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Remission of arterial thoracic outlet syndrome in a 67-year-old man after chiropractic treatment: A case report

Abstract

Objective:

This study aimed to describe the treatment of a 67-year-old male construction worker diagnosed with arterial thoracic outlet syndrome (aTOS) under chiropractic care, supplemented with thermal imaging findings.

Case presentation:

A 67-year-old man presented to a chiropractic clinic with paresthesia in his left medial arm, forearm, and the first to the fourth digits for 4 months, and a colder left forearm and palm. Physical, neurological, and orthopedic examination results demonstrated minimal neurological findings. Adson's test yielded positive results for the affected arm, and percussion of the supraclavicular fossa recreated the patient's symptoms. Imaging findings confirmed objectively colder left forearm and palm, and cervical disc degeneration post prominent at C3/4 and C5/6. Based on the results, the working diagnosis of Arterial thoracic outlet syndrome was established.

Intervention and outcome:

High-velocity, low-amplitude chiropractic manipulative therapy of the cervical and thoracic spine, scraping therapy, stretching therapy, and lifestyle and postural advice were provided to the patient. Skin peeling, paresthesia, and temperature differences improved after the third week, totaling 7 treatments. Treatment results were maintained at the eight-week follow-up, with only occasional numbness that subsided when stretching was applied to the shoulder and hand. No temperature difference between the palms and arms was observed at follow-up.

Conclusion:

Our patient demonstrated an improvement in aTOS under chiropractic care. Chiropractic therapy may play a role in managing aTOS patients. Thermal imaging could be a valuable tool for clinicians when diagnosing arterial based conditions including thoracic outlet syndrome, especially in regions where advanced imaging tools such as computed tomography or magnetic resonance imaging are not available.

Keywords: vascular thoracic outlet syndrome, cold hand, chiropractic care, arm numbness, manipulation

Introduction:

Thoracic outlet syndrome (TOS), first described in 1956,[1] refers to a set of conditions in which one or a combination of the following symptoms are present in the upper extremity and surrounding structures: pain, altered blood circulation (symptoms may include pallor, cyanosis, coldness, and early fatigability), muscle weakness or atrophy, and paresthesia.[2-5] These symptoms are the result of compression of the neurovascular bundle located at the scalene triangle , costoclavicular space and pectoralis minor space by cervical ribs, space-occupying lesions, changes due to repetitive injury to the area, and other soft tissue changes.[6,7] Some other conditions that are related or having similar presentations can include Takayasu's Arteritis, Thromboangiitis Obliterans, Hypothenar Hammer Syndrome and Raynaud's Phenomenon.[8]

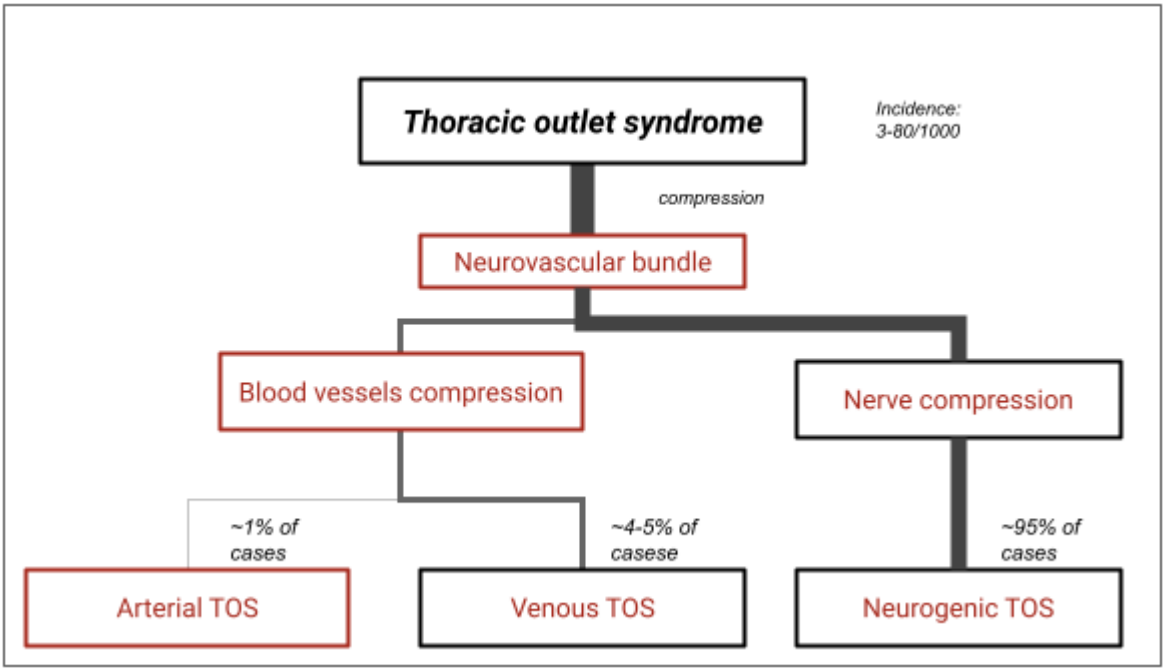

Fig.1 Categories of TOS by etiology with incidence rate of TOS.

Arterial TOS (aTOS) is an uncommon subset of TOS (~ 1% of total cases) and is often associated with cervical ribs, soft tissue anomalies, and clavicle fracture.[7,9,10]. This case report describes the treatment of a 67-year-old male construction worker with paresthesia of left medial arm, left forearm, and the left first to the fourth digits; cold left forearm and palm; and chronic neck pain under chiropractic care. On the basis of his presentation, assessment, and the absence of cervical ribs or other structural changes on imaging results, the patient was diagnosed with aTOS. The patient showed an improvement after chiropractic care.

Case presentation

History

A 67-year-old man presented to a chiropractic clinic with paresthesia in both his dorsal and palmar aspects of left medial arm, forearm, and the first to the fourth digits of 4 months duration. The patient described numbness as constant. He tried massaging and performing self-prescribed stretching exercises on his forearm, but failed to improve. The patient was a right-hand dominant interior decoration and renovation worker with chronic neck pain for the preceding 3 years. The onset of his chronic neck pain was nonspecific with the patient did not recall any spraining or injuries the precedes the onset. His neck pain was described as a constant dull ache over the lower cervical region, with a rating of 2/10 on the numerical pain rating scale. Cervical traction therapy by a physiotherapist and medications by a general practitioner, including ibuprofen and gabapentin, were prescribed to the patient 3 years prior. Patient was instructed to take these medication as needed in conjunction with physiotherapy. He went for physiotherapy twice per week for 4 weeks (8 sessions in total), but did not provide any relief. However, the neck massage provided relief; therefore, he visited the massage therapist once a week to continue his heavy work.

The patient reported skin peeling of his left hand together with a colder left palm for the past 3 years, for which he considered that the temperature difference was normal. In the past, he had consulted a dermatologist for skin peeling. The dermatologist attributed the cause of skin peeling to an allergic reaction to certain commonly-seen chemicals and irritants present in his working environment and paints.

Past trauma, medical, and family history

The patient had no relevant medical or family history. He did not recall any significant falls, sprains, straining, or history of trauma. However, the patient reported slight spraining frequently around his cervical and shoulder areas because of his work, which resolved mostly without any intervention.

Assessment

Upon observation, the patient demonstrated a forward head carriage, rounded shoulders, and skin peeling of the left palm, which was also slightly colder than the right hand (Fig.2a).

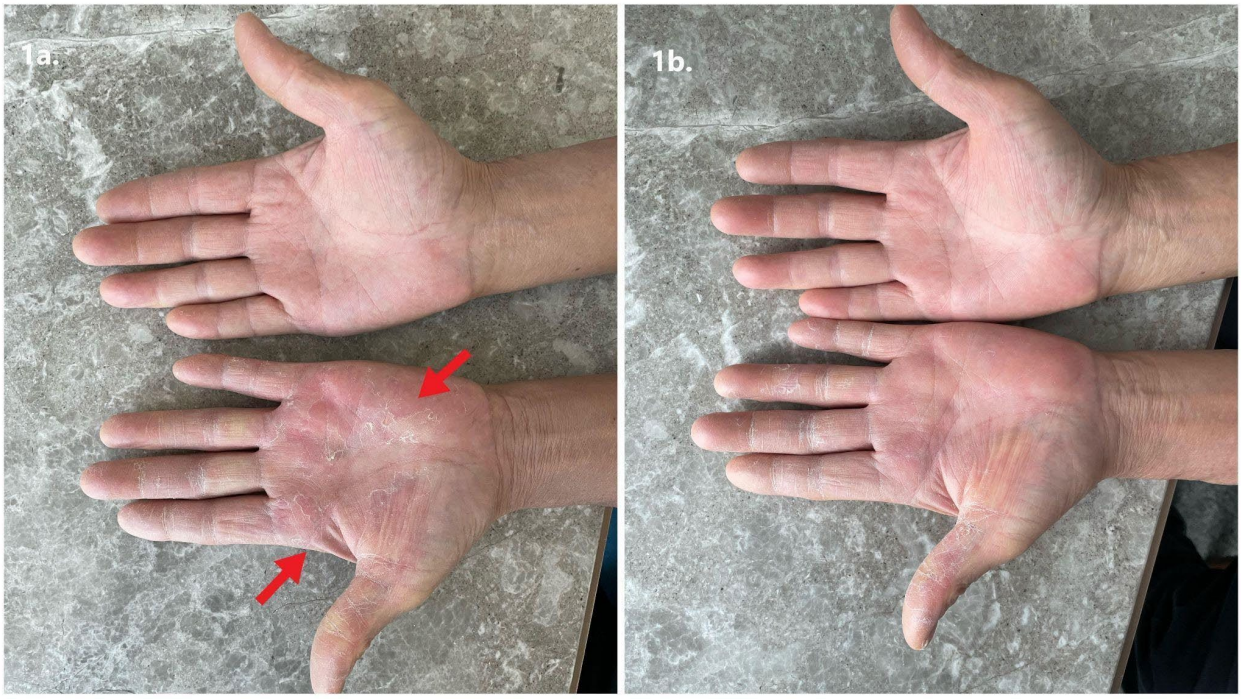

Fig.2 a) State of skin peeling during initial consultation with peeling mainly on the palmar surface of left hand and b) skin peeling after

The active cervical range of motion (aROM) was restricted to 10° in extension, 5° in lateral flexion, and 25° in rotation. The left shoulder aROM was tight and limited at 140° (mean left shoulder flexion range 159.9°, SD:18.1), abducted at 70° (mean left shoulder abduction range 149.7°, SD:20.3), and external rotation at 60° (mean left shoulder abduction range 55.7°, SD:17.4).[11] The aROM of right shoulder is full with no pain. Only mild muscle tension was noted at the end ranges.

The anterior and middle scalene, supraspinatus, infraspinatus, teres minor, subscapularis, upper trapezius, and sternocleidomastoid on the left were tender and rigid to palpate. However, trigger point palpation with firm pressure of these muscles was unable to recreate his symptoms. Paresthesia was reproduced when the left supraclavicular fossa was compressed. Percussion of the left supraclavicular fossa also provoked paresthesia of the left medial arm, forearm, and fingers. Joint play of the cervical spine revealed restriction at the C3/4, C5/6, C7/T1, and T3-6 levels.

During neurological examination, no motor or sensory deficits were observed. All upper-limb deep tendon reflexes were rated 2+. When Adson's test was performed on the affected limb, it was able to reproduce numbness and reduced radial pulse. Allen's test did not produce any positive results. The Spurling's test and upper-limb tension tests (ULTT) failed to reproduce the patient's symptoms.

Magnetic resonance imaging (MRI) revealed cervical disc bulges at C3/4 and C5/6 (Fig.3), causing mild spinal stenosis at these levels (Fig.4). The C6 nerve root that exits

the C5/6 level governs the C6 dermatome located at lateral forearm and the thumb. However, the disc bulge at C5/6 on the patient was towards the right side, making it very unlikely to be the cause of the patient's numbness.

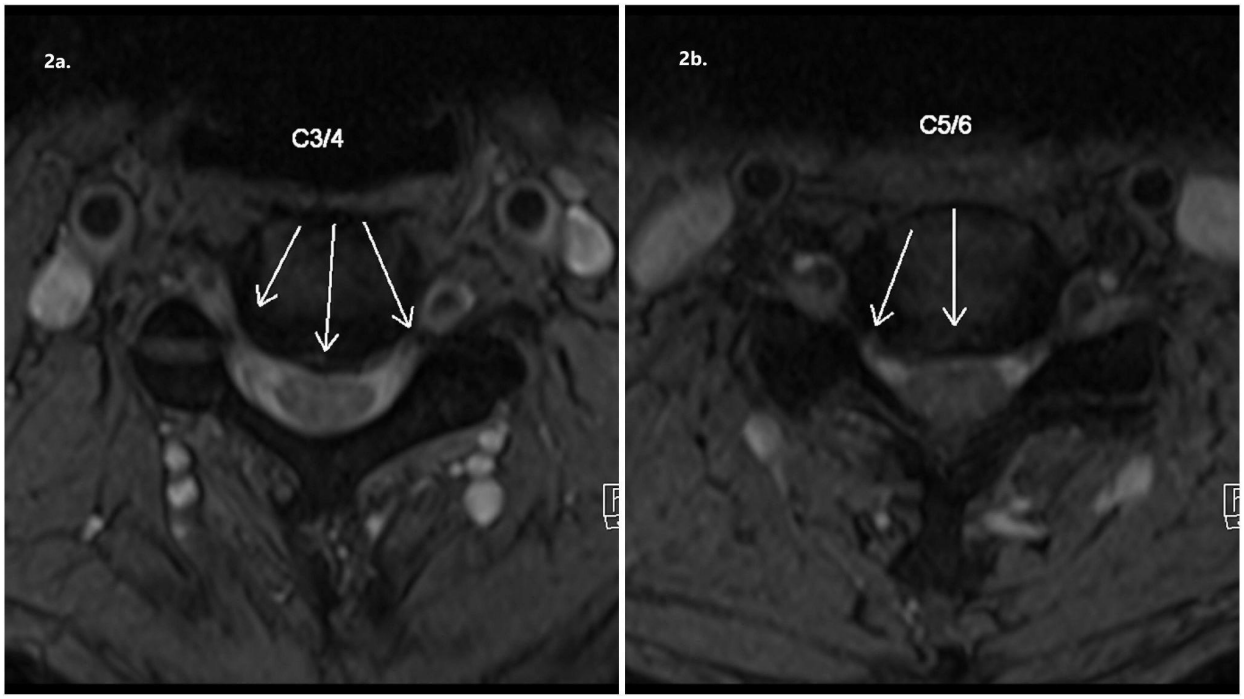

Fig.3 Transverse view of cervical plain magnetic resonance imaging reveals circumferential disc bulge at C3/4 (a) and C5/6 (b).

Fig.4 Sagittal view of cervical plain magnetic resonance imaging. Posterior disc bulge at C3/4 and C5/6 is noted, causing mild canal stenosis.

Thermal imaging was used to evaluate the extent of temperature difference between the two arms, together with the size of the affected area. The imaging demonstrated an objective temperature difference on the left hand (Fig.5a).

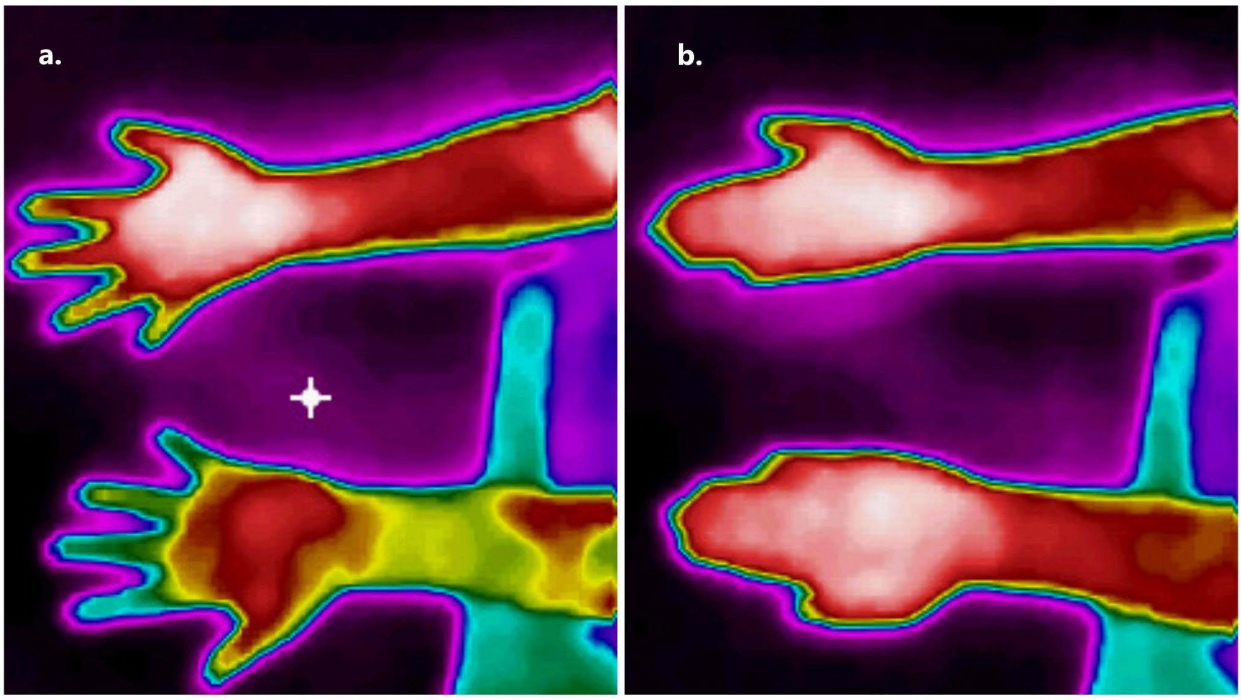

Fig.5 Pre-treatment temperature reading (a) and temperature reading at third week of treatment (b). (a) shows an objectively colder left arm and forearm especially at the finger and distal forearm compared to the right. (b) shows the equalization of temperature after 3 weeks of treatment.

Diagnosis and differential diagnosis

The working diagnosis of Arterial thoracic outlet syndrome (aTOS) was given. Some of the common differential diagnoses of TOS include cervical radiculopathy, carpal tunnel syndrome, peripheral compressive neuropathies, and Raynaud's phenomenon.

The patient's presentation of hypertonic scalene and shoulder girdle muscles, together with his job nature requiring heavy and repetitive shoulder movements, potentially caused the compression of the neurovascular bundle. The failure to respond to cervical traction, ibuprofen, and gabapentin during past treatments; negative Spurling's test; and negative upper limb tension test (ULTT) reduces the likelihood of prominent nerve root irritation. The tenderness and stiffness present when palpating the anterior and middle scalene muscles (doorbell test) is suggestive of local insertional or brachial plexus irritation. However, the absence of changes in muscle strength and deep tendon reflexes in the upper extremities suggests the absence of severe nerve compression or brachial neuritis. The inability of muscle trigger point palpation to recreate the patient's symptoms decreases the possibility of such symptoms being a muscle trigger point referral. These presentations, when combined, point towards a vascular origin of the chief complaint.

Additionally, the results of palpation, ROM examination, and MRI demonstrated degenerative changes in the cervical spine (Fig.4a and 4b).

There was the presence of pallor and an objectively colder left palm on thermal imaging, supplemented with a positive Adson's test on the affected arm and no cyanosis or swelling present. Hence, the working diagnosis of Arterial thoracic outlet syndrome (aTOS) was given.

Some other less commonly seen differentials that have similar presentation to aTOS can include quadrilateral space syndrome, axillary arterial injuries, subclavian artery aneurysm, compartment syndrome of upper limb, and palmar arch injury. These conditions could cause numbness, acute compression, and change in blood flood to their respective areas. However, the etiology of these conditions usually involves trauma, fractures, joints dislocation, bony anomaly, or quick onset of symptoms which were not observed or reported by the patient. [12-16] Nevertheless, these conditions can have severe consequences and may require surgical intervention. Thus, they were kept in the differential.

Management

Conservative management was prescribed because of the absence of neurological deficits and prominent ischemic symptoms. During the first stage of therapy, the patient underwent treatment three times per week for three weeks and was asked to pause his weekly massage session during the first stage of treatment. The treatment consisted of high-velocity low-amplitude manipulative therapy to the cervical and thoracic spine with the aim of improving spinal segmental hypomobility and to relieve muscle spasm. Moreover, stretching therapy, mainly Muscle Energy Technique (MET), was added to further increase cervical, shoulder, and elbow joint mobility, with the aim of minimizing irritation to the neurovascular bundle. The patient was advised to minimize the forward head carriage through conscious awareness of head position to reduce the pressure on the neurovascular bundle.[17,18] The patient was instructed to perform all exercises to avoid aggravation of his symptoms. He was also instructed to observe any changes to the symptoms that may suggest the worsening of TOS, such as weakness or numbness. Skin peeling and thermal imaging were periodically performed to follow the state of subclavian artery compression. By the third week after his initial visit, his skin peeling had improved (Fig.2b). The paresthesia also showed improvements, with only mild numbness that occurred while lying on the affected side at night whilst sleeping. The temperature difference also disappeared on thermal imaging (Fig.5b), with a negative Adson's test on re-evaluation at the end of three weeks of multimodal chiropractic therapy.

During the second stage of therapy, the visit frequency was reduced to once or twice per week for five weeks because of symptom improvement. Further behavioral recommendations such as avoiding repetitive shoulder movements were provided to avoid compressing the neurovascular bundle. The scalene muscles were still tender to

palpate at this point; however, percussion of the supraclavicular fossa no longer produced numbness. During follow-up in the eighth week of treatment, the patient's condition showed sustained improvement. The patient was placed on maintenance care once a fortnight for 3 months before re-evaluation. The numbness occurred occasionally but disappeared immediately on stretching his shoulder and hands; palm pallor and coldness did not return.

Discussion

Based on the specific structure or vessel affected, TOS can be largely grouped into neurogenic TOS (nTOS), aTOS, and venous TOS (vTOS).[7,9,19] The majority of TOS are nTOS (approximately 95%) with only 4%–5% being vTOS, while the scalene triangle, costoclavicular area, and subcoracoid space are typically the sites of subclavian vein compression. In terms of aTOS (~ 1% of the total TOS cases), 50% of the patients had cervical ribs, 33% had soft tissue anomalies, and 5% had a history of clavicular fracture, which caused artery compression.[7,9,10] Although there are no widely accepted estimates, the incidence rate of TOS is approximately 3–80 per 1000, and it usually occurs between the adolescent age and middle-age (especially in women between 20 and 50 years old).[6,7,20,21] nTOS can be further classified into true nTOS and disputed nTOS, of which true nTOS is classically a unilateral condition in female[7]. vTOS predominantly affects populations that undertake repetitive upper extremity motion and is more common in the dominant arm of young men.[7,22] aTOS, on the other hand, does not seem to affect one particular sex; it is more common in young adults with congenital changes such as cervical rib.[6]

Owing to the overlapping (and sometimes concurrent) nature of TOS with other conditions, the diagnosis of TOS could be difficult. Therefore, it should be accompanied by a thorough history, provocative tests that target suspected compromised structures, and imaging findings to differentiate numerous possible differential diagnoses.[23] Some common provocative tests include the elevated arm stress test (EAST), ULTT, and Adson test. Anatomic changes such as cervical ribs and acquired anatomic anomalies such as muscle hypertrophy should also be considered when diagnosing TOS[24]. Imaging tools such as radiography, computed tomography (CT) /MRI, electromyography (EMG), and duplex ultrasound can provide essential information for identifying anatomical changes, soft tissue anomalies, and blood flow changes respectively.[19,25-27]

Currently, there is still no consensus on the universal diagnostic criteria of TOS;[28] thus, clinicians are advised to gather comprehensive information during consultation to differentiate the structures involved and supplement the results with imaging modalities. This case report demonstrated an instance where thermal imaging, an inexpensive, easy-to-operate, and readily available tool, can help confirm an objective temperature difference of the upper extremity possibly resulting from blood circulation changes, which can help clinicians in regions where advanced imaging tools such as CT or MRI are not available. A UNI-T® UTi320E Infrared thermal imager was used in this case, but any

thermal imaging tool with the range that includes the normal human temperature and the sensitivity to one decimal point will function equally well.

Conservative treatment is the preferred treatment option if there are no significant signs of neurological changes, vascular obstruction, or ischemia;[29] treatment should be a combination of passive treatment, rest, patient education, behavioral modifications, and anti-inflammatory medication.[30] As there is no consensus on the universal diagnostic criteria of TOS, there is also no consensus on the optimal conservative treatment combination.[30,31] Treatment should focus on the affected structure and aim to relieve compression in the compressed area. Motions such as elevation and retraction of the scapula have been shown to be effective in relieving TOS symptoms in recent studies.[30,32] In cases where TOS is the result of scalene muscle compression and fails to respond to conventional conservative care, botulinum toxin or steroid injection to the involved muscles can also be considered.[33-36] Surgical intervention is warranted if extrinsic compression of the neurological bundle is present, and the patient fails to respond to conservative treatment.[29]

Although a few studies have assessed the chiropractic management of nTOS, only a few reports were found on chiropractic management of aTOS specifically. Also, there seems to be a lack of established objective method to quantify the temperature differences between extremities(one of the hallmark signs of aTOS.) in diagnosing TOS, and quantifying the extent of temperature changes. The use of thermal imaging in diagnosing aTOS and demonstrating the changes of temperature before-and-after treatment on this patient, sheds a light on how it can be an objective measure of extremity skin temperature. The skin temperature difference between the left and right side of the body is miniscule(<0.4-0.5 ℃) according to studies on skin temperature differences on human.[37-39] Therefore, the differences of skin temperature is also of significance in both diagnosing and quantifying treatment outcome. Thermal imaging can be incorporated in TOS, aiding diagnosis, treatment, and research. Chiropractic multimodal management that combines soft tissue therapy and behavior modification in patients with aTOS in the conservative treatment phase can be invaluable to patients.

Limitations:

Due to limitations associated with the case report, different compounding factors may present in different patients, limiting treatment results as they may not be reproducible in other cases of TOS. The lack of consensus on the universal diagnostic criteria of TOS has led to the diagnosis and direct comparison of aTOS to other studies difficult. The small number of chiropractic treatment reports for aTOS further increased the difficulty of comparison and contrast. Therefore, the generalizability of our result is limited.

Conclusion

TOS is a complicated condition for diagnosis and treatment due to its overlapping and sometimes concurrent nature with other conditions, other subtypes of TOS, and the number of structures involved. The lack of universal diagnostic criteria for TOS further complicates its diagnosis and treatment of TOS. Chiropractic care can theoretically offer improvements to patients with aTOS (and, by extension, other types of TOS) by reducing compression of the neurovascular bundle, as demonstrated in this case report. Thermal imaging can also assist clinicians in obtaining objective findings when advanced imaging tools, such as CT or MRI, are not available.

Conflict of interests

The authors reported no potential conflict of interests

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