

Chiropractic Treatment of Dorsal Scapular Nerve Entrapment

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ABSTRACT

Objective: The purpose of this case series is to describe the diagnosis and management of dorsal scapular nerve neuralgia in two patients. Both patients presented uniquely by having full strength of their rhomboids and levator scapula, and had a chief complaint of burning and tingling along the medial scapular border.

Clinical Features: Two patients presented with a chief complaint of paresthesia in the dorsal scapular nerve distribution. While the differential diagnosis included dorsal scapular nerve entrapment and notalgia paresthetica, these cases show the efficacy of treating without the use of advanced imaging techniques, nerve blocks, and/or electrodiagnostic studies.

Interventions and Outcomes: Both patients received chiropractic manipulation to their cervical and/or thoracic joints, had skin rolling performed over the distribution of the dorsal scapular nerve, and post-isometric relaxation (PIR) performed on the posterior and/or middle scalene muscles. Both patients had complete resolution of the presenting complaints at follow up.

Conclusion: Chiropractic care, including spinal adjustments, skin rolling, and PIR may be beneficial for patients with dorsal scapular nerve entrapments. While confirming a diagnosis may require advanced imaging, nerve blocks, and electrodiagnostics, it may not be needed to treat a patient successfully.

Key Words: Dorsal Scapular Nerve; Chiropractic

INTRODUCTION

Dorsal scapular nerve entrapment is a relatively rare diagnosis. In fact, the anatomy of the dorsal scapular nerve is highly variable, along with the potential locations of the entrapment and causes of symptoms. Discussion of the treatment of dorsal scapular nerve entrapments is also lacking and highly variable, including conservative care, hydrodissection, extracorporeal shockwave therapy, and botulinum toxin injections.^{1,2,3,4} When dorsal scapular nerve symptomatology is present, it can result in a spectrum from no motor weakness to complete atrophy and weakness of the rhomboids, and occasionally the levator scapula.⁵ When motor weakness occurs, it generally results in a winged scapula.⁶ It also may create tightness in the muscles it innervates.⁵ Additional symptoms may include paresthesia (tingling, burning, itching) medial to the scapula.^{3,5} This is thought to be caused by stretching and/ or compression of the nerve, causing inflammatory mediators to create scar tissue, swelling, and adhesions that prevent the nerve's ability to move.^{7,8,9} Due to entrapments at the scalene, cervical rotation and extension may recreate or intensify symptoms.¹⁰ It is often associated with repetitive overhead athletes and workers, chronic postural strain, post-surgery/ bracing, or post motor vehicle accident (MVA).⁵

The dorsal scapular nerve generally originates from the C5 nerve root anterior ramus through the middle scalene, and projects inferolaterally between the upper trapezius and the levator scapula, traveling inferiorly down the medial border of the scapula to about T7. The dorsal scapular nerve innervates the rhomboid major and minor. 48% of the time it innervates the levator scapula, and 52% of the time it innervates the rhomboid major, minor, and levator scapula.¹¹ **Table 1** shows the variance of the origin of the dorsal scapular nerve.

Table 1:

Origin of Dorsal Scapular Nerve	Percentage of Origin of Dorsal Scapular Nerve
C5 nerve root anterior ramus	17.9% ¹² , 95% ⁶ , 75.8% ¹³ , 70% ⁹
C4 nerve root anterior ramus	28.4% ¹⁴ , 22% ⁹
C6 nerve root anterior ramus	8% ⁹
C4 and C5 nerve roots anterior rami	7.6% ¹³ , 100% ¹⁵ , 23.1% ¹²
C5 and C6 nerve roots anterior rami	5% ⁶
C5 nerve root anterior ramus with a shared trunk with long thoracic nerve	30.4% ¹¹
C3-4 nerve root anterior ramus bilaterally	100% [n=1] ⁸
Superior trunk of brachial plexus	9% ⁷

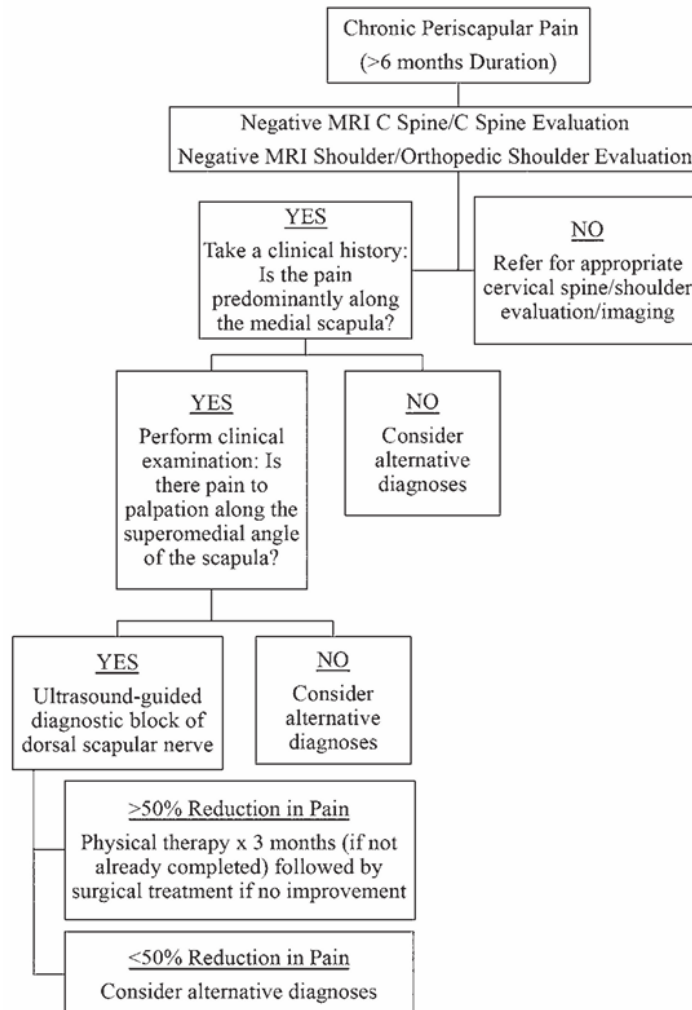
Additionally, the entrapment points vary. The most common entrapment point is the middle scalene, but the middle and posterior scalene can entrap the dorsal scapular nerve, as well as the levator scapula. **Table 2** shows the common entrapment sites and how likely the dorsal scapular nerve is entrapped at that sight.

Table 2:

Entrapment Site	Percentage of Entrapment at Site
Middle Scalene	74% ¹¹
Middle and Posterior Scalene	6.4% ¹³
Levator Scapula	25.7% ¹⁴
Anterior to Middle Scalene	13% ¹¹
Posterior to Middle Scalene	13% ¹¹

There is no gold standard to diagnose dorsal scapular neuralgia. Ottestad et. al used **Figure 3** to diagnose dorsal scapular neuralgia in chronic periscapular pain.¹⁶

Figure 3



Sultan et. al used electrodiagnostic studies to diagnose dorsal scapular neuralgia.⁸ Electrophysiologic abnormalities of the dorsal scapular nerve were found in 52.7% (29 of 55) of people with unilateral periscapular pain.⁸ Interestingly, only 16.4% (9 of 55) had scapular winging.⁸

While utilization of these studies are both appropriate and effective, conservative care providers may have difficulty following the flowchart. It would be difficult to clinically justify all advanced diagnostic tests required due to the need for referrals and authorization. Justification is difficult prior to initiating a trial of care due to the amount of time needed for prior authorization to become approved, both in the amount of time needed to spend on the paperwork and/ or phone calls on the prior authorization, and the amount of time needed to wait for a response. In 2017, the American Medical Association conducted a study that found each physician needs 14.6 hours per week dedicated solely to completing prior authorization forms.¹⁷ Individual insurance carriers also vary in the time it takes to accept or deny prior authorization. This does not include the amount of time needed before an imaging center has an availability for the patient and the time needed to write the report. Conservative care providers also must consider the risk of rejection of the advanced diagnostic tests, further increasing the amount of time between initial presentation and the patients' diagnosis and treatment. In the amount of time this would take, a trial of care may be nearly complete and the patient can experience relief of symptoms.

The differential diagnosis for disorders that must be ruled in/ out when considering dorsal scapular neuralgia include notalgia paresthetica, and C5 radiculopathy.⁵ The key difference between dorsal scapular neuralgia and notalgia paresthetica is the absence of weakness of the rhomboids with notalgia paresthetica. There may, however, be a link between notalgia paresthetica and dorsal scapular neuralgia.⁵ Dorsal scapular neuralgia may cause adhesions and taut bands within the rhomboids, resulting in entrapment of the thoracic medial cutaneous nerves from the thoracic posterior primary rami that supply the area.⁵ Without motor weakness, it is difficult to differentiate between notalgia paresthetica and dorsal scapular neuralgia. Clinically, recreating the tingling/burning/itching by moving the neck or sustaining pressure on an entrapment point may assist in deciding whether it is dorsal scapular neuralgia causing notalgia paresthetica, or only notalgia paresthetica. The dysesthesia and pruritis commonly seen medial to the scapula can be created due to the adhesions along the course of either the dorsal scapular nerve or thoracic medial cutaneous nerves.⁵ A C5 radiculopathy differs by having pain/ symptoms in the C5 dermatomal distribution, weakness of the biceps and deltoid muscles, sensory loss, and reflex loss. Additionally, the orthopedic cluster of cervical distraction relieving arm symptoms, Spurling's recreating arm symptoms, positive upper limb tension test, and cervical rotation <60 degrees with recreation of arm symptoms should have 3 of 4 or 4 of 4 positive in a C5 radiculopathy. 3 of 4 positive tests lead to a specificity of .94 and a + Likelihood Ratio of 6.1 and 4/4 positive tests has a specificity of .99 and a + Likelihood Ratio of 30.3.¹⁸

CASE PRESENTATION 1

Subjective: A 32-year-old female presented to the clinic with chief complaints of right sided neck pain and burning along the medial border of her scapula to about T6-7. This had

been present for greater than 2 years without known cause. She had received cervical radiographs, which were deemed unremarkable, as well as corticosteroid injections, muscle relaxants, and a trial of physical therapy; none of which resolved her problem. She stated that when she works as a Certified Nursing Assistant, the symptoms increase, especially when wrapping her arm around a patient. Symptoms also increased when driving while holding the steering wheel with her right hand, and sitting. Symptoms are present throughout the day. The only remarkable past medical history of the patient was an overactive bladder, diagnosed seven months prior.

Objective: Upon inspection, she had no evidence of scapular winging, rhomboid atrophy, or hyperpigmentation in her thorax. The patient had full cervical range of motion in all directions. Active range of motion was less than passive range of motion, with minor neck pain noted on flexion, extension, and bilateral rotation. No arm symptoms were elicited upon cervical ranges of motion. Soft tissue examination revealed a hypertonic right levator scapula, relatively hypotonic right paraspinal/ intrinsic muscles at C3, tenderness and trigger points over the medial right rhomboid major, tenderness at the superior angle of the scapula, and hypertonic right middle and posterior scalene muscles. With sustained compression of the posterior scalene, burning increased at the border of her right medial scapula. Palpation along the length of the dorsal scapular nerve induced patient reported tenderness. A C3 left lateral flexion restriction was found that did not change the burning symptoms or induce change in the patient's thoracic spine. The performed neurological examination was unremarkable with the exception of mild loss of pinprick sensation lateral to C3 on the right. Her motor strength in her upper extremities were all 5/5 and symmetrical including scapular protraction and retraction. All other sensory tests were unremarkable in all dermatomes, reflexes were 2+ at the biceps, brachioradialis, and triceps. Hoffman's sign and Tromner's sign were unremarkable. Orthopedic tests performed included Spurling's, Cervical Compression, and Cervical Distraction, all of which were unremarkable.

Assessment/Plan: The patient was diagnosed with a chronic dorsal scapular nerve entrapment, likely at the posterior scalene. A trial of conservative care was recommended for 2x/ week for 3 weeks consisting of cervical adjusting, post-isometric relaxation of the right posterior scalene, and skin rolling over the course of the dorsal scapular nerve. At subsequent treatments, PIR of the right middle scalene and manual cervical traction for 6 sets of 10 seconds were also administered.

Results: The patient was noncompliant with the treatment frequency, but after 4 visits over 22 days, on her 5th visit on day 24, she reported that she had no neck pain and minimal burning, which now is concentrated to just her superior angle of the scapula. After a subsequent 5 treatments, she reported complete relief of symptoms. There were 9 total treatments over the course of 56 days.

CASE PRESENTATION 2

Subjective: The second patient was a 41-year-old female with a 3-month history of right sided posterolateral and anterolateral neck pain and pain and tingling down the medial border of her right scapula to about the level of T6-7. Although she could not pinpoint an

exact cause, the patient stated her rolling onto her pillow using her neck may be the cause. She has had no prior treatment for this condition. She states that turning her neck to the left increases her neck pain and both neck pain and pain/ tingling at her right medial border of the scapula get worse as the day progresses. Using a massage gun on her neck and back are the only temporary palliative factors. They also reported full strength in her arm, shoulder, and scapula, and denied radiating arm symptoms. She has had no prior imaging for this condition. Her past medical history was remarkable for a partial thyroidectomy 13 years ago, a tonsillectomy, seasonal allergies, GERD, and a hiatal hernia.

Objective: Upon objective examination, no evidence of scapular winging, rhomboid atrophy, or hyperpigmentation in her thorax was noted. Her cervical range of motion was full in all directions, with neck pain upon bilateral rotation and lateral flexion, with her active range of motion being less than passive range of motion. Range of motion testing did not create arm symptoms. Soft tissue examination revealed a hypertonic right posterior scalene that did not increase the symptoms with digital overpressure, a trigger point in her right upper trapezius that recreated her posterolateral neck pain, tenderness at the superior angle of the scapula, and tenderness with mild tautness of the medial portion of the right rhomboid major. Tenderness along the course of the dorsal scapular nerve was elicited with palpation. A right rotation restriction of C2 and a C3 left lateral flexion restriction were present with pain in the cervical spine only, along with restrictions from T5-T10 with local tenderness only. Her neurologic examination was unremarkable- she had full strength in both upper extremities, full sensation for both upper extremities, and 2+ reflexes at the biceps, brachioradialis, and triceps. Orthopedic examination was unremarkable for Spurling's, Cervical Compression, Cervical Distraction, and Maximal Foraminal Compression testing.

Assessment/Plan: She was diagnosed with a chronic dorsal scapular nerve entrapment, likely at the posterior scalene. A six-appointment trial of conservative care was recommended, on a schedule of 2x/week for 3 weeks. Recommended treatment would consist of cervical and thoracic adjusting, PIR of the right posterior scalene, ischemic compression of the trigger point in the right upper trapezius, and skin rolling along the course of the dorsal scapular nerve. She also presented with a separate hip complaint that is unrelated to the dorsal scapular nerve entrapment that was treated simultaneously. That treatment consisted of PIR to the left tensor fascia latae, blocking her sacroiliac joints, and adjusting her left hip.

Results: The patient was treated two times over one week, and reported complete elimination of the tingling on the third visit two weeks later. There were 3 total treatments over 21 days.

DISCUSSION

The ability to definitively diagnose dorsal scapular neuralgia as a conservative care provider is challenging due to barriers in obtaining additional diagnostic tests. While following evidence-based procedures for diagnosis would be ideal, clinically for conservative care providers, they are near impossible to follow. A patient may be able to have reduction of

symptoms in the amount of time necessary for a patient to receive advanced diagnostic testing. After ruling out cervical spine pathology with an exam, having no evidence of shoulder pathology due to no weakness, and ruling out contraindications to treatment, conservative care providers will be tasked with deciding whether to treat the patient with a likely diagnosis of dorsal scapular neuralgia, or dorsal scapular neuralgia causing notalgia parasthetica, or ordering advanced diagnostic tests and waiting for the results. In these two cases, there was no cervical pathology and no contraindication to treat.

There are no meta-analyses or systematic reviews present on the conservative treatment of dorsal scapular neuralgia. The only case study that was purely conservative care treated a case of dorsal scapular neuralgia with chiropractic manipulation to the cervical and thoracic spine as well as the upper posterior ribs, trigger point therapy to the scalene muscles, upper trapezius and rhomboids, PIR to the scalene muscles in office and as an at home stretch, as well as applying a high volt galvanized current to the left rhomboids.¹ The patient was treated 5 times over a 1-month timeframe and was symptom free at 1 and 6 months.¹

A study on the comparison of the effectiveness of Extracorporeal Shockwave Therapy (ESTW) vs. isotonic saline injections at both the sternocleidomastoid and middle scalene showed that both had significant impact on reduction of a visual analog scale score (VAS) and percent pain intensity difference, where the injection therapy had a larger treatment effect size than ESTW.² The study, however, did not differentiate between the dorsal scapular nerve entrapment and the spinal accessory nerve in patients, and appeared to apply an intervention to both in both groups. While ESTW can be administered by conservative care providers, more research and/ or data from the current study would be needed prior to its recommendation.

One case study by Agkun followed a patient treated partially with conservative care for a patient with dorsal scapular neuralgia, beginning with using Codman's Pendulum exercises 5x5min/ day, cold gel packs 5x20min/day, paracetamol tablets (4x/ day, 500mg) and meloxicam (1x/ day, 15mg).¹⁹ The patient then progressed to active and passive range of motion of the affected side shoulder and neck, strengthening the rhomboid and levator scapula, and general conditioning training (3x/ week for 1 month) followed by a home exercise program.¹⁹ At both one and two year follow up, the patient had no symptoms.¹⁹

Another case study in which a patient had dorsal scapular neuralgia diagnosed four years post trauma, confirmed by electromyography (EMG) and unremarkable cervical spine MRI and rotator cuff ultrasound, along with rhomboid weakness and scapular winging, had increased rhomboid strength and use of her arm from treatment.²⁰ Treatment consisted of "ultrasound treatment of the left shoulder, continuous passive motion, back and shoulder massage, lymphatic drainage of the upper limb, transcutaneous electrical nerve stimulation applied to the left shoulder and arm, shoulder kinesitherapy, EMG biofeedback (to release the trapezius and better activate the rhomboid), and electrical stimulation of the deltoid. In order to further improve the shoulder ROM, a 100 IU dose of botulinum toxin A (BTA) was injected into the left trapezius, in two sites, to relax the trapezius" as well as pharmacologic pain control measures.²⁰ The duration of rehabilitation, as well as the type, duration, and amount of pharmacologic pain control measures were not mentioned in the report. The

patient was treated with at least two more trials of care over the next 14 months (not explicitly mentioned in the study) before muscle strength and functional arm movements were stated as “satisfactory”, per the report.²⁰ Again, the treatment extends beyond traditional conservative care, and used advanced imaging to diagnose, which may not be accessible to many conservative care providers.

Medical interventions include landmark guided injections, radiofrequency lesioning, botulinum toxin, and surgery. For surgery, 22 patients went through resection of the middle scalene, and all 22 patients reported their symptoms were “mostly relieved” post-surgery.²¹ Radiofrequency lesioning was used in one case study, where the patient reported a 60% reduction in their pain.²² Landmark guided injections into pain points at the neck and T3-4 in 128 patients with dorsal scapular neuralgia showed “excellent” results in 87 patients, “good” in 28 patients, “poor” in 3 cases, and “ineffective” in 2 cases at 6-12 months post injection²¹. 90.9% of patients who required 4 to 6 injections ended up having symptoms after 6-12 months.⁴ Ultrasound guided hydrodissection of the dorsal scapular nerve completely resolved symptoms in a patient at 4 weeks post second injection and 16 weeks after.³ In a study conducted with the use of dorsal scapular nerve decompression surgery on 21 patients, VAS scores decreased significantly ($p < .001$) post operatively, and 71% had a “good” outcome determined by DASH scores, where longer duration of symptoms led to poorer outcomes.¹⁶

To our knowledge, there are no studies that have examined the therapeutic effect of skin rolling on dorsal scapular neuralgia. Skin rolling has been utilized by Maigne to treat thoracolumbar syndrome (Maigne Syndrome) by treating the intersegmental cutaneous nerve supply.²³ The utilization of this technique may be more effective for notalgia parasthetica and the thoracic medial cutaneous nerves. There are some studies reporting patient benefit with skin rolling for fibromyalgia and chronic musculoskeletal pain.^{24,25}

Dysesthesia secondary to dorsal scapular neuralgia appears to be infrequently mentioned in the literature. It is important for clinicians to consider this diagnosis even when motor findings are not present. This follows the theory that the dorsal scapular nerve can become symptomatic due to adhesions and fibrous bands around the nerve after inflammatory chemical release by the nerve. Theoretically, this may cause neuralgia without the patient experiencing loss of nerve function. In order to allow for proper blood flow to the nerve and allow it to move more freely, it makes sense from a neurophysiologic perspective to decrease the tone of the muscles that entrap the dorsal scapular nerve, as well as theoretically reducing the entrapment of the nerve in the fascia due to the adhesions and fibrous bands via skin rolling.

LIMITATIONS

This case series shows a positive response to care for two patients with dorsal scapular neuralgia. This may not necessarily correlate to the general population or others with this condition. More high-quality research and case studies are needed to establish a relationship between the therapies and response to treatment. Due to having multiple interventions for the same diagnosis, one cannot say definitively if one intervention led to the greatest results,

or if it was due to multiple interventions applied together. Patient responses were based on patient subjective statements, not validated outcome assessment tools. No long term follow up was performed on these patients.

CONCLUSION

This case series describes two patients who presented with dorsal scapular neuralgia who appeared to respond positively to conservative treatment that included cervical adjusting, PIR of the posterior and middle scalene, and skin rolling over the distribution of the dorsal scapular nerve. While a definitive diagnosis is lacking due to no utilization of advanced diagnostic testing, providers may be able to treat these patients effectively.

CONSENT

Both patients gave written informed consent for their information to be used in this case series and did not withdraw written consent at a later date.

COMPETING INTERESTS

The author declares no competing interests.

REFERENCES

1. Plezbert JA, Nicholson CV. Dorsal scapular nerve entrapment neuropathy: a unique clinical syndrome. *J Neuromusculoskel System*. 1994;2(4):206–211.
2. Park SH, Kim SH, Kim M, et al. A Novel Therapeutic Approach Targeting Spinal Accessory and Dorsal Scapular Nerves for the Relief of Posterior Neck, Trapezius, and Interscapular Pain. *J Clin Med*. 2024;13(24):7754.
3. Sharma GK, Botchu R. Dorsal scapular nerve entrapment neuropathy managed by ultrasound-guided hydrodissection - a case report. *J Ultrason*. 2021;21(84):74-76.
4. Liu Q-j, Zhang X-p, Xia P, Zhu J, Li J. Clinical analysis of 128 patients with dorsal scapular nerve compression treated with painpoint injections. *Pain Clin J*. 2010;1:10–2.
5. Muir B. Dorsal scapular nerve neuropathy: a narrative review of the literature. *J Can Chiropr Assoc*. 2017;61(2):128-144.
6. Tubbs RS, Tyler-Kabara EC, Aikens AC, et al. Surgical anatomy of the dorsal scapular nerve. *J Neurosurg*. 2005;102(5):910-911.
7. Sultan HE, Younis El-Tantawi GA. Role of dorsal scapular nerve entrapment in unilateral interscapular pain. *Arch Phys Med Rehabil*. 2013;94(6):1118-1125.
8. Mackinnon SE. Pathophysiology of nerve compression. *Hand Clin*. 2002;18(2):231-241.
9. Aker PD, Gross AR, Goldsmith CH, Peloso P. Conservative management of mechanical neck pain: systematic overview and metaanalysis. *BMJ*. 1996;313(7068):1291-1296.
10. Nguyen VH, Liu HH, Rosales A, Reeves R. A Cadaveric Investigation of the Dorsal Scapular Nerve. *Anat Res Int*. 2016;2016:4106981.

11. Ballesteros LE, Ramirez LM. Variations of the origin of collateral branches emerging from the posterior aspect of the brachial plexus. *J Brachial Plex Peripher Nerve Inj.* 2007;2:14.
12. Tubbs RS, Tyler-Kabara EC, Aikens AC, et al. Surgical anatomy of the dorsal scapular nerve. *J Neurosurg.* 2005;102(5):910-911.
13. Martin RM, Fish DE. Scapular winging: anatomical review, diagnosis, and treatments. *Curr Rev Musculoskelet Med.* 2008;1(1):1-11.
14. Malessy MJ, Thomeer RT, Marani E. The dorsoscapular nerve in traumatic brachial plexus lesions. *Clin Neurol Neurosurg.* 1993;95 Suppl:S17-S23.
15. Ottestad E, Wilson TJ. Assessment of outcomes in consecutive patients undergoing dorsal scapular nerve decompression. *J Neurosurg.* 2022;138(5):1411-1418
16. Sharma, S, Russo, A, Deering, T. et al. Prior Authorization: Problems and Solutions. *J Am Coll Cardiol EP.* 2020 Jun, 6 (6) 747–750
17. Wainner RS, Fritz JM, Irrgang JJ, Boninger ML, Delitto A, Allison S. Reliability and diagnostic accuracy of the clinical examination and patient self-report measures for cervical radiculopathy. *Spine.* 2003;28(1):52-62.
18. Akgun K, Aktas I, Terzi Y. Winged scapula caused by a dorsal scapular nerve lesion: a case report. *Arch Phys Med Rehabil.* 2008;89(10):2017-2020.
19. Benedetti MG, Zati A, Stagni SB, Fusaro I, Monesi R, Rotini R. Winged scapula caused by rhomboid paralysis: a case report. *Joints.* 2017;4(4):247-249.
20. Chen D, Gu Y, Lao J, Chen L. Dorsal scapular nerve compression. Atypical thoracic outlet syndrome. *Chin Med J (Engl).* 1995;108(8):582-585.
21. Restrepo-Garces CE, Gomez CM, Jaramillo S, Ramirez L, Vargas F. Dorsal scapular nerve block under ultrasound guidance. Poster presentation ASRA 11th Annual meeting. Miami. 2012
22. Liu Q-j, Zhang X-p, Xia P, Zhu J, Li J. Clinical analysis of 128 patients with dorsal scapular nerve compression treated with painpoint injections. *Pain Clin J.* 2010;1:10–2.
23. Maigne R. Low back pain of thoracolumbar origin. *Arch Phys Med Rehabil.* 1980;61(9):389-395.
24. Hirschberg, GG. Case Report: A Case of Chronic Musculoskeletal Pain Treated Successfully by Skin-rolling Massage. *Journal of Orthopaedic Medicine*, 2000;22(3):99-101.
25. Hirschberg, GG. Skinfold Tenderness and Skinrolling Massage in Fibromyalgia. *Journal of Orthopaedic Medicine.* 1997;19(3)77-82.