
Carpal tunnel syndrome	<p>Pain, numbness, and tingling in thumb, index, and middle fingers, and lateral half of ring finger</p> <p>Gradual atrophy and reduced fine motor skills</p>	<p>Phalen's test</p> <p>Tinel's sign</p> <p>EMG nerve conduction test</p>	<p>See Carpal Tunnel</p>
Temporomandibular joint disorder	<p>Difficulty biting or chewing</p> <p>Clicking sound when moving jaw</p> <p>Aching in the jaw and face</p> <p>Earache</p> <p>Headache</p> <p>Reduced ROM in mandible</p>	<p>Dental exam</p> <p>MRI</p> <p>X-ray</p> <p>Palpation of muscles of mastication</p>	<p>Massage is indicated</p>

Table 6-1: Differentiating Conditions Commonly Confused with or Contributing to Thoracic Outlet Syndrome (continued)

CONDITION	TYPICAL SIGNS & SYMPTOMS	TESTING	MASSAGE THERAPY
Raynaud's disease	Cold hands and feet White or blue skin Dulled sensation Numbness or pain as extremities warm	Signs and symptoms Rule out conditions causing similar symptoms such as nerve damage Tests for underlying causes Cold simulation test Nail bed or nailfold capillaroscopy Antinuclear antibodies test Erythrocyte sedimentation rate	Raynaud's that is not linked to an underlying condition is indicated for massage. If Raynaud's disease is associated with another condition, follow the guidelines for that condition.
Reflex sympathetic dystrophy syndrome (complex regional pain syndrome)	Often preceded by injury Severe, burning pain that is more intense than the severity of injury and gets worse over time Changes in skin temperature, color, texture, and sensitivity Changes in nail and hair growth Sweating Swelling Joint stiffness Reduced ROM	Signs and symptoms Ruling out other conditions Bone scans	Sufferers of RSDS may not tolerate touch in the affected area. If the client is willing, massage is indicated on or around the affected area.

CONTRAINDICATIONS AND SPECIAL CONSIDERATIONS

It is essential to understand the factors contributing to thoracic outlet syndrome. If a systemic condition or structural abnormality is present, work with the client's health care provider and consult a pathology text for massage therapists before proceeding. Following are a few general contraindications:

- **Underlying pathologies.** The signs and symptoms of thoracic outlet syndrome may result from a wide variety of underlying conditions. If you suspect one of these (consult Table 1 and your pathology book for signs and symptoms) or if the client shows signs of vascular compression, refer the client to their health care provider for medical assessment before initiating treatment. If the client is diagnosed with an underlying pathology that is not a contraindication for massage, work with the health care provider when necessary to develop an appropriate treatment plan.
- **Edema.** If edema is present, do not work directly on the site. Work proximally, moving the fluid toward the nearest proximal lymph nodes. If vascular compression is a consideration but massage is not contraindicated for the client, do not allow the arm to fall below the heart because gravity may draw fluid into the arm and hand. Bolster the arm if necessary to keep fluid from accumulating.
- **Treatment duration and pressure.** If the client is elderly, has degenerative bone disease, or has been diagnosed with a condition that diminishes activities of daily living, you may need to adjust your pressure as well as the treatment duration. Frequent half-hour sessions may suit the client better.

- **Positioning.** Use bolsters to position a client for comfort as well as to correct postures that may reproduce symptoms. If the head-forward posture or extension of the neck is evident, placing a small bolster under the occiput in the supine position and adjusting the face cradle to reduce the extension of the neck in the prone position may help. A bolster along the length of the spine in the supine position reduces the protraction of the scapulae and the extension of the neck. Bolsters under the shoulders in the prone position reduce the protraction of the scapulae and lengthen the pectoral muscles.
- **Reproducing symptoms.** Symptoms may occur during treatment if you manually compress the neurovascular bundle or if the client's posture causes structures to compress this area. If treatment produces symptoms, first adjust the client to a more neutral posture to relieve compression. If this does not relieve the symptoms, reduce your pressure or move away from the area. You may be able to treat around the site that reproduced the symptoms, but proceed with caution.
- **Hydrotherapy.** Do not use moist heat on the neck or chest if the client has a cardiovascular condition that may be affected by the dilation of blood vessels. Severe hypertension and atherosclerosis are two examples of conditions that are contraindicated for hydrotherapy. Consult your pathology book for recommendations. Do not use heat in areas of edema or inflammation, because heat dilates vessels and may increase the accumulation of fluid.
- **Friction.** Do not use deep frictions if the client has a systemic inflammatory condition, such as rheumatoid arthritis or osteoarthritis, if the health of the underlying tissues is compromised or if the client is taking anti-inflammatory medication. Friction initiates an inflammatory process, which may interfere with the intended action of the anti-inflammatory medication. Recommend that your client refrain from taking such medication for several hours prior to treatment if their health care provider is in agreement.
- **Tissue length.** It is important when treating soft tissues that you do not further stretch those that are already overstretched. Assess for myofascial restrictions first and treat only those that are clearly present. Likewise, overstretched muscles should not be stretched from origin to insertion. If you treat trigger points in a muscle that is overstretched, use heat or a localized pin and stretch technique to lengthen that area.
- **Mobilizations.** Be cautious with mobilizations if the client has degenerative disc disease, rheumatoid arthritis, a cervical rib, hypermobile joints, or if ligaments are unstable from pregnancy or a systemic condition.

MASSAGE THERAPY RESEARCH

Although articles about the benefits of conservative treatment have been published and abundant anecdotal evidence suggests recovery from symptoms is possible following massage, there are currently no extensive experimental investigations into the specific outcomes following massage for the treatment of thoracic outlet syndrome. Much of the research on treatment for thoracic outlet syndrome focuses on pharmaceutical muscle blocks and surgery. Much of the theory behind the use of massage in the treatment of thoracic outlet syndrome has been adapted from other disciplines. Studies conducted by trained therapists into specific outcomes using only massage are needed.

In 1996, Barnes published an article titled "Myofascial Release in Treatment of Thoracic Outlet Syndrome" describing a single treatment program. The client had a 2-year history of chronic pain in her neck, upper extremities, and whole back initiated by an injury to the posterior mid thorax. The client saw many physicians in a variety of specialties and several physical therapists and took dozens of medications in various combinations with no lasting results. Her level of function was reduced; she needed help dressing and grew tired after even minimal writing. Her medical diagnosis at the time she was referred to Barnes' clinic was thoracic outlet

syndrome. The client received 30-minute treatments two or three times a day for 2 weeks by a team of physical therapists trained in myofascial release. The client was able to sleep comfortably without using bolsters after the fourth treatment. The client's mobility increased, and she was walking and climbing stairs by the end of the 2-week program. She continued to have difficulty with fine motor skills. Although the positive outcome suggests the benefits of manual therapy for clients with thoracic outlet syndrome, this case study involves a single, severe case complicated by multiple diagnoses that was treated intensively. Further study is needed.

In 1999, Peng published a study titled “16 Cases of Scalenus Syndrome Treated by Massage and Acupoint-Injection.” The 16 participants in this study were all female, between 20 and 40 years of age, who had symptoms from 3 months to 4 years prior to treatment. Each had had a previous injury to the shoulder. One of the participants had a cervical rib. All had a positive Adson's test. Of the 16 participants, 12 had vascular symptoms including a cold affected limb, 9 presented with impaired fine motor skills, and 4 showed thenar atrophy. In the seated position with the neck as relaxed as possible, manual manipulations were applied to the shoulder and medial arm followed by kneading and compression of acupoints, which are known in the system of Chinese medicine, while the limb was mobilized. The arm was then shaken and rubbed until the skin warmed. This treatment was performed every day. The study does not state the precise treatment program, only that the relief of symptoms required one or two courses of treatment for 20–40 days. In addition to manual therapy, these clients received an acupoint-injection containing procaine hydrochloride and vitamin B12 once every 5 days followed by infrared radiation. According to the author, all but one client was cured. Only the client with the cervical rib continued to have pain and numbness in the arm, but even this client had a negative Adson's test after treatment. Again, this study did not isolate the effects of massage from another form of treatment, in this case acupoint-injection. In addition, few details are provided regarding relief of neurogenic or vascular symptoms or changes in ROM; it is stated only that the client was cured. Although the results are encouraging, further study is necessary.

In 2006, Michael Hamm published a case study titled “Impact of Massage Therapy in the Treatment of Linked Pathologies: Scoliosis, Costovertebral Dysfunction, and Thoracic Outlet Syndrome.” As the title suggests, this case also involved a client with multiple conditions. The client presented with pain and weakness in the right shoulder and arm that had increased progressively over the previous 8 months. She was regularly awakened by symptoms and ultimately had to quit her job as a waitress. Chiropractic diagnoses included scoliosis, costovertebral dysfunction, and thoracic outlet syndrome. The client received eight 60-minute treatments over the course of 4 weeks, which included deep tissue massage, neuromuscular therapy, and muscle energy techniques. Following this treatment plan, the client slept better, ROM increased, postural imbalances in the ilia and spine showed improvement, and pain with shoulder activity reduced by 50%. Other longstanding postural imbalances responded less significantly. As the author suggests, further research is needed. He recommends using more precise measurements of bony alignments that will allow for more accurate results upon follow-up, and using a standard measure for psychological stress to include this dimension of musculoskeletal dysfunction. The author also recommends a larger-scale study of massage to treat linked diseases concurrently. The study offers minimal data regarding increased strength or changes in neurogenic or vascular symptoms common to thoracic outlet syndrome. Although the results are encouraging, further research that considers thoracic outlet syndrome independently is needed.

Working With the Client

CLIENT ASSESSMENT

Assessment begins with your first contact with a client. In some cases, this may be on the telephone when an appointment is requested. Ask in advance if the client is seeking treatment for a specific pain so that you can prepare yourself. It is essential that your assessment is thorough. If you suspect an underlying condition that requires medical attention, refer the client to a health care provider for assessment. If the client

is diagnosed with an underlying condition, research the contraindications or special considerations for the condition. During your assessment, ask questions that will help you to differentiate the possible causes of thoracic outlet syndrome.

Table 2 lists questions to ask the client when taking a health history.

QUESTIONS FOR THE CLIENT	IMPORTANCE FOR THE TREATMENT PLAN
Where do you feel symptoms?	The location of symptoms gives clues to the location of trigger points, injury, or other contributing factors.
Describe what your symptoms feel like.	Differentiate between possible origins of symptoms, and determine the involvement of nerves or blood vessels.
How long have you had symptoms?	Onset may coincide with an illness or trauma and may help you to assess the extent of the injury.
Do any movements make it worse or better?	Locate tension, weakness, or compression in structures producing such movements.
Have you seen a health care provider for this condition? What was the diagnosis? What tests were performed?	A cervical rib or other bony prominence is most accurately assessed with an X-ray. Vascular insufficiency should be assessed by a health care provider.
Have you been diagnosed with a condition such as diabetes, rheumatoid arthritis, a thyroid condition, or a respiratory condition? Are you pregnant?	Systemic conditions may contribute to signs and symptoms, may require adjustments to treatment, and may impact treatment outcomes. Fluid retention and changes in posture during pregnancy can contribute to signs and symptoms.
Have you had an injury or surgery?	Injury or surgery and resulting scar tissue may cause adhesions, hyper- or hypotonicity, and atypical ROM. The use of crutches may contribute to thoracic outlet syndrome.
What type of work, hobbies, or other regular activities do you do?	Repetitive motions and static postures that increase thoracic flexion, protracted scapulae, cervical extension, or a head-forward posture may contribute to the client's condition.
Are you taking any prescribed medications or herbal or other supplements?	Medication of all types may contribute to symptoms or involve contraindications or cautions.
Have you had a cortisone shot in the past 2 weeks? Where?	Local massage is contraindicated.
Have you taken a pain reliever or muscle relaxant within the past 4 hours?	The client may not be able to judge your pressure.
Have you taken anti-inflammatory medication within the past 4 hours?	Deep friction causes inflammation and should not be performed if the client has recently taken anti-inflammatory medication.

Postural Assessment

Allow the client to enter the room ahead of you while you assess their posture and movements. Look for imbalances or patterns of compensation due to pain or restriction. In the case of thoracic outlet syndrome, have the client turn the doorknob to enter the room, pick up a pen, or grasp a cup of water without making them aware that you have begun your assessment. Do not hand these things to the client but allow them to pick them up. If the client performs these tasks clumsily with the affected arm, or performs them with the unaffected arm, particularly if it is the nondominant side, it could indicate a compensation pattern due to weakness in the affected arm.

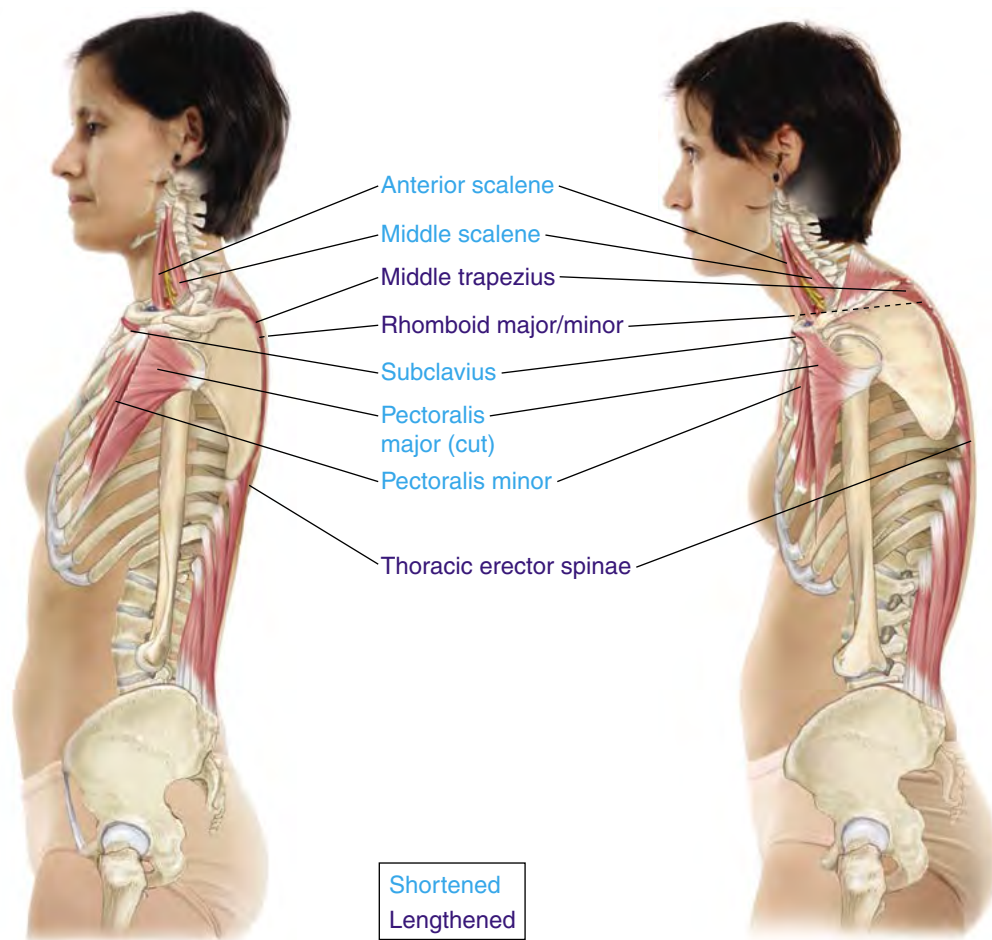


Figure 6-4 Postural assessment comparison. Compare the anatomical posture on the left to the deviated posture on the right.

Because the symptoms of thoracic outlet syndrome can be confused with those of other musculoskeletal conditions, it is important to assess the client's posture thoroughly. If you are performing 30 minutes of treatment in the area of compression, it is best to use the remaining time to target related contributing factors. For example, if your assessment of the client reveals lateral flexion of the thorax, spend some time lengthening the muscles that flex the thorax. Clients with thoracic outlet syndrome may also present with hyperkyphosis. The head-forward posture, a drooped or elevated shoulder, and internally rotated shoulders typically contribute to the compression of the brachial plexus. Figure 4 compares the anatomic position to the posture affected by thoracic outlet syndrome.

ROM Assessment

Test the ROM of the neck and shoulders, assessing the length and strength of both agonists and antagonists that cross the joints being tested. Since it allows the client to control the amount of movement and stay within a pain-free range, only active ROM should be used in the acute stage of an injury to prevent undue pain or re-injury. Box 1 presents the average active ROM results for the joints involved in thoracic outlet syndrome.

Active ROM

Compare your assessment of the client's active ROM to the values in Box 1. Pain and other symptoms may not be reproduced with active ROM assessment, because the client may limit movement to the symptom-free range.

Box 6-1: Average Active ROM for Joints Involved in Patellofemoral Syndrome

Cervical Spine

Flexion 60°

SCM (bilateral)
Anterior scalenes (bilateral)
Longus capitis (bilateral)
Longus colli (bilateral)

Extension 55°

Upper trapezius (bilateral)
Levator scapulae (bilateral)
Splenius capitis (bilateral)
Splenius cervicis (bilateral)
Rectus capitis (bilateral)
Oblique capitis superior (bilateral)
Semispinalis capitis (bilateral)
Longissimus capitis (bilateral)
Longissimus cervicis (bilateral)
Iliocostalis cervicis (bilateral)

Lateral Flexion 20–45°

Upper trapezius (unilateral)
Levator scapulae (unilateral)
Splenius capitis (unilateral)
Splenius cervicis (unilateral)
SCM (unilateral)
Longus capitis (unilateral)
Longus colli (unilateral)
Anterior scalene (unilateral)
Middle scalene (unilateral)
Posterior scalene (unilateral)
Longissimus capitis (unilateral)
Longissimus cervicis (unilateral)
Iliocostalis cervicis (unilateral)

Ipsilateral Rotation 70–90°

Levator scapulae (unilateral)
Splenius capitis (unilateral)
Splenius cervicis (unilateral)
Rectus capitis (unilateral)
Oblique capitis (unilateral)
Longus colli (unilateral)
Longus capitis (unilateral)
Longissimus capitis (unilateral)
Longissimus cervicis (unilateral)
Iliocostalis cervicis (unilateral)

Contralateral Rotation 70–90°

Upper trapezius (unilateral)
SCM (unilateral)
Anterior scalene (unilateral)
Middle scalene (unilateral)
Posterior scalene (unilateral)

Shoulder

Flexion 180°

Anterior deltoid
Pectoralis major (upper fibers)
Biceps brachii
Coracobrachialis

Extension 50–60°

Posterior deltoid
Latissimus dorsi
Teres major & minor
Infraspinatus
Pectoralis major (lower fibers)
Triceps brachii

Internal Rotation 60–100°

Anterior deltoid
Latissimus dorsi
Teres major
Subscapularis
Pectoralis major

External Rotation 80–90°

Posterior deltoid
Infraspinatus
Teres minor

Abduction 180°

Deltoids
Supraspinatus

Adduction 50–75°

Latissimus dorsi
Teres major
Infraspinatus
Teres minor
Pectoralis major
Triceps brachii (long head)
Coracobrachialis

Horizontal Abduction 45°

Posterior deltoid
Infraspinatus
Teres minor

Horizontal Adduction 130°

Anterior deltoid
Pectoralis major (upper fibers)

- **Active contralateral rotation and ipsilateral lateral flexion of the cervical spine** on the affected side may cause pain due to trigger points in the scalenes. Ipsilateral rotation and contralateral lateral flexion may also be reduced and produce symptoms when the shortened scalenes are stretched, or cause discomfort on the unaffected side because of weakened antagonists. Active rotation and flexion of the cervical spine may reproduce symptoms.
- **Active extension of the cervical spine** may be reduced or reproduce symptoms and pain when the shortened anterior scalene is stretched.
- **Active external rotation, abduction, and flexion of the shoulder** may be reduced or produce symptoms when trigger points or hypertonicity in the pectorals limits motion in the shoulder.

Passive ROM

Compare the client's P ROM on one side to the other when applicable. Note and compare the end feel for each range. The client may resist even passive movement if this movement causes pain in their daily life. Symptoms of pain, numbness, and tingling may also occur.

- **Passive ipsilateral rotation and contralateral lateral flexion of the cervical spine** on the affected side may be reduced and may reproduce symptoms as the hypertonic scalenes are stretched.
- **Passive extension of the cervical spine** may be reduced and may reproduce symptoms when the anterior scalene is stretched.
- **Passive external rotation, abduction, or flexion of the shoulder** may be reduced due to myofascial restrictions and hypertonic pectorals.

Resisted ROM

Use resisted tests to assess the strength of the muscles that cross the joints involved. Compare the strength of the affected side to the unaffected side.

- **Resisted contralateral rotation and ipsilateral lateral flexion of the cervical spine** on the affected side may cause pain and reproduce symptoms. Resisted ipsilateral rotation and contralateral lateral flexion may reveal weakness in the antagonists.
- **Resisted flexion of the cervical spine** may reproduce symptoms.
- **Resisted internal rotation, abduction, or flexion of the shoulder** may reproduce symptoms or result in pain.
- **Resisted extension or external rotation of the shoulder** may reveal weakness in the antagonists with regard to flexion and internal rotation of the shoulder.
- **Resisted flexion of the elbow, flexion or extension of the wrist and fingers, and grasping** may reveal weakness if thoracic outlet syndrome has led to atrophy of the muscles involved in those actions.

Special Tests

The **Roos elevated arm stress test** is intended to test for thoracic outlet syndrome (Fig. 5).

1. Ask the client to abduct the shoulders 90°, laterally rotate the shoulders 180°, flex the elbows 90°, and slightly retract the scapulae.
2. Once in this position, ask the client to flex and extend the fingers (open and close the hands) for as long as the client can tolerate, up to a maximum of 3 minutes.
3. If the client is unable to hold the position for 3 minutes, feels intense heaviness or weakness in the affected arm, or feels numbness and tingling in the fingers of the affected side, the test is considered positive for thoracic outlet syndrome. Minor weakness or fatigue do not suggest thoracic outlet syndrome.



Figure 6-5 Roos stress test.



Figure 6-6 Adson's test.



Figure 6-7 Costoclavicular maneuver.

Adson's test assesses the compression of the neurovascular bundle by the scalenes (Fig. 6).

1. Stand behind the seated client.
2. Passively abduct and externally rotate the shoulder on the affected side.
3. Place your fingers on the radial pulse and note its strength.
4. Once you have assessed the strength of the pulse, ask the client to extend the neck and rotate it toward the affected side. In this position, the client should take a full, deep breath and hold it for 15–20 seconds or as long as possible, up to 20 seconds. Taking a breath raises the first rib and contracts the anterior scalene.
5. A decreased or absent pulse or the recurrence of pain or tingling in the arm and hand indicates a positive test for compression of the nerves and vessels by the anterior scalene.

The **costoclavicular maneuver** assesses for compression of the neurovascular bundle between the clavicle/subclavius and the first rib (Fig. 7).

1. Stand behind the seated client.
2. Place your fingers on the radial pulse, and note its strength.
3. Once you have assessed the strength of the pulse, ask the client to depress and extend the shoulder.



Figure 6-8 Wright's test.

4. In this position, ask the client to take a breath deep enough to expand the chest and hold for 15–20 seconds or as long as possible, up to 20 seconds.
5. A decreased or absent pulse or the recurrence of pain or tingling in the arm and hand indicates a positive test for compression of the nerves and vessels between the clavicle/subclavius and the first rib.

Wright's test assesses compression of the neurovascular bundle by the pectoralis minor muscle (Fig. 8).

1. Ask the client to sit in a chair while you stand behind them.
2. Place your fingers on the radial pulse, and note its strength.
3. Once you have assessed the strength of the pulse, passively laterally rotate, abduct, and slightly extend the affected arm while keeping your fingers on the radial pulse.
4. A decreased or absent pulse or the recurrence of pain or tingling in the arm and hand indicates a positive test for compression of the nerves and vessels beneath the pectoralis minor.

Palpation Assessment

Assess the tissues of the neck, chest, shoulder, arm, forearm, and hand. Compare the affected to the unaffected side. Check the temperature, color, and texture of the superficial tissues. You may find fascial restrictions and tenderness in the lateral neck, beneath the clavicle, or around the anterior glenohumeral joint as well as in the muscles involved in any accompanying postural deviations such as the head-forward posture or hyperkyphosis. Depending on the duration and degree of compression of the brachial plexus, you may find atrophy, pale skin, swelling, reduced hair growth, ulcers, cyanosis, and possibly even necrosis of the tissues of the fingers and hand. If ulcers, cyanosis, or necrosis is present, refer the client to a health care provider for medical assessment.

CONDITION SPECIFIC MASSAGE

Since the causes of pain, numbness, and tingling in the arm and hand vary, it may be difficult to pinpoint the area of compression. Moreover, it is common for more than one area to be compressed at the same time. A client who works at a desk for long periods everyday is likely to be seated with the head jutting forward (affecting the scalenes), one or both scapulae elevated or depressed, one or both shoulders internally rotated (affecting the pectorals), the forearms pronated (affecting the pronator teres), and the wrists and fingers in flexion, extension, or moving constantly between these (affecting the contents of the carpal tunnel).

It is essential for treatment to be relaxing. You are not likely to eliminate the symptoms of thoracic outlet syndrome, or any of the conditions associated with it, in one treatment. Do not try to do so by treating aggressively. Be sure to ask your client to let you know if the amount of pressure you are applying keeps them from relaxing. If the client responds by tensing muscles or has a facial expression that looks distressed, reduce your pressure. Remember that you are working on tissue that is compromised.

It is also important for the client to let you know if any part of your treatment reproduces symptoms. Adjust the client to a more neutral position, reduce your pressure, or move slightly off the area if this occurs, and make a note about it as this may help you understand more clearly exactly which neuromuscular conditions are contributing to symptoms. Instruct your client to use deep but relaxing breathing to help with relaxation.

If deep palpation of a trigger point refers pain elsewhere, explain this to your client, and ask them to breathe deeply during the technique. As the trigger point is deactivated, the referred pain will also diminish. Scalene trigger points refer pain across the shoulder and along the medial border of the scapulae, into the chest, and down the lateral arm and forearm into the lateral hand. Subclavius trigger points refer pain across the clavicle, into the areas around the biceps and brachioradialis, and into the lateral hand. Pectoralis minor trigger points refer pain across the chest and into the areas of the anterior deltoid, down the medial arm

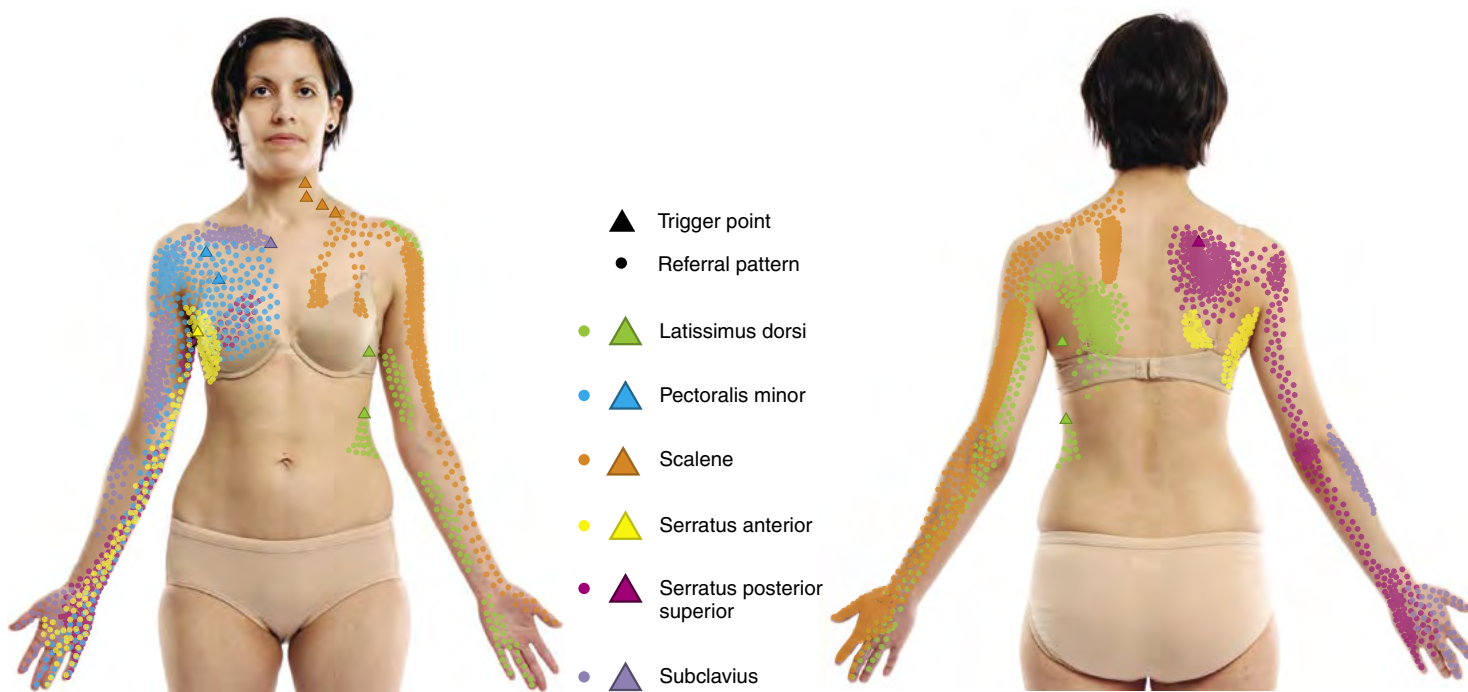


Figure 6-9 Common trigger points and referral.

and forearm, and into the palm and three middle fingers. Other muscles with trigger points that refer pain into the arm, forearm, and hand include the pectoralis major, sternalis, serratus anterior, serratus posterior superior, latissimus dorsi, muscles of the rotator cuff, and the triceps brachii. Most of the muscles of the arm and forearm refer pain into the wrist, hand, and fingers. Common trigger points and their referral patterns are shown in Figure 9.

The following suggestions are for treatment that considers several neuromuscular factors involved in producing pain, tingling, or numbness along the arm and into the hand. The section of this treatment that focuses on the anterior and middle scalene, subclavius, and pectoralis minor is specific for thoracic outlet syndrome. If the client has an acute injury, follow the PRICE (protect, rest, ice, compression, elevation) protocol. In this case, you may work conservatively proximal to the site but will have to avoid the injured area until the subacute or chronic stage.

Treatment Goals:

-  Increase circulation
-  Reduce adhesions
-  Reduce tone/tension
-  Lengthen tissue
-  Treat trigger points
-  Passive stretch
-  Clear area

- Begin in the supine position, and initiate treatment on the affected side. If both arms are affected, begin on the dominant side. If edema is present, bolster the arm so that gravity will encourage venous return and the draining of fluid toward the proximal lymph nodes. If hyperkyphosis is a consideration, refer to that PDF for additional bolsting.



- Moist heat is indicated on the chest, neck, and shoulder unless the client has cardiovascular disease.



- Before applying emollient, assess the tissues of the upper cross for myofascial restrictions, and release them if indicated. Restrictions are often found around the glenohumeral joint, along the anterior deltoid, and along the lateral and posterior neck.



- Use warming strokes to superficially assess the tissues from the neck down to the hand and to begin superficial draining of accumulated fluid toward the nearest lymph nodes. You should be able to minimally assess the degree of tension in each area, which may help you to determine where to focus your time.



- Use broad strokes along the full length of the pectoralis major to soften tissues, allowing you to access the deeper structures.



- Assess pectoralis major for trigger points, and treat them if found. Common trigger points in the pectoralis major are found along the mid sternum, at the clavicular attachments, along the inferior fibers, and near the axilla.



- Assess and treat the subclavius for hypertonicity and trigger points. The subclavius is a slight, thin muscle and may not be easily palpated. Trust your knowledge of anatomy as you palpate along the inferior edge of the middle third of the clavicle toward the costal cartilage of the first rib. If you find and treat trigger points in the subclavius, use a pin and stretch technique to lengthen the muscle fibers.



- You can access the pectoralis minor through the pectoralis major or by pushing the lateral fibers of the pectoralis major medially as you palpate ribs 3, 4, and 5. This may be performed more easily by kneeling next to the client and placing their hand on your shoulder nearest the table, which will gently lift the pectoralis major out of the way. This is also preferable to externally rotating the shoulder, which may put tension on the pectorals and reproduce symptoms. Once you believe you have found it, ask the client to depress the shoulder and feel for a contraction. As you assess and treat the pectoralis minor for tension and trigger points, ask the client about the reproduction of symptoms. If they occur, adjust the client to a more neutral position, reduce pressure, or move away from the area. You may be able to revisit the pectoralis minor later in the treatment without reproducing symptoms.



- If you found myofascial restrictions, hypertonicity, and trigger points in the pectoral area, perform a full stretch to the pectorals and close with clearing strokes. If the tissue is resistant to lengthening, apply postisometric relaxation within the client's tolerance to encourage a normal resting tone. If you found the area to be only minimally affected, close with clearing strokes.



- Warm and lengthen the superficial neck muscles, namely the upper trapezius. Be careful to avoid endangerment areas, and back away gently if you feel a pulse.



- Reduce tension in the SCM, and treat any trigger points found. Trigger points in the SCM may cause vertigo, nausea, or ringing in the ears. Ask the client to let you know if they feel any unusual sensations, and explain that these are common referrals from SCM trigger points.

- Once you have softened the SCM and trapezius, you will have greater access to the scalenes. To access the anterior scalene, gently push the SCM medially with one or two fingertips as you feel for the deeper scalenes. As you move the SCM medially, your fingers should gently rest on the transverse processes of the cervical vertebrae. Use this as your guide for palpating the anterior scalene. Once you have found it, ask the client to take a quick, forced breath into the chest and feel for a contraction.



- Reduce tension and lengthen the anterior scalene. Treat any trigger points found. It is often helpful, once you have found a trigger point in the scalenes, to compress it gently while slowly rotating the head. Trigger points in the anterior scalene are often quite sensitive, and the client may feel cautious about you working deeply in the neck. Begin gently and slowly to avoid frightening the client or causing them to jerk the head. Remember that you are working in an area of many nerves and abundant vasculature.



- Find the middle scalene by gently palpating the transverse processes and then moving slightly posterior. The middle scalene crosses the transverse processes and heads toward the first rib. Once you have found it, ask the client to take a quick, forced breath into the chest and feel for a contraction. Take the same cautions with the middle scalene as with the anterior scalene to avoid frightening the client. Lengthen the muscle and treat any trigger points found.



- Stretch the scalenes by increasing the distance between their origins and insertions. Options for stretching include contralateral lateral flexion and ipsilateral rotation of the cervical spine (Fig. 10). If the tissue resists lengthening, apply postisometric relaxation within the client's tolerance to encourage a normal resting tone. If you found the area to be minimally affected, apply clearing strokes and move on to the arm and hand.



- Warm the whole arm and assess the muscles for myofascial restrictions, hypertonicity or hypotonicity, and trigger points. If the client has had symptoms for a long time, the muscles of the arm may be compensating. If you suspect pronator teres syndrome or carpal tunnel syndrome to be involved, assess and treat as time permits. You may be able to revisit these areas in a subsequent visit when primary symptoms subside. If you do not find compromised tissue in the arm, be conservative in your treatment of the arm to save time, but do not ignore it. It is important to perform at least the Swedish techniques to the arm to restore neuromuscular memory and function.



- Treat the unaffected side—superficially if you find no compromised tissue and comprehensively if the client's thoracic outlet syndrome is bilateral.



- Try to leave at least 10 minutes for work in the prone position. Referral patterns for trigger points in the latissimus dorsi, serratus anterior, and serratus posterior superior may be similar to the common pain pattern found in thoracic outlet syndrome. Assess and treat these muscles as time permits.



- Because hyperkyphosis is commonly associated with thoracic outlet syndrome, the muscles of the upper back are likely to be tender or painful, and this may be one of the client's primary complaints along with numbness and tingling in the arm and hand. Treat the back conservatively if time does not allow you to assess and treat trigger points. You can return to this in a subsequent visit once the symptoms of thoracic outlet syndrome begin to subside.



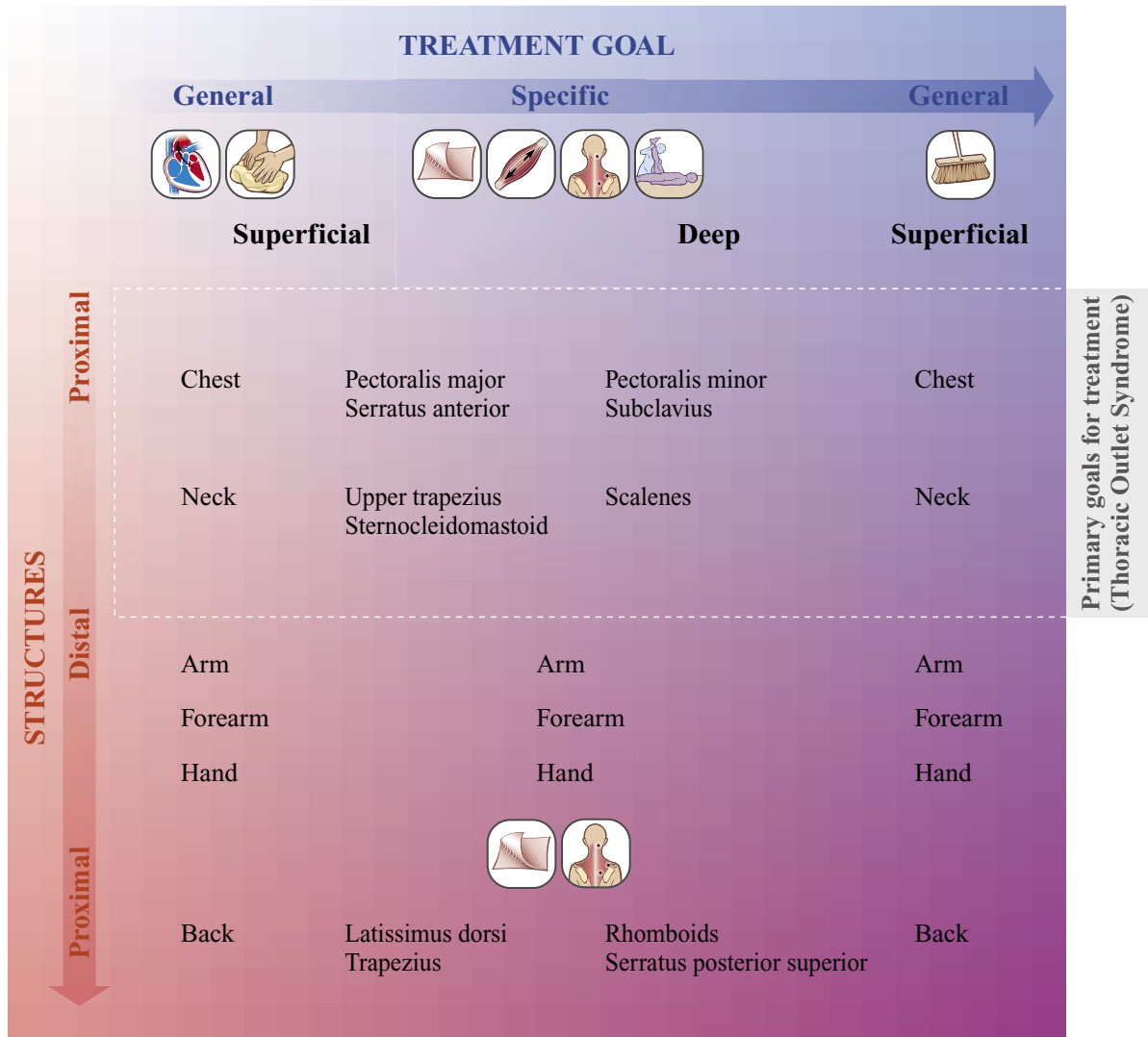
Figure 6-10 Scalene stretch.



- If the scapulae are protracted, remember to treat the rhomboids and middle trapezius from the scapulae toward the spine to avoid stretching them further. Trigger points can develop in overstretched muscles as well as hypertonic ones.



- Use a local pin and stretch to lengthen fibers that contained trigger points, and clear the area treated.



CLIENT SELF-CARE

The following are intended as general recommendations for stretching and strengthening muscles involved in thoracic outlet syndrome. The objective is to create distance between the attachment sites of muscles that have shortened and to perform repetitions of movements that decrease the distance between the attachments of muscles that have weakened. If you have had no training in remedial exercises and do not feel that you have a functional understanding of stretching and strengthening, refer the client to a professional with training in this area.

Clients often neglect self-care because their daily lives are busy. Encourage them to follow these guidelines:

- Instruct the client to perform self-care activities throughout the day, such as while taking a phone call, reading e-mail, watching television, or performing other activities of daily living, instead of setting aside extra time.
- Encourage your client to take regular breaks from repetitive actions or static postures.
- Demonstrate gentle self-massage to keep adhesions and hypertonicity at bay between treatments.
- Instruct the client on proper posture in the seated position to keep pressure off the weakened joints. Instruct clients with symptoms of thoracic outlet syndrome to sleep in positions without raising the arm over the head and without lateral flexion or rotation of the cervical spine.
- Instruct an athlete whose sport strengthens the pectorals and internal rotators of the shoulder to reduce pectoral resistance exercises and increase scapular retraction and thoracic extension to strengthen the middle trapezius, rhomboids, and thoracic erector spinae, balancing strength in the thoracic area.
- Instruct a client who regularly performs heavy lifting to lift with the legs instead of the back.
- Demonstrate all strengthening exercises and stretches to your client and have them perform these for you before leaving to ensure that they are performing them properly and will not harm himself or herself when practicing alone.

Stretching

Instruct the client to stretch the scalenes. Have the client hook the hand of the affected side under the chair while slowly and gently extending and laterally flexing the neck in the opposite direction until they feel a deep but comfortable stretch (Fig. 11). To increase the stretch, instruct the client to pull gently on the head with the opposite hand.

To stretch the pectoralis major and minor, instruct the client to clasp the hands behind the head, then retract and elevate the scapulae (Fig. 12). For a deeper stretch, instruct the client to stand in a doorway with the hands on the frame and then step forward, which will bring the arms slightly posterior. It is essential that the client steps forward rather than leans forward, because leaning would affect the muscles of the neck, back, and hips (Fig. 13).



Figure 6-11 Scalene stretch.



Figure 6-12 Pectoralis minor stretch.



Figure 6-13 Pectoral stretch.



Figure 6-14 Strengthen contralateral scalenes.

Strengthening

If thoracic outlet syndrome is unilateral and the scalenes are involved, remember that the scalenes of one side antagonize those of the other. If the scalenes of the unaffected side are weak, it is important to strengthen them in order to bring the neck back to a neutral position. Resisted rotation toward the affected side will strengthen the scalenes on the unaffected side. This should be performed only if it does not reproduce symptoms on the affected side or cause pain in the posterior neck or shoulder. Instruct the client to rest the palm of the hand on the side of the head with the affected scalenes and rotate the head toward the affected side (Fig. 14).

The client can also strengthen the middle trapezius and rhomboids to reduce protraction of the scapulae. Instruct the client to stand with the arms comfortably hanging at the sides while squeezing the scapulae together (Fig. 15). When this is done properly, only the middle trapezius and rhomboids should contract while the shoulders remain relaxed.

SUGGESTIONS FOR FURTHER TREATMENT

Ideally, a client with symptoms of thoracic outlet syndrome will have treatments twice a week for the first week or two or until symptoms are absent for at least 4 days. This should be followed by weekly treatments until the symptoms are absent for at least 7 days and ROM and strength are restored. As treatment continues, the period



Figure 6-15 Middle trapezius and rhomboid strengthening.

of symptom-free days should increase until the symptoms become occasional or are relieved completely. After this, the client can schedule appointments as necessary. If the thoracic outlet syndrome is caused by muscle tension, the client should have some improvement with each session. If this is not happening, consider the following possibilities:

- There is too much time between treatments. It is always best to give the newly treated tissues 24–48 hours to adapt, but if too much time passes between treatments in the beginning, the client’s activities of daily living may reverse any progress.
- The client is not adjusting their activities of daily living or is not keeping up with self-care. As much as we want to fix the problem, we cannot force a client to make the adjustments we suggest.
- The client’s thoracic outlet syndrome is advanced or involves other musculoskeletal complications that are beyond your basic training. Refer this client to a massage therapist with advanced clinical or medical massage training. Continuing to treat a client whose case is beyond your training could turn the client away from massage therapy altogether and hinder healing.
- The symptoms have an undiagnosed, underlying cause. Discontinue treatment until the client sees a health care provider for medical assessment.

If you are not treating the client in a clinical setting or private practice, you may not be able to take this client through the full program of healing. Still, if you can bring some relief, it may encourage that client to discuss this change with their health care provider and to consider manual therapy rather than more aggressive treatment options. If the client returns for regular treatments, the symptoms are likely to change each time, so it is important to perform an assessment before each session. As the client’s symptoms change, you may be able to focus more of your treatment on a specific area or on other postural imbalances.

Professional Growth

Case Study

Salim is a 53-year-old father of two adult children. He and his brother own a house painting company. In recent months, business has been slow. To reduce expenses, he and his brother have been doing much of the painting themselves. He began feeling numbness and tingling in his hand a few weeks ago and now feels weak when painting. Salim’s primary health care provider, Dr. Johnson, practices in an integrative medicine clinic with massage therapists on staff.

SUBJECTIVE

Salim stated that a few weeks ago he started feeling pins and needles in his left hand and noticed that from time to time he cannot feel the object he is holding in that hand, as if the tips of his ring finger and little finger had no sensation. During the past week, he has felt fatigue and weakness in his left shoulder and arm, and now his neck is sore on the right side too. In the beginning the symptoms would appear in the middle of the day, but now they happen almost as soon as he starts to paint and sometimes when he sleeps. Recently, he has been awakened from sleep by the sensation. When asked, Salim answered that he has never noticed any swelling in the arm or hand.

OBJECTIVE

Salim’s visit with Dr. Johnson included blood and other tests for systemic conditions, the results of which were negative. Positive Wright and Roos tests suggest thoracic outlet syndrome. Palpation revealed no cervical rib, and no X-ray was ordered. The doctor stated that he believed muscle tension to be the cause

and referred Salim to the massage therapy clinic with the caveat that if symptoms were not reduced after two treatments per week for 2 weeks, he would recommend an MRI. Dr. Johnson saw no need to be conservative or cautious with massage.

Salim stood with most of his weight on his left leg while discussing his symptoms, with his pelvis rotated toward the right. The right hip is slightly flexed and externally rotated. The thorax is laterally flexed left, and the left hip is elevated. The right shoulder is elevated compared to the left. The left scapula is tilted anteriorly. The cervical spine is rotated to the right, laterally flexed to the left. The shoulders are internally rotated bilaterally with increased pronation in the right forearm. Slight scoliosis is evident.

The pectoralis major is dense and adhered bilaterally. Nothing is remarkable in either subclavius. The left pectoralis minor is hypertonic and tender to the touch with taut bands but no referral. Superficial fascial restrictions are present along the lateral neck and into the shoulder. The left scalenes are hypertonic. There is a trigger point in both the anterior and middle scalenes with referred pain into the shoulder. The left latissimus dorsi is adhered and tender. No trigger points were found. The left serratus anterior is dense, and the left side of the ribcage is slightly compressed. There is a trigger point in the serratus anterior with referred pain into the forearm. The right levator scapulae and upper trapezius are hypertonic and tender. There is crepitus around the right superior angle of the scapula. The erector spinae are taut bilaterally along the full spine. The left external obliquus and quadratus lumborum are shortened and hypertonic. The right quadriceps femoris and iliotibial band are thick and adhered. I did not investigate the gluteals or lower limbs; these will be revisited in a subsequent visit.

ACTION

I applied moist heat to the left pectoral area while palpating/assessing tissues around the hips. I moved the heat to the right pectoral area. I performed myofascial release around the glenohumeral joint and across the pectorals bilaterally. With the arm laterally rotated and abducted, I applied effleurage and cross-fiber friction followed by muscle stripping to the pectoralis major, latissimus dorsi, and serratus anterior. I applied trigger point therapy to the serratus. The pain reduced from level 8 to 3 and referral ceased. I applied petrissage to the origin and insertions of the pectoralis minor followed by stripping to the muscle belly. This reproduced symptoms. I returned the client's arm to the neutral position, which eased symptoms, then palpated the pectoralis minor again. No symptoms were reproduced the second time. The pectoralis minor may be too dense to reach trigger points in taut bands. I applied kneading and lengthening strokes to reduce tension, and will attempt to treat trigger points in a subsequent session. I applied a stretch to the pectorals, taking care not to reproduce symptoms. The left scalenes are solid and dense, and the fibers are barely palpable. There are trigger points in the anterior and middle scalene that referred pain across the shoulder but did not reproduce symptoms. I applied cross-fiber friction followed by several rounds of muscle stripping, which reduced referred pain slightly. I used three rounds of brief compression to a trigger point that caused pain at level 7, which then reduced to level 2. I applied general treatment to the upper trapezius, levator scapulae, and neck extensors as well as to the arms bilaterally. In the prone position, I applied general deep tissue massage to the upper back with minor attention to the low back and hips, primarily attempting to lengthen the left latissimus dorsi, abdominals, and quadratus lumborum and to reduce the flexion of the thorax.

The client remained very relaxed throughout the session, seemingly on the verge of sleep if not for my questions regarding symptoms. He stated that he felt looser but a little sore in the pectoral area.

PLAN

I recommended taking time throughout that day to mobilize the neck and arm within his comfort level, in positions other than the one(s) he uses while painting. For example, I suggested that he slowly rotate the

neck from left to right and bring the ear to the shoulder on both the left and right sides. I demonstrated stretches for pectorals and scalenes and those needed to reduce flexion in the thorax. I demonstrated strengthening for the shoulder retractors and lateral rotators of the shoulder. The client will return for treatment in 3 days and keep an account of symptoms during that time.

As Salim's condition improves and he becomes more able to perform activities of daily living without symptoms, I will focus attention on deviations in his hips and spine that may be contributing to the imbalance in the upper body. I will assess legs, knees, and ankles at that time.

CRITICAL THINKING EXERCISES

1. Develop a 10-minute stretching and strengthening routine for a client covering all of the muscles commonly involved in thoracic outlet syndrome. Use Box 6-1 and Figure 6-4 as a guide. Remember that a stretch increases the distance between the origin and insertion of a muscle and is important for those muscles that are shortened while strengthening is performed by actively bringing the origin and insertion closer together and is important for the antagonists of shortened muscles and otherwise weakened muscles. Describe each step of the routine in sufficient detail that the client can perform it without your assistance.
2. Sometimes an assessment reveals signs and symptoms that differ from the average presentation for a client with thoracic outlet syndrome. The following is a list of possible findings. For each, discuss how or why a client may have developed the imbalance, and how the treatment plan should be adapted:
 - Drooped shoulder on the affected side
 - Elevated shoulder on the affected side
 - Trigger point in the scalenes on the unaffected side, with referred pain, but no other symptoms
 - Lateral flexion of the thorax with internal rotation of the shoulder on the affected side, without scoliosis
 - Symptoms when carrying heavy objects with the arms hanging, no symptoms when raising the arm above the head
 - Previous injury to the shoulder on the unaffected side
3. Your client first had symptoms of numbness, tingling, and weakness in the right arm 6 years ago. Following 2 years of treatment including pharmaceutical injections in the scalenes, oral medications, and 6 months of physical therapy intended to strengthen the muscles of the chest and shoulder, the client had no long-term relief. Ultimately, the client was diagnosed with thoracic outlet syndrome and, after another year of medication and physical therapy with no long-term relief, had decompression surgery that involved dividing the anterior scalene and removing a portion of the first rib. The client had considerable relief, but from time to time, particularly when reaching for something, the tingling would return. Over the past 3 months, the symptoms have worsened. Discuss possible reasons why the injections, physical therapy, and surgery were not successful treatments for the client's symptoms, and explain how manual therapy planned according to a current assessment may reduce the client's symptoms.
4. Discuss special considerations and adjustments to treatment for a client who has been diagnosed with a condition such as hypertension or atherosclerosis that is currently under control and being monitored by a health care provider.
5. Discuss how stress might contribute to the symptoms of thoracic outlet syndrome. Consider possibilities that include nerve conduction, muscle tension, diet and exercise, and life outlook. Knowing that a stressed client will see you for 6 treatments over the course of 4 weeks, plan treatment that takes the client's stress into consideration.

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