

Thoracic Outlet Syndrome, Part 2: Twelve Management Options

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January 3, 2017 Article published on www.aptei.ca “Clinical Library”

The first part of this paper discussed the clinical features and clinical tests for the three primary classifications of Thoracic Outlet Syndrome (TOS): arterial, venous and neurogenic. The TOS classification was then further divided into Advanced or Simple. Patients with **Advanced TOS** present with constant, obvious vascular and/or neurological symptoms which can be confirmed with various vascular imaging and nerve conduction tests (Sanders et al 2008). Advanced TOS often requires surgical interventions; fortunately the condition is relatively uncommon.



On the other hand, patients with **Simple TOS** present with more subtle and intermittent neurological and/or vascular symptoms that are associated with specific postures and activities. Medical imaging, vascular imaging and nerve conduction tests are not indicated for Simple TOS as the tests will likely prove negative. Based on a few clinical studies, Simple TOS may be effectively managed with conservative care (Vanti et al 2007). It is hypothesized that identification and appropriate management of Simple TOS early on may prevent progression into Advanced TOS.

The 12 Conservative Management Options

Although there is controversy regarding the ideal specific treatment of patients with TOS, there is little debate that conservative management should be attempted before surgery is considered. A

systematic review found that good results were achieved with conservative treatments in 76 to 100% of neurogenic TOS patients at short-term follow-up and 59 to 88% after one year (Vanti et al 2007). However, poor outcomes with conservative therapy were found when TOS was associated with obesity and worker’s compensation (Novak et al 1995).

It is suggested that neurogenic TOS should be managed conservatively with physical therapy including posture and activity modification, scaleni and pectoral stretches, neural mobilizations, manual therapies, upper extremity strengthening exercises and if required, pharmaceutical interventions for pain control (Buller et al 2015). If symptoms become progressively worse despite conservative care, surgical consultation may be required for Advanced TOS (Buller et al 2015).

The aim of this paper is to review **12 clinically applicable management strategies for TOS**. Admittedly, there are currently no studies to date to support any of the 12 management strategies on their own. Effective management of TOS likely involves a combination of strategies based on the unique presentation and needs of each patient.



Option #1: Repeated cervical extension

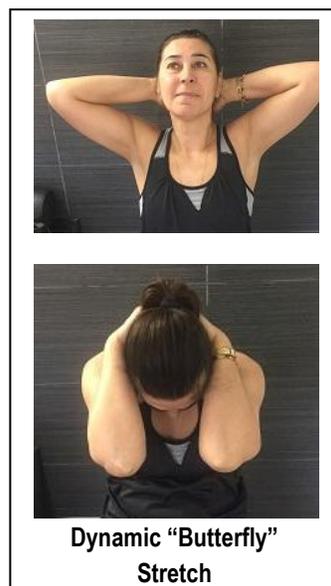
The primary conservative intervention should include patient education on avoiding or at least limiting postures and activities that potentially aggravate TOS symptoms, such as sustained slouched postures and neck flexion (Hooper et al 2010).

Self cervico-thoracic extension mobilizations can be valuable for interrupting prolonged flexed neck postures. The fingers of both hands are placed at the T1-3 spinous processes and a cranial glide is sustained while the neck is actively retracted and extended. This cervical extension exercise may be repeated 3-5 times for every hour of sitting.



Option #2: Repeated thoracic extension

The dynamic “butterfly” stretch may be effective for extending the thoracic spine and for lengthening the pectoral muscles. In sitting, the hands are clasped behind the head and elbows are drawn maximally apart while the thoracic spine is extended. Once end-



range is reached, the elbows are brought together while the thoracic spine is flexed. Each position is held one second and repeated 3-5 times for every hour of sitting.

Option #3: Limit Scapular depression

In order to reduce traction forces on the brachial plexus, sustained scapular depression must be avoided. It is essential to instruct patients to limit the carrying of a heavy purse over the affected shoulder. The carrying of heavy objects or suitcases with the affected arm should also be temporarily limited.



It may also be beneficial to educate patients on the use of pillows and arm rests to support the elbows, therefore minimizing sustained traction forces on the brachial plexus.

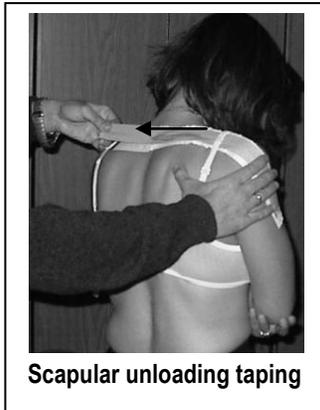
In severe and unresponsive cases of TOS, the temporary use of a sling for a few days may prove to be valuable.



Option #4: Scapular unloading taping

Taping may help provide proprioceptive feedback to reduce scapular depression and unload stresses on the brachial plexus. Have the patient support their elbow in order to slightly elevate their affected shoulder. The tape is applied starting from the deltoid insertion and then pulled across the upper trapezius region to the T1-2 spinous processes.

For this particular technique, a rigid versus an elastic tape is recommended as it may provide greater physical support. Potential risk of skin irritation must be discussed with the patient prior to tape application.



Scapular unloading taping

Option #5: Sleeping posture modifications

If symptoms are particularly worse at night or in the morning, sleeping posture modification is recommended (Crosby et al 2004). A body pillow may help support the affected arm and prevent prone lying. To prevent the arm from being raised above the shoulder while sleeping, the patient can be instructed to place their arm inside the shirt versus out of sleeve; limiting the unwanted shoulder abduction and traction on the brachial plexus.



Use of a body pillow may provide support for the arm and prevent prone lying



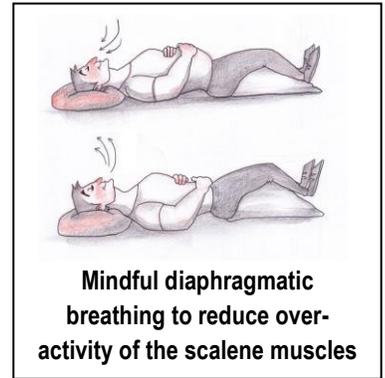
Arm inside shirt to prevent arm abduction at night

Option #6: Diaphragmatic breathing

Relaxed diaphragmatic breathing may help reduce reliance on the accessory respiratory muscles such as the scaleni and lessen the potential elevation of first rib. Scaleni muscle over-activity and an elevated first rib are proposed to be contributing factors to the development of TOS (Novak 2003). In addition, mindful breathing (which is a component of mindfulness meditation) can be an

effective method of relaxation and pain management (Hilton et al 2016).

The patient may also be informed to temporarily limit vigorous aerobic activities that encourage apical breathing and over-activity of the scalene muscles (Walsh 1994).



Mindful diaphragmatic breathing to reduce over-activity of the scalene muscles

Option #7: First rib depression

There are various manual therapies suggested for the mobilization of the first rib, however a daily self-management strategy for addressing the first rib may be more feasible. In sitting, the unaffected hand is used to firmly push a tennis ball down on the affected first rib at the costo-clavicular space. The head is slightly tilted towards the ball in order to relax the ipsi-lateral scalene muscles. With each exhalation the ball is pressed caudally into the first rib in order to assist its depression. Sometimes immediate improvement in active shoulder flexion mobility is noted after only 5-10 breaths.



Self 1st Rib Caudal mobilization

Option #8: Dynamic scalene stretching

Static passive scaleni muscle stretching has been suggested by several authors (Hooper et al 2010, Novak 1996). However, in my opinion, gentle dynamic active stretching of the scalene muscles may provide greater relief and is less likely to cause a flare-up. The scaleni can be lengthened by rotating and side bending the cervical spine away then slightly into extension.

This can be achieved by drawing a large figure 8 with the nose as if there is a pencil at the tip of the nose. This is best achieved with the eyes closed and must be performed slowly and short of pain. The figure 8 neck movement will result in the neck moving into all four quadrants. This exercise must be performed gently and mindfully in order to help normalize the tone of potentially hypertonic cervical muscles.

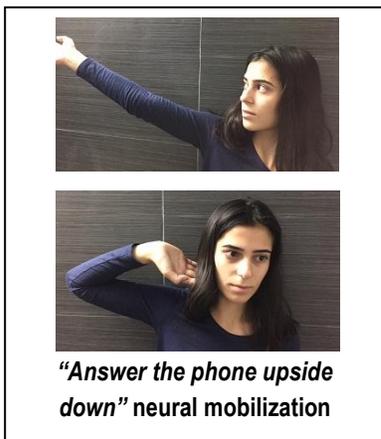


Dynamic scalene stretch using the figure 8 pattern

Option #9: Neural mobilization



“Free the bird” neural mobilization



“Answer the phone upside down” neural mobilization

Various neural mobilizations have been recommended for TOS; these mobilizations must be performed in a pain-free manner to reduce the risk of symptom flare-up (Wehbe et al 2004). Examples of self-neural mobilizations as described by David Butler (2005) include “free

the bird” for the median nerve and “answer the phone upside down” for the ulnar nerve. The patient may be instructed to perform 3-5 repetition of each every 2 hours but to reduce the frequency and range if symptoms worsen.

Option #10: Shoulder strengthening

When tolerated, progressive non-aggravating upper extremity strengthening exercises are necessary to improve postural muscle endurance (Novak 2003). Shoulder girdle strengthening exercises should focus on optimal scapular upward rotation and posterior tilting during arm elevation. The ideal upper extremity exercise program should include the shoulder press using dumbbells or elastic resistance.



Shoulder press with resistive band

Option #11: Tissue distraction release/cupping therapy

Tissue distraction release (TDR) may be an effective method of reducing tension on myofascial structures contributing to TOS such as the scaleni and the pectoral muscles. TDR is a fairly painful procedure and can lead to significant temporary skin discoloration, therefore it is imperative that informed consent be received prior to application. TDR cups including the e-manual with instructions, indications and contra-indications are available on www.apeti.ca/shop.



TDR: Scaleni

TDR: Pectorals

Option #12: Bra modification (if required)

In rare cases, heavy breasts in females may be a contributing factor to the sagging shoulder posture and TOS symptoms. Therefore, the use of custom measured supporting bra with wide, crossed back straps is recommended. In exceptional cases, reduction mammoplasty surgery has been recommended, as women post breast reduction have demonstrated improved posture and reduced spinal pain associated with heavy breasts (Chao et al 2002, Mackinnon et al 2002).



Supporting bra with wide, crossed back straps

Surgical Management Options

In the past, TOS surgical interventions have been questioned “*whether surgery should be done at all for a condition that is vague and controversial.*” (Cherington 1992). However, the more recent studies support surgical management for Advanced arterial and venous TOS because of the potentially limb-threatening complications that can result from the vascular compromise. A systematic review has shown that 90% of patients with arterial or venous TOS have significant symptomatic relief following TOS decompression surgical procedures that also included vessel reconstruction (Peek et al 2016). Although potentially effective for arterial and venous TOS, surgical interventions for neurogenic TOS have been shown to have poor surgical outcomes, possibly because of previous irreversible nerve damage (Buller et al 2015).

The most common surgical treatment for TOS is referred to as supraclavicular decompression



First rib resection surgery

Image courtesy of Youtube: University of Maryland Vascular Surgery

which involves scalenectomy, neurolysis and the resection of the first rib. This surgery requires on average 5 days of hospital stay (Vemuri et al 2013). Isolated pectoralis minor tenotomy is a relatively low-risk outpatient surgery which has been shown to be as effective as supraclavicular decompression on selected patients with neurogenic TOS (Vemuri et al 2013).

Perhaps prior to considering surgery, there are now some studies supporting botulinum toxin (BTX) injections for relaxing the anterior scalene, pectoralis minor and subclavius muscles in the management of TOS (Foley et al 2012), however further research is needed.

Summary

The aim of this two part paper was to review the classification system for diagnosing TOS and discuss twelve potential physical therapy and self-management options for treating this sometimes challenging condition. In rare cases, those who are unresponsive to conservative care may require further medical investigations and a surgical consult. Future research investigating the efficacy of physical therapy incorporating the twelve management options reviewed in this paper is necessary.

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