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Scalenus Anticus Syndrome: A root of the neck and shoulder disorder

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Narrative: The *scalenus anticus* syndrome is a neurovascular compression at the root of the human neck and torso, the interscalene triangle, and is made up of the *scalenus anticus* and *medius* muscles and the 1st rib.

The condition is very often associated with hyperextension–hyeprflexion cervical strain–sprain, as in auto accidents, sometimes with occupations and activities that use the arms in a repetitive manner, such as supermarket cash register operators.

It is a very common muscle and joint problem that is pervasive in the Chiropractic patient population. Differential diagnosis of this important problem is necessary, because it is sometimes associated with a cervical rib, which may be a complicating congenital anomaly. Occasionally the *scalenus anticus* syndrome may be caused by the anomalous course of the subclavian artery through the *scalenus anticus* muscle.

Indexing Terms: Chiropractic; AK; Applied Kinesiology; Scalenus Anticus Syndrome; Scalenes; MMT.

Introduction

The *scalene* muscles are commonly involved with cervical hyperflexion–hyperextension sprain–strain, the so–called 'whiplash' accident. (1, 2) As a result of this common human trauma and rapid movement, they frequently need subluxation correction including trigger point and strain/counterstrain treatment. True hypertrophy does not seem to be a problem because the muscles usually respond adequately to proper corrective AK treatment.

It should be remembered that insertion of a needle into a cervical disc for discography causes pain radiation to the ipsilateral vertebral border of the scapula. When the upper cervical discs are thus stimulated, the pain is in the upper portion of the scapula; it is more caudal when the lower cervical discs are stimulated.

> Anterior or anterolateral disc disruption causes radiated pain similar to that referred by needle stimulation of the dic, to the ipsilateral vertebral border of the scapula.

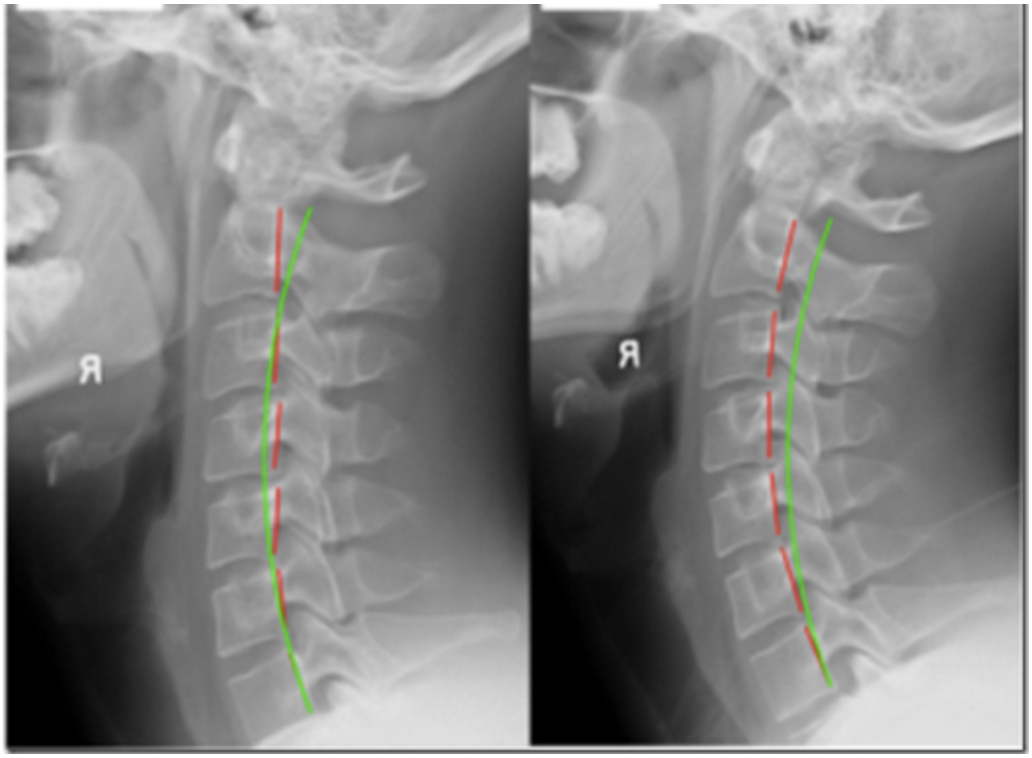
The pain radiation is definitely from nerve fibres in the disc, as the stimulation of the disc has been visually observed during surgery on conscious and alert locally anaesthetised patients. Objective information was also obtained by electromyographic studies of the shoulder and arm muscle

> *...Impairment of the craniocervical flexion test in combination with palpably painful upper cervical joint dysfunction associated with restricted range of cervical extension were found to have 100% sensitivity and 94% specificity to differentiate cervicogenic headache from migraine and tension-type headache ...'*

resulting from stimulation of the lower cervical discs.

Cloward initially described the pain radiation from stimulating the disc or from disc fibre disruption as being mediated by the sinuvertebral nerve: '*The receptors of this sensory nerve are located through the peripheral fibres of the annulus fibrosus of the intervertebral disk, including the attachment of these fibres to the margins of the adjacent vertebral bodies (Sharpey's fibres).*' (3) There is no pain radiation from stimulating the anterior longitudinal ligament over the vertebral body, but only as it crosses over the disc. It may be that the attachment of the longitudinal ligament to the disc pulls upon it to stimulate the fibres in the disc.

Figure 1: Left lateral radiograph showing a cervical spine in a typical presentation to a Chiropractor (Left) and for comparison, a curvature generally accepted as Within Normal Limits (Right).



Cloward accounts for the pain referral from the anterior disc to the scapula as due to the embryonic association in development of the structures.

Cloward's clinical impression is that there is little autonomic component to the sinuvertebral nerve in relation to disc disruption: '*If pain of a sympathetic character results from irritation of these structures by a ruptured disk, it remains localised as part of the neck, shoulder, and arm pain and does not spread to other regions*'. (3)

Thorough evaluation of the *scalene* muscles is mandatory in every presentation of arm and shoulder symptoms. Much attention has been given to these muscles in the surgical literature. Many echo the sentiment that scalenectomy is ' *... a relatively simple procedure with a high failure rate*'. In an applied kinesiology practice these muscles are often found to be only part of the complex, with their dysfunction secondary to a remote disturbance, as discussed in another case in a recent paper in this Journal. (4)

Cuthbert reported on a patient who endured 14 months of only partly ameliorative treatment modalities (medical, pharmaceutical, physiotherapeutic, and chiropractic), while the actual cause of her neck, arm and shoulder dysfunction was never diagnosed by her care givers. The missing

component for the patient involved a Dorsal Scapular Nerve entrapment from interscalene triangle neck muscle dysfunction, treatment of which resolved her prolonged MVA symptom picture rapidly. (4)

The famous Adson manoeuvre

The individual more likely to develop *scalenus anticus* syndrome was characterised by Adson (5) as having a longer cervical spine than usual, with a high-lying position of the subclavian artery. He found that the distance between the surfaces of the *scalenus anticus*, *medius*, and *posticus* muscles were shorter and perhaps lower, decreasing the space through which the neurovascular bundle could pass. If a cervical rib is present it encroaches upon this anatomical arrangement even more. The individual with a long cervical spine is usually an ectomorph with slight muscle build, making them more vulnerable to traumatic cervical strain/sprain involving the scalene muscle group.

Adson considered the descent of the shoulder girdle a contributing factor in *scalenus anticus* syndrome. This condition is infrequently found in children. Partly accounting for this, as in other thoracic outlet conditions, is the relatively high position of the shoulder to the thorax in children. At puberty it gradually descends to the adult position, with the descent greater in females. Postural degradation due to dysfunction appears to be more responsible for entrapment than the natural descent as one becomes an adult. This is based on effective correction of this and other thoracic outlet syndromes when postural improvement is obtained by Chiropractic and especially applied kinesiology methods.

Other medical and surgically-minded authors discuss the '*intermittent vertebral artery compression syndrome*'. This is a condition in which the vertebral artery and thyrocervical trunk rise from the subclavian artery in an anomalous manner. The vertebral artery can become almost completely occluded from compression by the angulation produced by the thyrocervical trunk and the medial border of the *scalenus anticus* muscle.

This is an episodic condition that can produce vertigo and other symptoms in an almost explosive manner, as opposed to the constant symptoms in arteriosclerotic occlusive disease. The precipitating factors are either emotional tension or rotation and extension of the head. The variable factor seems to be the tension of the neck muscles, including the *scalenus anticus*, which are drawn tightly over the thyrocervical trunk and subclavian arteries to produce compression of these vessels against the proximal vertebral artery.

Headache of the tension type is common. It is predominantly unilateral and located in the supraorbital or parietal-occipital area. Symptoms may extend to visual disturbances and to the upper extremity, somewhat simulating a thoracic outlet syndrome.

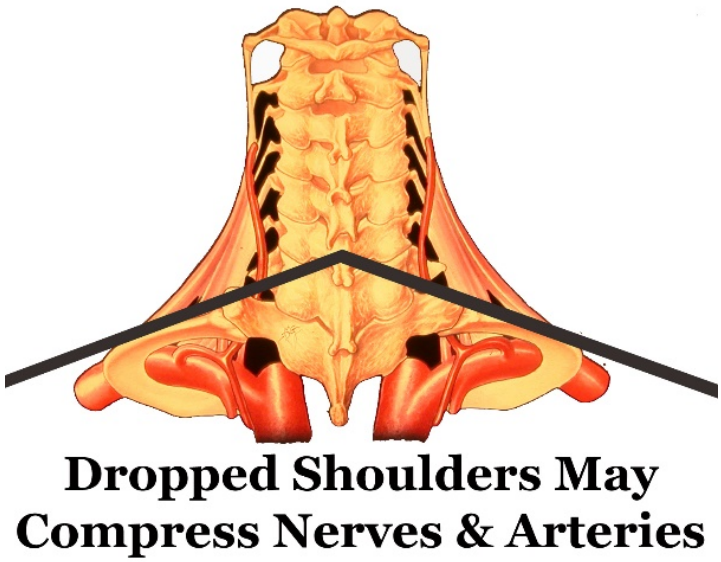
The symptoms may develop with Adson manoeuvre, particularly precipitating an attack of vertigo. In the author's experience, some of their patients refused to have the test repeated for fear of the severe symptoms that developed. There are occasions when the intermittent vertebral artery compression syndrome is present in the absence of a positive Adson test.

Pain is the most common symptom in a *scalenus anticus* syndrome. It may be sharp or dull, and it is usually exaggerated by rotation of the patient's head or a forceful, downward pull of the shoulder. The pain usually radiates down the arm, but it may also radiate into the neck. Weakness is usually in muscles of ulnar nerve distribution. There may be unexpected dropping of objects. In addition to pain, symptoms are described as paresthesia and sometimes weakness of the extremity. There may be a diminished pulse.

Venous congestion is not part of this syndrome, as the subclavian vein courses anterior to the *scalenus anticus* muscle. Often the symptoms are worse in the early morning, frequently waking

the patient. Nocturnal paresthesia may lead to confusion with carpal tunnel syndrome, which more frequently displays symptoms at night.

Figure 2: Posterior view of the cervical spine and *scaleni* muscles with clinical observed 'dropped' shoulders



Early descriptions of the *scalenus anticus* syndrome were directed strongly to arterial entrapment as a cause of symptoms. It is now recognised that most often symptoms are due to neurologic entrapment. Nerves rather than arteries has been a consistent comparative between Chiropractic and Osteopathy, and is the explanation in this syndrome as well.

Historically, Adson described three groups of vascular symptoms:

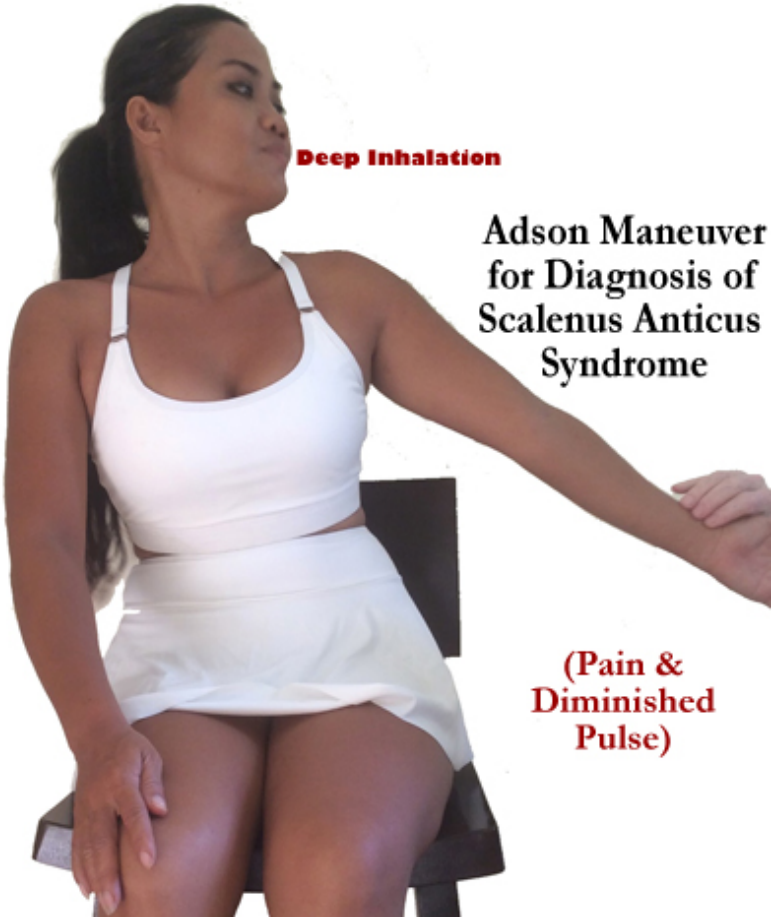
- The first is due to constriction of the subclavian artery at the scalenus anticus muscle. Symptoms include being unable to work with the hands raised above the shoulder, drive a car, or lift a heavy object because of pain and paresthesia. When attempting to sleep on the side of involvement, numbness in the arm and hand develops. These symptoms are now recognised as primarily due to peripheral nerve entrapment;
- The second group of symptoms develops as a result of organic changes in the subclavian artery and its terminal branches. This includes atheromatous patches and aneurysms, with subsequent oedema, cyanosis, and gangrene in one or more fingers. This is the group that indicates referral for surgical consultation;
- The third group of symptoms includes changes in the circulation because of disturbance of the sympathetic nervous system. The skin is likely to be cool, dusky, and moist. Horner's syndrome in association with *scalenus anticus* syndrome has been observed.

Postural analysis of the cervical spine helps reveal muscular imbalance. If the scalene muscles are hypertonic, either primary or secondary to weak antagonists, head tilt will be toward the side of hypertonicity. The prominence of the scaleni muscles, as well as the sternocleidomastoid muscle, may be visualised. (1)

With hypertonicity of the *scalene* muscles there will be normal cervical flexion, but limited overall extension. Upper cervical extension will be normal, while the *scalene* muscles limit the motion in the lower cervical area. Lateral flexion is normal to the side of involvement but restricted contralaterally.

The Adson manoeuvre is designed to decrease the volume of the interscalene triangle to allow observation for increased paresthesia or decreased arterial pulsation. It is important to note that decreased arterial pulsation with this manoeuvre is present in the majority of normal asymptomatic people. The test is of value if one primarily observes for re–creation or exacerbation of the patient's symptoms, which is usually due to nerve entrapment.

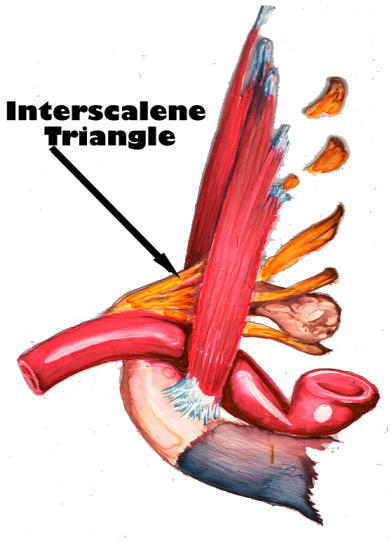
Figure 3: Demonstration of the Adson manoeuvre. Note the palpation of the radial pulse



The Adson manoeuvre has been described in many ways in the literature. The original description is for the patient to be seated, with the arms resting on their knees. The examiner monitors the radial pulse throughout the test. The patient takes a long breath, elevates the chin, and turns it toward the affected side. In a positive test there will be reduction of the pulse wave as a sign of vascular entrapment, and/or an increase of paresthesia or pain as a sign of nerve entrapment. The test's rationale is that head rotation and extension stretch the *scalenus anticus* muscle posteriorly, and the deep inspiration causes contraction of the muscle since it is an accessory muscle of respiration. An additional factor that may cause a positive test is a cervical rib or an anomalous 1st thoracic rib.

Sectioning of the *scalenus anticus* muscle was the initial approach used by Adson and many others, and this was followed for several years before other procedures were developed for better results. Studies indicating the failure rate of sectioning the scalenus anticus muscle of at least 40%. Some orthopaedic surgeons of that cruel time stated that resection of the 1st rib gives relief by detaching the scaleni muscles. They found that patients who failed to obtain continued relief from the surgery developed pain again because the *scaleni* re-attach. When surgery fails orthopedically, the future life of the patient can be simply awful.

Figure 4: The Left interscalene triangle



In some instances, neurovascular compression can be even greater when the patient takes a deep breath, turns his head to the side opposite involvement, and extends his neck. Both directions should be evaluated however. The wonderful diagnostic team of Travell and Simons believe that rotating the head toward the unaffected side is more likely to be positive if the *scalenus medius* or *posticus* muscle is involved than if the *scalenus anticus* is taut. Identification of the muscles involved is usually confirmed by palpating for trigger points. The AK approach to more specifically diagnosing trigger points in these muscles has been described previously in the Journal (6)

Other descriptions include having the arm abducted to 45° with the elbow straight during the manoeuvre, and abducting, extending, and externally rotating the arm and having the patient take a deep breath, turning his head toward the arm being tested. If an Adson test, or a variation of it, produces or exacerbates the patient's symptoms, the manner in which the test was done should be recorded so that repetitive tests are comparative. Positive findings in Adson's test are not usually due to circulatory deficiency, but evaluating the pulse helps determine what manoeuvres cause compression on the neurovascular bundle. An objective method of evaluating the pulse during the manoeuvre is to record it with plethysmography; it is an improvement over radial artery palpation.

The finger flexion test described by Travell and Simons (7) evaluates for oedema that may develop in the hand from *scalenus anticus* syndrome. This test also helps locate trigger points (TPs) in the *extensor digitorum* muscles. The patient keeps the metacarpophalangeal (MCP) articulations in forceful extension while the interphalangeal articulations are maximally flexed. Normally the pulp of the fingertips can firmly touch the volar pads or palms of the MCP articulations.

Figure 5: The Finger-Flexion test

If there are subluxations affecting the interscalene triangle and associated trigger points in the *extensor digitorum* muscles, the fingers will fail to flex completely and be inhibited on manual muscle testing, especially with AK Challenge to the lower cervical spine. Failure of one or more fingers to fully flex while the MCP articulation is in full extension indicates oedema or probable trigger points in that section of the *extensor digitorum* muscle controlling the involved finger.

Travell and Simons (7) explain the latter by stating '*Voluntary hyperextension of the MCP joints strongly loads the finger extensors, increasing the activity of these TPs. This TP activity apparently reflexly limits simultaneously end–finger flexion by reciprocal inhibition of the finger flexors*'. When the test is positive because of active trigger points in the *scalene* muscles, all four fingertips fail to touch the palm; however, there is no difficulty in making a tight fist when the metacarpophalangeal joints are allowed to flex. Travell and Simons' rationale for this is that '*Apparently, TPs in the extensor digitorum communis are activated secondarily, as satellite TPs, because they lie within the pain reference zone of primary scalene TPs*'. When a positive finger flexion test is due strictly to trigger points, the test will immediately become negative after the trigger points are successfully treated. If the positive finger flexion test is secondary to oedema, there will be a delay in recovery from the test. The positive test associated with oedema is more likely to occur when trigger points are in the *scalenus anticus*. The other *scalene* muscles may refer to the *extensor digitorum* muscle to cause the positive test.

Trigger points in the *scalene* muscles have a ropy characteristic and are exquisitely tender. A trigger point can usually be located by palpation. There is also a tender point just below the clavicle in the infra-clavicular fossa, which Travell and Simons call the '*scalene test point*'. (7) The tenderness at this location can also be due to *pectoral* muscle involvement. Referred pain from trigger points in the *scalene* muscles tends to radiate into the radial side of the hand, as opposed to the pain of ulnar distribution with puffiness of the hand in brachial plexus and subclavian vein entrapment.

Figure 6: Showing the Right Scalene Test Point

The *scalene* muscles contralateral to the side of pain are often sub-clinically involved. They should be evaluated for latent trigger points and treated, when found, to prevent the other side from becoming involved as the primary side is successfully treated. (1)

The *scalene* muscles will probably test weak following trauma; but they are strengthened by one or more of the five factors of the intervertebral foramen. Cranial dysfunctions and spinal subluxations are commonly interacting with this disorder in patients. When trauma to the cervical spine is recent, care should be taken not to use forceful manipulation as it might induce additional trauma to the soft tissue, with subsequent swelling and worsening of symptoms. Corrections can be made by respiratory adjustment (8, 9) or with the Activator™ instrument. When cranial dysfunctions are involved, very accurate challenge to determine the exact correction may be necessary, especially with the inspiration/expiration assist, sphenobasilar, and frontal faults. (8)

When muscles test strong in the clear, they can be tested for the muscle stretch reaction. (8, 9) The starting position for the test is with the patient seated and his head turned approximately 10° away from the side to be tested. The physician extends the patient's cervical spine, placing the *scalene* muscles into stretch. She then immediately returns the patient's head and neck to the testing position and tests the deep flexor muscles. When trigger points are present, the muscles will test weak when they were strong in the clear. Care should be taken not to extend the patient's neck forcefully, causing additional trauma to injured ligaments. Placing the muscles into maximum stretch is all that is necessary. Trigger points can be treated with the stretch and spray technique (7) or with digital pressure. In chronic conditions, the muscle stretch reaction of the *scalene* muscles may need treatment with the fascial release technique. (6)

The rapidity of trauma often accompanying cervical injuries may create the strain/counterstrain muscular imbalance described by Jones. (10) This muscular dysfunction can be the cause of pain in the thoracic outlet vicinity, or it can contribute to neurovascular entrapment at the thoracic outlet because of the muscular imbalance. The subject is discussed in detail in the author's book under cervical trauma. (1)

As the *scalene* muscles are brought back into normal function, the patient must refrain from activities that tend to recreate the imbalance. Most of these are poor habits one should avoid in any event, such as holding a cell phone between the ear and shoulder, especially when done frequently for long periods in a work environment. There is almost no proper position for reading in bed, often done with poor light. Side-lying with the elbow on the bed and the head propped on the hand is especially bad.

Poor work and other habits may be discovered by asking what type of activity was done prior to a recent exacerbation after effective treatment has been given relief.

Medial neck flexors (deep)

From Whiplash Dynamics and Manual Muscle Testing textbook (1, 4)

- *Scalenus Anticus*

  Attachments: From the anterior tubercles of the transverse processes of the 2nd-6th cervical vertebrae to the scalene tubercle on superior surface of the 1st rib.

  Action: flexes and rotates cervicals; raises 1st rib.

  Nerve supply: anterior branches, C5, 6, 7, 8.

- *Scalenus Medius*

  Attachments: From the posterior tubercles of the transverse processes of 2nd-7th cervical vertebrae to the superior surface of the 1st rib behind subclavian groove.

Action: flexes and rotates cervical vertebrae; raises 1st rib.

Nerve supply: posterior branches of anterior primary rami of C3, 4; lateral muscular branches of C3, 4.

- *Scalenus Posticus*

  Attachments: From the posterior tubercles of transverse processes of 4th, 5th, and 6th cervicals to the lateral surface of 2nd rib posterior to the attachment of *serratus anticus*.

  Action: flexes and rotates cervical vertebrae; raises 2nd rib. Note: All scalenes, when acting bilaterally, flex the neck.

  Nerve supply: posterior branches of C5-8; lateral muscular branches of C3, 4.

Figure 7: Anterior view of the cervical spine and *scaleni*

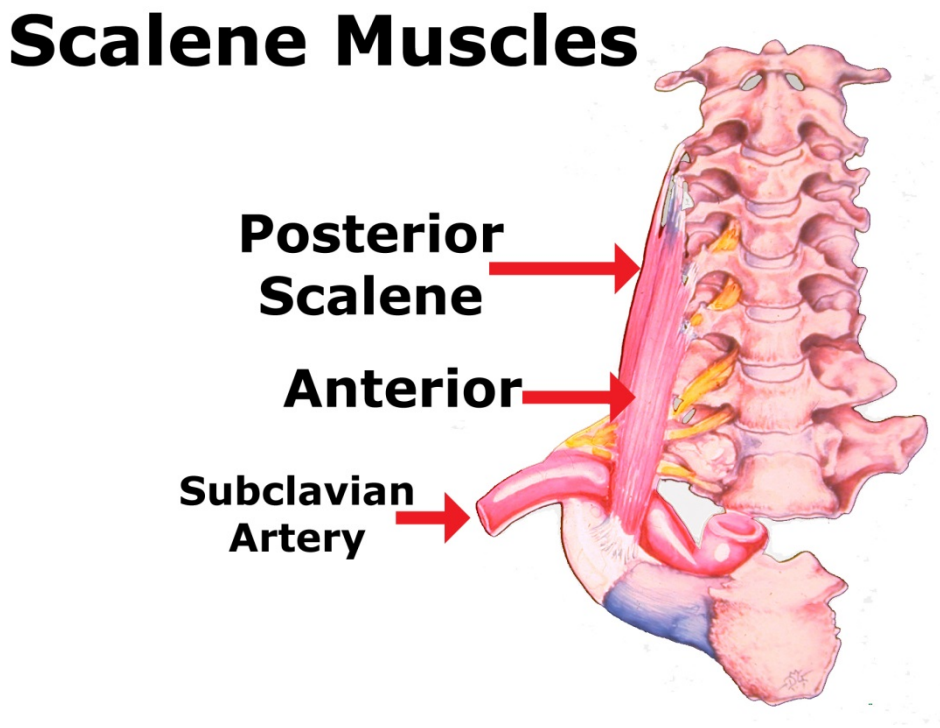


Figure 8:MMT *anterior scalene*

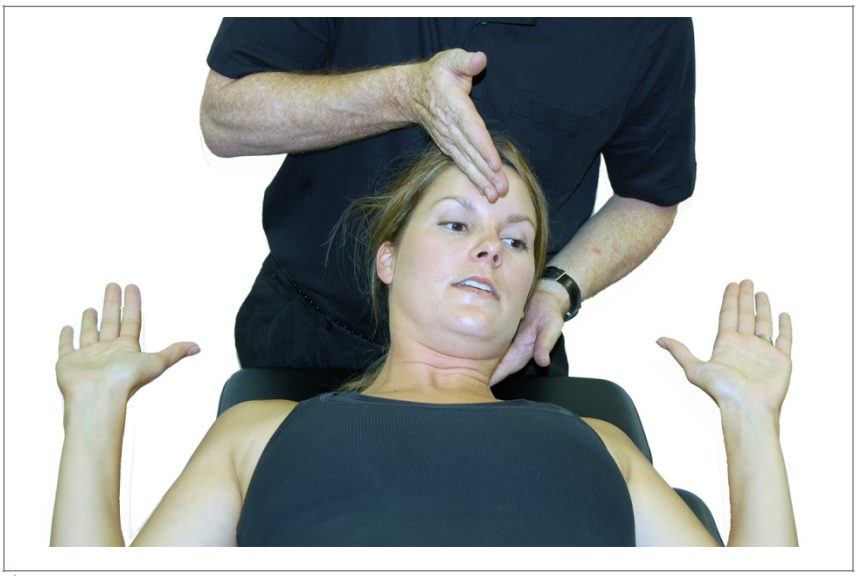


Figure 9: MMT *deep flexors on the* right

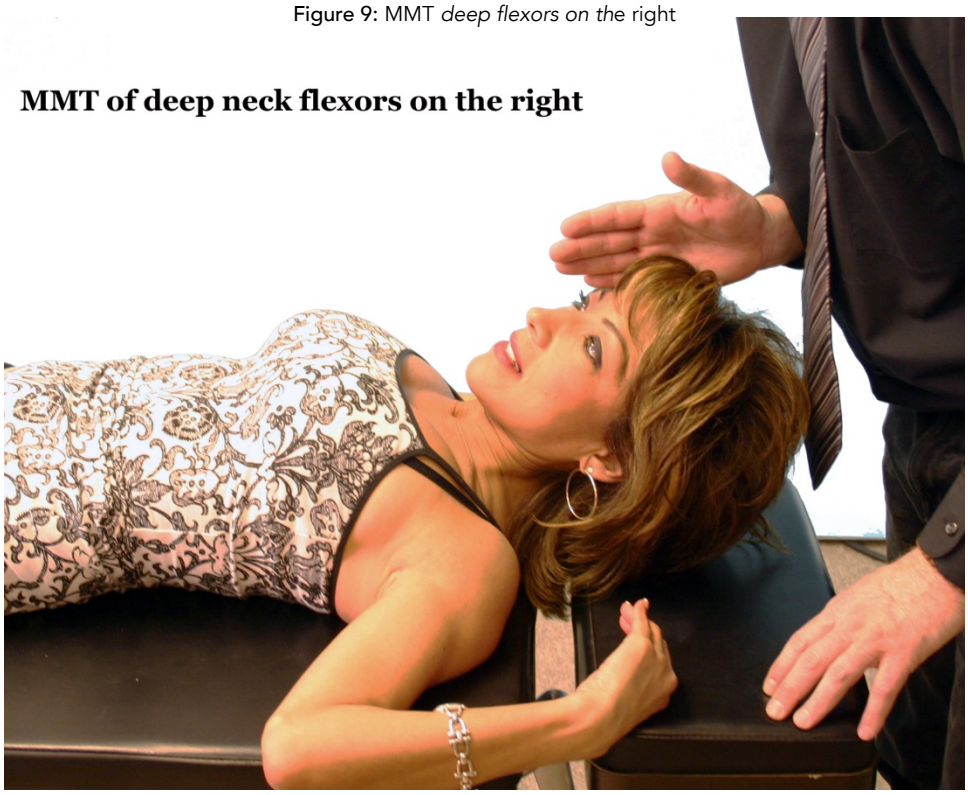
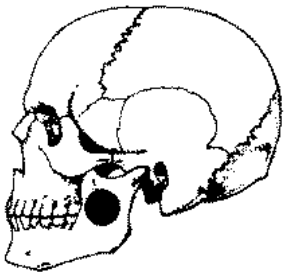
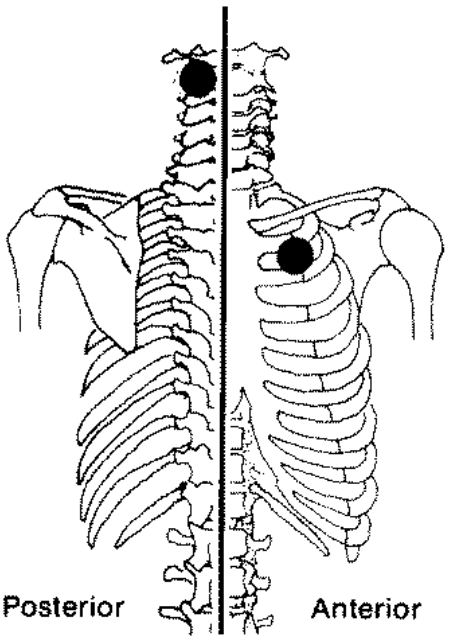


Figure 10: *Scalenus anticus* reflexes



NEUROVASCULAR



NEUROLYMPHATIC
BILATERAL

- *Longus Capitis*

  Attachments: From the anterior tubercles of transverse processes of the 3rd-6th cervical vertebrae to the inferior surface of the basilar portion of the occiput.

  Action: flexes cervical vertebrae and head; unilaterally rotates and flexes cervical vertebrae and head.

  Nerve supply: muscular branches of C1-4.

- *Longus Colli*

  Attachments: From bodies of the first three thoracic and last three cervical vertebrae, with slips from other areas to the bodies of 2nd, 3rd, and 4th cervicals with myofascial slips to other areas.

  Action: flexes cervical vertebrae unilaterally; assists in rotation and lateral flexion.

  Nerve supply: anterior primary rami of C2-8.

  Test: The supine patient places her hands above the head by shoulder abduction and elbow flexion. She lifts the head from the table by neck flexion and rotates it 10° away from the side being tested. The examiner uses the ulnar edge of the hand, pressing against the forehead in the direction of neck extension directly toward the table and not in alignment with the 10° rotation of the patient's head. Tugging of the skin on the forehead may produce inhibition, so a gentle contact between the examiner's hand and the patient's head is essential. The edge of the hand gives better directional force; it also reduces the patient's ability to work rotational factors into the test against the examiner's flat hand. Observation should be made for the patient's attempt to rotate the head, recruiting more activity from synergists. The patient should also be prevented from laterally tilting the head.

  Neurolymphatic:

  Anterior: 1st intercostal space 3½" (8 to 9 cm)from sternum.

  Posterior: laminae C2.

  Neurovascular: ramus of jaw below zygoma.

  Nutrition: vitamin B6, niacinamide or niacin. (Remarkable effective when indicated)

  Meridian association in AK: stomach.

  Organ/gland association in AK: sinuses.

Body language of *scalene* weakness

Patient has difficulty bringing head and neck into the testing position or in holding it if the examiner places the head and neck in the testing position. Patient may have difficulty arising from a supine position without head and neck support.

Postural Imbalances: Loss of normal lordosis of cervical spine may be observed on x-ray, especially from weakness of the scalene muscle group. This is frequently present after whiplash injuries. In hyperextension injuries, the *scalene* and *longus colli* muscles may be severely stretched and some of the fibres torn.

In an acute case, it is characteristic for the patient to support his head and neck with his hands. With these more severe injuries, the ligaments are sprained and the muscles may be lacerated, with accompanying haemorrhage and oedema. There may be damage to the sympathetic nerve fibres that lie on the *longus colli* muscle, causing unusual symptoms such as nausea, dizziness, blurred vision, and possibly unilateral dilated pupils (Horner's syndrome). Earache and even

precordial pain may develop. (17) Lateral neck tilt is present from unilateral weakness of the *scalene* group.

Alternate Testing Methods

These muscles may be tested in a seated or standing position. The clinician must carefully stabilise the trunk and observe for any attempt by the patient to alter the parameters of the test. The easiest weight-bearing test is obtained by leaning the patient against an upright examination table. Free nerve endings are scattered throughout the skin and are grouped around the bases of hair. They can register pain and pressure. (5) Gentle contacts on the patient's head are essential for accurate MMT of these muscles.

Special notes

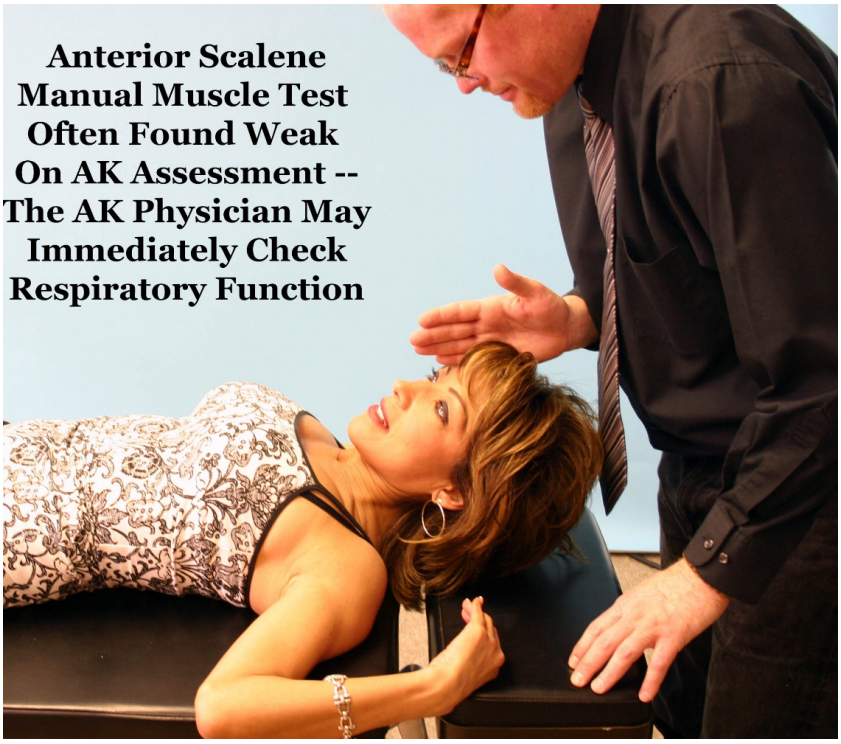
Muscle injuries of the *scalene* muscles frequently results from hyperextension during whiplash dynamics. If the head is turned during the MVA or the patient is hit from the side, the injury will be more unilateral.

Falla, Jull and Hodges found that the deep neck flexors in particular have reduced EMG activity in patients with neck pain. (18) The importance of diagnosing this physical finding in patients with neck pain makes the MMT all the more important. It is likely that the reason patients with chronic neck pain have difficulty maintaining cervical lordosis is this weakness in the deep neck flexor muscles.

When the sinuses are involved, the muscular weakness is often due to lymphatic involvement. The neurolymphatic reflexes may require considerable manipulation to clear the involvement. (19)

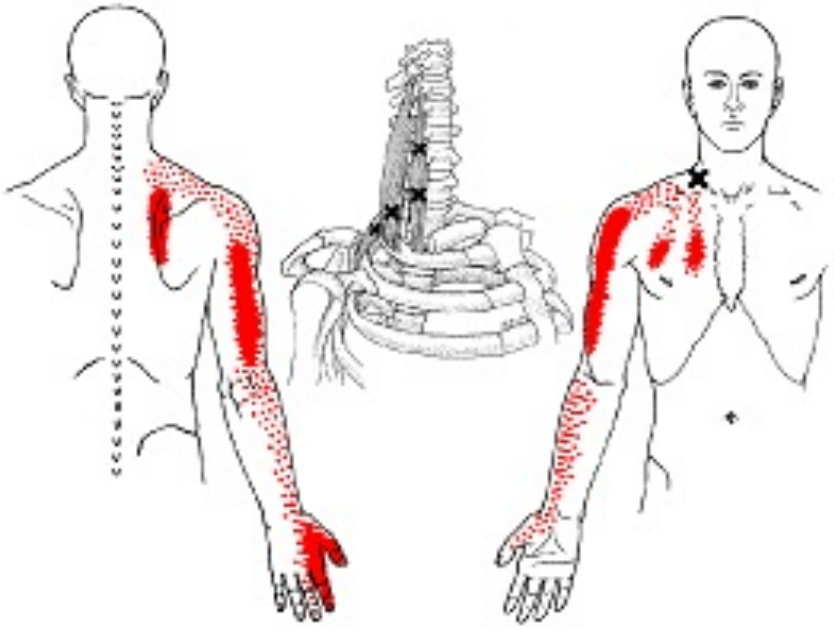
The *scalene* muscles are accessory muscles of respiration. When the head and neck are stabilised, the *scalene* muscles elevate the first rib; the *posterior scalene* elevates the second rib, thereby lifting the entire rib cage. They are active during quiet respiration, and highly active during forced inspiration. It is generally considered that the *scalenes* anchor the 1st rib during quiet breathing, while the external intercostals elevate the remaining ribs toward the 1st. In general, the *scalenes* are more important as a secondary muscle of respiration than the SCM.

Figure 11: MMT *scalenus anticus*



Active myofascial trigger points in the *scalenes* refer pain and paresthesia symptoms into the ipsilateral *deltoid* area, over the *biceps* and *triceps*, and along the radial side of the forearm, thumb, and index finger.

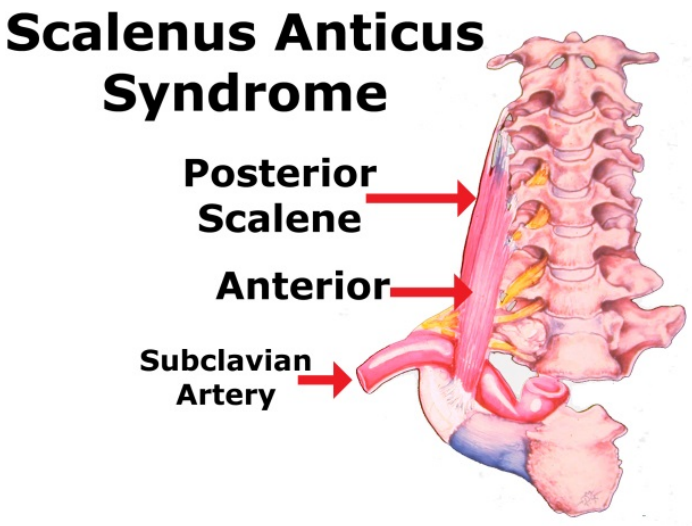
Figure 12: *Scalenus anticus* myofascial trigger points (similar to and overlapping with subclavian MTrPs



The *scalene* muscles have been associated with a neurovascular compression syndrome known as the *scalenus anticus* syndrome. The brachial plexus emerges from the cervical spine between the *scalenus anterior* and *medius*. These two muscles, along with the 1st rib, form the scalene opening, and it is through this opening that the brachial plexus and vascular structures for the upper extremity pass.

These neck flexors are the most proximal site for peripheral compression syndromes of the upper extremity. Surgery for this condition has been associated with a high failure rate for the pain of the condition, but it does improve the paresthesia. (20) When there is an apparent *scalenus anticus* syndrome of an acquired nature and without a space-occupying lesion, there are good results from the applied kinesiology approach. Occasionally the muscles of the cervical region, including the *scalene* group, are primarily involved. Usually the local area causing compression is secondary to some other involvement, such as a Category 1 pelvic problem, foot problem, etc. (11)

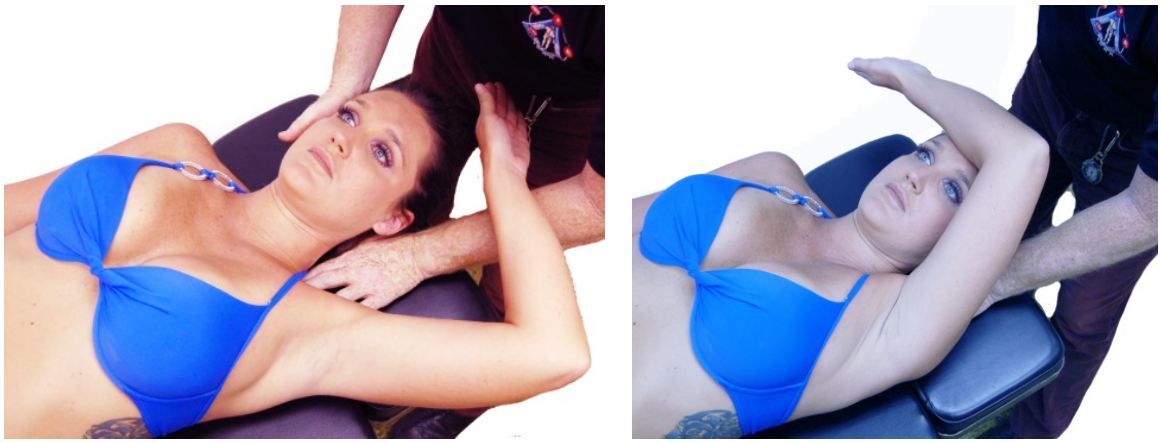
Figure 13: *Scalenus anticus* syndrome



The diagnosis of *scalenus anticus* syndrome has been described in the literature, and is presented in the companion textbook. (1) Briefly, the manual muscle testing diagnosis of this syndrome involves testing the relevant arm muscles innervated by the nerves suspected of involvement in the neck. In the supine patient, if the muscles of the arm are found strong, instruct the patient to lift the head into the MMT position for the *scalenes*. If either the right or left *scalene* muscle test position leads to inhibition of the arm muscles, there is reason to suspect a scalene-entrapment syndrome.

Travell describes an examination procedure involving the placement of the ipsilateral forearm across the forehead, which raises and pulls the forearm forward and lifts the clavicle off the underlying *scalene* muscles and brachial plexus. If it relieves pain, it may be used to differentiate cervical radiculopathy. (10)

Figure 14: Travell's 'Scalene Relief' test



Travell also offers several physical examination tests which the author has found useful. The Scalene-relief test helps to identify whether the scalene possesses a MTrP as a source of referred pain that is caused or aggravated by clavicular pressure on the nerves passing over the elevated first rib or the involved muscle.

In the test, the examiner's fingers demonstrate the tightness of the space between the clavicle and *scalene* muscles. The fingers then demonstrate the increased clearance behind the clavicle when the patient raises their shoulder and arm. Clearance beneath the clavicle is maximised by swinging the shoulder forward, which pivots the clavicle forward and upward to fully relieve clavicular pressure on the thoracic outlet structures. Pain relief by this test occurs immediately or in a short period of time.

The second test demonstrates a physical finding in the fingers when there are MTrPs in the *scalene* muscles. The patient attempts finger flexion and the test is normal when the fingertips can firmly touch the palm of the metacarpophalangeal joints. When there are MTrPs in the *scalene* muscles, all four fingertips may fail to touch the metacarpophalangeal joints. Simons and Travell observe that '*the referred motor effects of MTrPs frequently are independent of, and can affect different locations than, referred sensory effects. Apparently, MTrPs in the scalene muscles similarly inhibit finger flexors when the MCP joints are extended*'. (12) [See Figure 5]

Longus capitis & colli

When there is a disturbance of flexion or extension between the atlas and the occiput, there is probably involvement of the *longus capitis* and *longus colli* muscles, which are inaccessible for

direct treatment by manual methods, with the exception of 'muscle energy' Osteopathic techniques or the 'rocker motion' technique in applied kinesiology. The *longus colli* is the only muscle which attaches to the anterior of the spine and is completely confined to the vertebrae.

The craniocervical flexion test (CCFT) is a clinical test (developed by Jull et al) (13) of the anatomical action of the deep cervical flexor muscles, the *longus capitis*, and *colli* has evolved over the past 20 years as both a clinical and research tool because of the recognition of the importance of the deep cervical flexors that support the cervical lordosis and motion segments and clinical observations of their impairment with neck pain and headache. (13) Impaired performance of the craniocervical flexion test in combination with palpably painful upper cervical joint dysfunction associated with restricted range of cervical extension were found to have 100% sensitivity and 94% specificity to differentiate cervicogenic headache from migraine and tension-type headache. (14) One of the diagnostic criteria for cervical headaches as described by the *International Headache Society* includes changes in deep neck flexor muscle strength. (15)

Basmajian et al, using bipolar fine-wire electrodes, studied the *longus colli* and its action compared to the ipsilateral *sternocleidomastoid* muscle. (16) The two muscles act synchronously in flexion and extension movements, and act together ipsilaterally in lateral flexion. During free rotation to the left, the left *longus colli* is active with the right *sternocleidomastoid*.

Conclusion

Chiropractic is a low-cost, highly effective form of health care used by millions of people around the world. Its inclusion for the treatment of '*root of the neck and shoulder disorders*' and in workers' compensation programs is simply good public policy. Chiropractic provides a cost-effective alternative to the medical-surgical hospital-based interventions offered to the public today.

This is despite its 'last resort' status of Chiropractic care for many patients. One explanation for this is the lower insurance coverage of Chiropractic care. If Chiropractic care is insured to the extent other medical specialties are stipulated, it may emerge as a first option for patients with certain conditions, like the *scalenus anticus* syndrome described in this report. This could very well result in a decrease in overall treatment costs for these conditions.

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