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Serratus Posterior: Incorporating the Superior and Inferior Division into Professional Applied Kinesiology

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Narrative: Serratus posterior superior and serratus posterior inferior muscles are discussed and treated by many manual therapists in the health care field. Yet in Professional Applied Kinesiology official literature there is no mention of this muscle. In the medical literature, the Serratus posterior muscle has traditionally been viewed as an accessory muscle of respiration.

This paper proposes that the serratus posterior superior muscle be viewed more as an anchoring muscle stabilising the cervicothoracic junction and the serratus posterior inferior muscle stabilising the thoracolumbar junction. An inhibition of these muscles will cause compensatory response in other areas of the body thus leading to body distortion and pain.

A muscle test for the serratus posterior superior and serratus posterior inferior is proposed along with its anatomy and clinical relevance.

Many of the compensatory inhibited muscles that are found in our initial structural exam can be reduced by evaluating and correcting these two divisions of the serratus posterior. This in turn allow the practitioner to better able address the more underlying root cause of a patient's structural condition.

Indexing terms: Chiropractic; Professional Applied Kinesiology; Serratus posterior superior muscle; Serratus posterior inferior muscle; Serratus Posterior muscle; Muscle Testing; Muscle balancing.

Introduction

Serratus posterior superior (SPS) and serratus posterior inferior (SPI) are thin back muscles which lie above the intrinsic back musculature and are deep to the trapezius, rhomboids, and other spinal extensor muscles.

... The concept of the serratus posterior muscle is currently not discussed in an official manner within PAK. However, it is widely discussed amongst many other disciplines ...'

An internet search on the SPS and SPI shows a vast array of websites which describe the anatomy, function, clinical relevance, exercise, rehabilitation done by a wide variety of practitioners ranging from medical doctors, Chiropractors, osteopaths, physical therapists, massage therapists, sports trainers, and body workers etc.

Yet in the three major reference manuals of Professional Applied Kinesiology (PAK), such as Walther's Synopsis, (1) Leaf's Flowchart Manual, (2) and Garten's Muscle Test Handbook, (3) there is no mention of the *serratus*

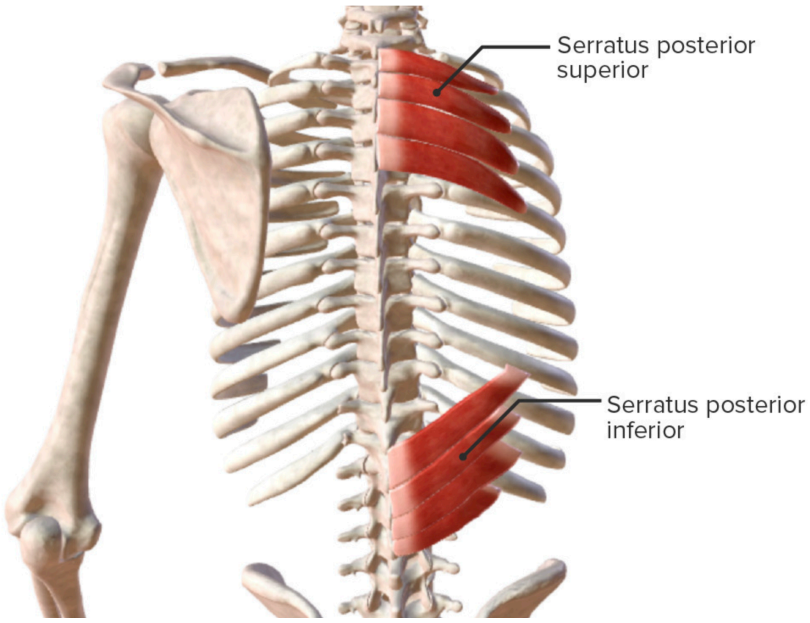
posterior muscle.

In Janet Travell's trigger point book, there is a full chapter dedicated to the *serratus posterior superior* and *inferior* muscle. (4)

Kendall et al mention the SPS and SPI muscles as two of the five respiratory accessory muscles that '*cannot be tested manually and are inaccessible to palpation*'. The other three muscles are *levatores costarum*, *transversus thoracic* and the *subclavius*. (5)

It is interesting to note with regards to the *subclavius*, which Kendall had mentioned that '*cannot be tested manually*', that a muscle test was found by Beardall and is presented in David Leaf's flowchart manual (6) and Garten's Muscle Test Handbook. (7)

It is my intention to introduce the serratus posterior muscle into PAK. And also, present its anatomy, clinical relevance, to show the importance of this muscle and when inhibited how it can create many compensatory muscle responses within the body that the patient will present as their pain. After years of refinement, a muscle test is proposed for the SPS and SPI.



Discussion

Traditionally, in medicine the serratus posterior muscles are looked upon as being accessory muscles of respiration where the SPS elevates the ribs on inspiration and the SPI depresses the ribs on expiration. (8)

However, in the following study there was no evidence of the serratus posterior muscle having a respiratory role. Cadaver dissections of the SPI and SPS muscles from COPD patients were performed and it was found that '*no morphometric differences exist between that of serratus posterior superior and inferior muscles of COPD patients versus controls*'. (9)

Another study showed that these muscles may not be an accessory muscle of respiration but may be proprioceptive in nature. With the SPS monitoring the head and the SPI monitoring the spine which then communicates with the surrounding muscles on how to best maintain the body in a proper functioning manner. The study proposes that the SPS have myofascial pain syndrome implications and '*may have greater clinical relevance than commonly attributed to them*'. (10)

It is my opinion that the serratus posterior be viewed as a strong extensor stabiliser where the superior division anchors the cervicothoracic junction, and the inferior division anchors the

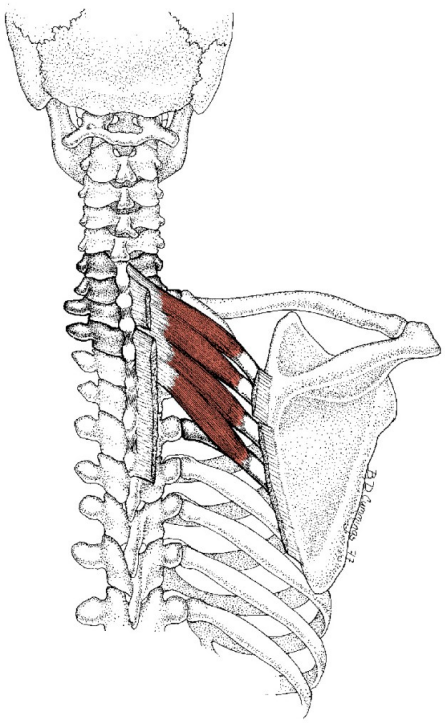
thoracolumbar junction, which are the transitional segments of the spine. This is akin to a door hinge, which anchors the door to the door frame. If the hinge is loose, then the door is more unstable and prone to breaking off the door frame when pressure and stress is applied to the door.

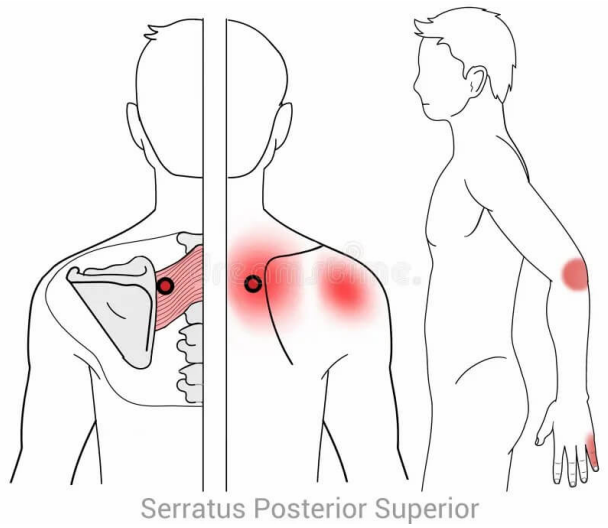
It has been well established in PAK than an inhibition of the extensor muscles will cause a forward translation of the body with subsequent hypertonicity of the flexor muscles such as the anterior neck flexor, *pectoralis*, and *psoas* muscles. This type of a scenario can create and/or aggravate a myriad of impingement syndromes in the cervical spine, cranium, shoulder, low back, pelvis, upper and lower extremity along with affecting the function of the ribs.

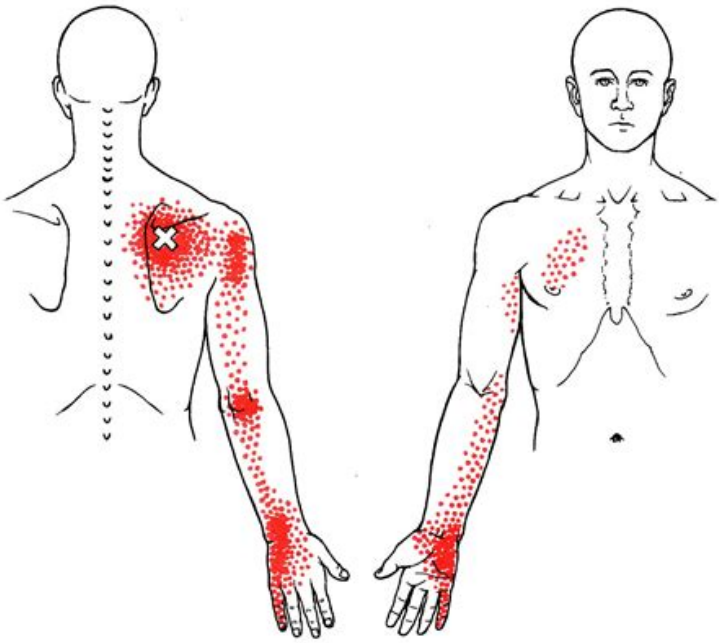
By finding and correcting the inhibition of the SPS and SPI muscles, it can support the extensor portion of the body to be more stable and thus eliminate or drastically reduce many of the compensatory hypertonic muscles that are found in our initial structural exam findings. With this additional tool in our 'toolbox', we can rediscover the use of the SPS and SPI muscles.

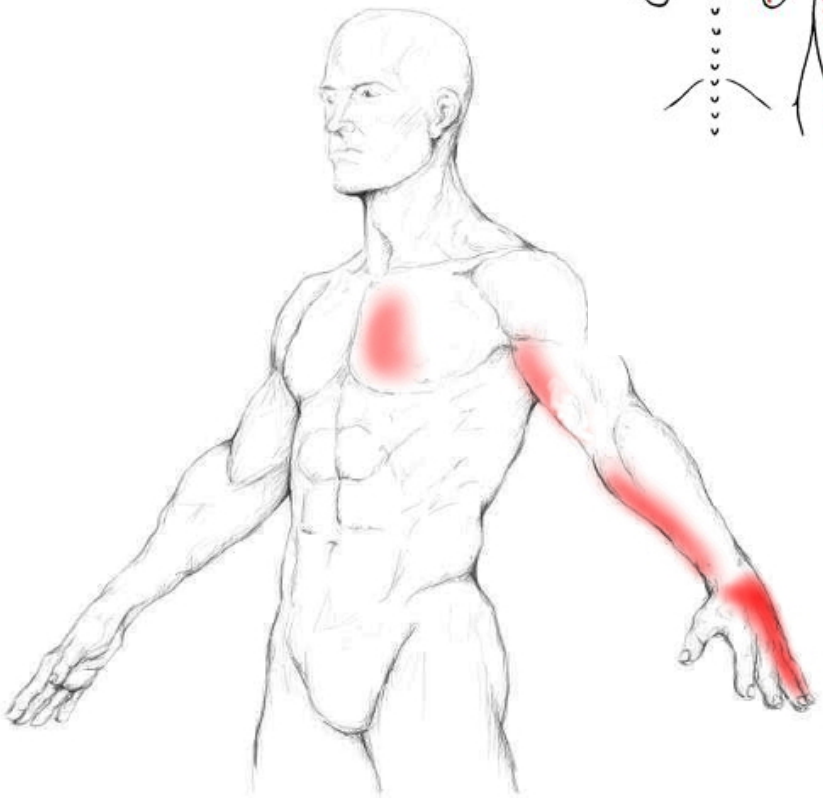
Serratus Posterior Superior (General information)

- Origin: Arises from the aponeurosis at the inferior end of the nuchal ligament at the spinous process of C6-T2, adjacent to the supraspinous ligament (4).
- Insertion: The fibres pass inferior and laterally at almost 45° angle and insert via four separate tendons onto the external surface just lateral to the angle of the 2nd to 5th ribs. (4)
- Nerve supply: Anterior rami of 2nd to 5th intercostal thoracic nerve. (4)
- Action: Elevates the ribs at their costovertebral joint during forced inspiration. It may also be involved in proprioception for the head and neck. Bilateral contraction elevates the thoracic spine. (4) According to this author it is a strong stabiliser of the cervicothoracic spinal junction.
- Sign of weakness: Patient may present with a slouched posture and a forward head carriage (4) along with hypertonicity of scalene, SCM, TMJ, pectoral, and upper and mid trapezius muscles.









- Referred pain: Referral of pain is usually felt over the posterior deltoid, long head of the triceps, towards the olecranon and occasionally to the ulnar side of the forearm, hand and to the little finger. Anteriorly, the pectoral region maybe involved. Patient may also feel numbness in the C8-T1 distribution of the hand. The pain is perceived to be deeper in nature than a trigger area that is felt from the middle trapezius. The trigger point referral can be similar to that of the scalene muscle (4).
- Comments: Deep steady ache at rest or when moving about which gets worse when lifting objects with an outstretched hand. Laying on the affected muscle can cause the symptoms to

get worse due to the scapula pressing against the trigger points of the muscle. Sitting at a desk for an extended period or driving can aggravate the symptoms. Pain in the little finger is a signature sign of the serratus posterior superior trigger point. (11)

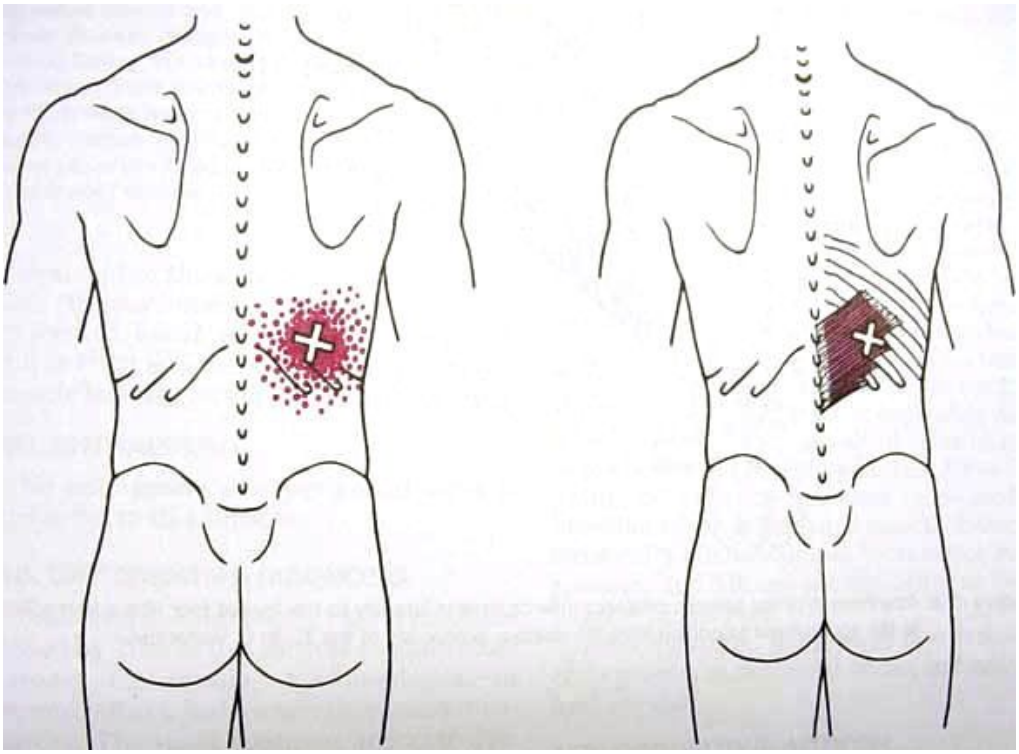
To get access to the insertion of the serratus posterior superior muscle, the scapula needs to be protruded since at a neutral stance the medial border of the scapula will cover this area. (4) Often this muscle gets adhered to the rhomboids causing sharp stabbing pains in the mid-back, and restrictions in breathing (12)

Serratus Posterior Inferior (General information)

- Origin: Arises from the aponeurosis of spinous process of T11-L2/3 vertebrae. It also blends with the aponeurosis of the thoracolumbar fascia as well as the *latissimus dorsi* muscle. (4)
- Insertion: The fibres pass superiorly and laterally into 4 digits attaching into the 8th to 12th ribs just past the angle of the ribs. (4)
- Nerve supply: Anterior primary rami of 9th to 12th thoracic nerve. T9- 11 intercostal nerve and T12 subcostal nerve. (4)
- Action: Acts to move the ribs posteriorly and inferiorly to assist in extension and rotation of the trunk and may contribute to inhalation and forced expiration along with the *quadratus lumborum*, *latissimus dorsi* and *internal abdominal oblique*. Helps to depress the ribs. (4) Contributes to the movement and stabilization of the thoracolumbar junction by being a synergist with the *iliocostalis* and *longissimus thoracic* muscles on the same side. Unilateral contraction rotates the thorax to the same side and bilateral contraction extends the vertebra at the thoracolumbar junction. It may also be involved in proprioception for the thoracolumbar junction. According to this author, it is a strong stabiliser of the thoracolumbar spinal junction.

- Sign of weakness: Unilateral weakness will rotate the thorax anteriorly. Bilateral weakness will cause an increased kyphosis at the thoracolumbar junction. Often, there will be presence of compensatory muscle imbalance in the diaphragm, pelvis, abdominal and low back region along with muscular hypertonicity of the pectoral and trapezius and rhomboid region.
- Referred pain: Produces an aching discomfort over and around the muscle which can extend across the back and over the lower ribs.
- Comments: It is one of the many back muscles that can be strained during a combined movement of lifting, turning, and reaching and if this muscle is not anchored, there can be a lingering sensation of pain even after the other surrounding muscles have been stabilised.

The trigger point of this muscle can be mistaken for a sign of kidney distress. When this muscle is hypertonic it will tend to restrict movement, especially bending and twisting. (13) Often this muscle gets adhered to the *erector spinae* resulting in restrictions in breathing, low back pain, and limited active range of motion. (12.



- Muscle test for the Serratus Posterior: In PAK, the objective of the muscle test is to isolate the action of a specific muscle and prevent or reduce recruitment from surrounding synergistic muscles. For this to happen, the origin and insertion of the muscle needs to be approximated for maximum effectiveness. (14) Due to the location of the serratus posterior muscles, it is a challenge to test it in this manner.

There are many muscle tests in PAK which do not take full advantage of the origin and insertion approximation. Instead, a long lever approach is utilised where the direction of the force for the test is applied on a body part which is not directly attached to the muscle.

The following is a list of some of the muscles that are tested in a long lever fashion:

• Serratus Anterior	• Subclavius	• Popliteus
• Piriformis	• Rhomboid	• Quadratus Lumborum
• Mid trapezius	• Lower trapezius	• GIGO muscles
• Infraspinatus	• Latissimus Dorsi	• Levator Scapula
• Subscapularis	• Teres Minor	

The Muscle Test I propose for the serratus posterior will utilise the long lever approach.

Serratus Posterior Superior (Proposed muscle test)

- Patient position for the muscle test: Patients' arm is along the side of their thorax with the elbow bent to 80°. Patients' shoulder/AC joint is slightly retracted with a slight elevation as to create some approximation of the origin and insertion of the SPS muscle.
- Stabilisation: At the top of the shoulder.
- Testing hand position: Soft contact at the medial aspect of the elbow.
- Direction of force: Ask the patient to gently push posteriorly and slightly medially while the doctor counters with an anterior and lateral force to abduct the arm in an arch.
- Common errors: The patient will attempt to protract the shoulder, lean into the test, or flex the elbow to recruit the bicep muscles. Avoid bony contact over the olecranon.
- Sign of an inhibited muscle: The testing muscle will not lock and give away. In a person with over developed shoulder muscles, a weakness in the SPS muscle can still be noted by feeling for a bulging in the belly of the muscle during the application of the test.
- Organ relationship: Liver as the SPS muscle fibres are in line with the rhomboid and an inhibited SPS muscle facilitates to the liver Chapman reflex.
- Comment: To determine if the muscle inhibition found is from the SPS and not the rhomboid, have the patient therapy localise to C6 to see if it facilitates. If it does, then there is a high chance it was a SPS inhibition and not rhomboid since the rhomboid attaches to C7.

Serratus Posterior Inferior (Proposed muscle test)

- Patient position for the muscle test: With the elbow fully extended, the patient's shoulder is slightly retracted with a slight inferior direction as to approximate the origin and insertion of the muscle. With the arm being posterior to the body, abduct the arm to approximately 30° with the palm facing posteriorly.
- Stabilisation: At the top of the shoulder.
- Testing hand position: Soft contact on the radial aspect of the testing arm proximal to the wrist to avoid any hard bony contact.
- Direction of force for the muscle test: Ask the patient to push their arm medially and slightly anterior towards their hip while the doctor counters this with a lateral and slightly posterior force in an arch to abduct the arm. This author finds that by tapping the patient's hip prior to the test gives them a better understanding of the direction they need to push towards.
- Common errors: The patient will attempt to bend their elbow, bring their shoulder and arm anteriorly to try and recruit other muscles.
- Sign of an inhibited muscle: The patient will not be able to resist the pressure applied and the testing arm will move in a lateral and posterior direction.
- Organ relationship: Pancreas as the muscle fibres of the SPI are in line with the *latissimus dorsi* and an inhibited SPI muscle facilitates to the pancreas Chapman reflex.

If unable to test muscle due to shoulder restriction: If the serratus posterior is unable to be tested due to shoulder restriction and this muscle is suspected to be inhibited, palpate into the *pectoralis* muscles for the SPS and lateral ribs for the SPI. If they are tender to palpation, see if it decreases by bringing the body into extension as well as retracting the shoulder posteriorly.

Another way to determine if the SPS or SPI is involved is by gently pressing into the origin or insertion of the SPS or SPI and then pushing it either towards or away from the belly of the muscle. If it is involved either of these manoeuvres will decrease in tenderness at the *pectoralis* muscle or lateral rib area.

Therapy localisation to the spinous process at the level of the origin of the SPS and SPI to see if it facilitates other inhibited muscles found during the initial structural evaluation. Since there are many other structures that attach to the spinous process, it is important to ascertain if there are other reasons for the inhibition.

Incorporating the serratus posterior muscle into practice

During the ICAK convention at Montreal Canada in May 2023, I presented the *serratus posterior* muscle. During a patient demonstration, many muscle inhibitions were found in the upper and lower extremity, palpatory tenderness in the traditional fibromyalgia regions, along with neurological disorganisation. It was also determined that there was a TMJ involvement.

Instead of addressing the TMJ, the SPS and SPI muscles were treated after which the previously inhibited muscles were retested to see if there was any change. Many of the inhibited muscles in the upper and lower extremity were now facilitated and the neurological disorganisation was no longer present. However, the TMJ issue remained.

From this example, it was shown that many of the inhibitions found in the patient demonstration were secondary and by treating the SPS and SPI, the more primary issues came to the surface. I have seen many other similar cases where initially treating and anchoring the SPS and SPI muscles helped to reduce many inhibited muscles found during a structural assessment as well as improve range of motion, rib expansion and decrease pain tenderness.

Due to the transitional nature of the cervicothoracic and thoracolumbar spine, an imbalance here will create a spinal torque and other muscles will compensate accordingly to help protect this instability. Once it is not able to manage this instability, symptoms of pain will appear.

SPS and SPI are two different muscles which are winglike in shape and are mirror images to each other. Interestingly enough, there is a spinal Lovett brother correlation where the C6-7 origin of the SPS corresponds with the T11-12 origin of the SPI.

With its attachment at the cervicothoracic and thoracolumbar junction, an imbalance here can have an impact on neurological disorganisation due to it being in structural alignment with the K27 junction as well as the umbilicus. An interesting concept to further ponder upon.

There are many ways to treat the muscle and it is recommended for the reader to use the one that works best for him/her. This author typically treats the muscle at the golgi tendon organ to anchor it at the origin and insertion points. If the spindle cells need to be treated, then it gets addressed. Range of motion in a passive and active manner can also be added when working on the golgi tendon organ to enhance the treatment. Isometric exercise, which is basically in the position of the muscle test, are very helpful in anchoring the SPS and SPI to their respective transitional segments at the spine. After that, isotonic exercises can be prescribed to strengthen the various muscle groups in the region.

Conclusion

Serratus posterior superior and *serratus posterior inferior* muscles act as strong stabilisers of the cervicothoracic and thoracolumbar junction respectively and should be considered in the overall structural evaluation of our patients. Once corrected they can mitigate many compensatory muscles thus freeing the practitioner to concentrate more on the deeper underlying cause of their patient's condition.

The concept of the *serratus posterior* muscle is currently not discussed in an official manner within PAK. However, it is widely discussed amongst many other disciplines.

The goal of this paper is to introduce the serratus posterior muscle so that this we can start to look at it in a more detailed manner and come up with treatment protocols that can help the members of our profession do an even better job at serving our patients.

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