CASE STUDY

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Collaborative Pain Management and Movement Systems Impairment Approach in Reducing Pain and Opioid Consumption in a Patient at Risk for Opioid Dependence

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ABSTRACT

Background: Dependence on prescription opioid analgesics has become an increasing public health concern in the United States. Opioids are often prescribed to treat moderate to severe pain. Experts agree that a multidisciplinary approach should be used to treat OAD. Research has shown that chronic neck pain is best treated with a multimodal approach. MSI is an approach that incorporates exercise and education. This study aimed to determine if a collaborative approach by a pain management specialist and a physical therapist, using the MSI approach, can result in pain reduction, improved function, and decreased opioid consumption in a patient who is determined to be at risk of opioid abuse and dependence by the pain specialist.

Case Description: This case involves a woman in her early fifties who presented to outpatient physical therapy following referral from a pain management specialist for longstanding neck and shoulder pain that began after a motor vehicle accident approximately five years earlier. The medical diagnosis was cervical spondylosis without radiculopathy. The patient was identified as being at risk for opioid dependence based on an elevated score on a validated patient-reported screening questionnaire. Physical therapy evaluation using the Movement System Impairment (MSI) framework resulted in movement system diagnoses of Cervical Extension–Rotation Syndrome and Scapular Depression with Anterior Tilt and External Rotation Syndrome.

Intervention consisted of a collaborative interdisciplinary approach involving a pain management specialist and a physical therapist, with weekly physical therapy sessions over six weeks focused on movement correction, postural education, and a structured home exercise program, along with a planned reduction in opioid use and initiation of non-opioid analgesics.

Outcomes included reductions in pain intensity at rest and with activity. Functional disability improved over the six-week intervention period based on a validated neck-specific disability measure. Complete discontinuation of tramadol use by week four, with no opioid consumption reported during the final two weeks of care.

Outcomes: From the initial visit to 6 weeks, the patient's pain at rest was reduced from 4/10 to 0-1/10 on NRS, pain with movement was reduced from 6/10 to 0-1/10, pain after driving more than 30 minutes was reduced from 5/10 to 1/10, and the pain after work was reduced from 10/10 to 3/10. On NDI, her disability was reduced by 16% at the end of 6 weeks. She did not consume any tramadol from week 4 to week 6.

Conclusion: The case report suggests that Physical Therapy can be considered one of the disciplines to treat opioid analgesic dependence. The MSI approach for neck and scapular syndromes was effective in treating this patient. However, Additional studies are needed to examine further the reliability and clinical utility of this assessment approach in broader patient populations. The cervical examination tests included the efficacy of the recommended treatment for cervical diagnosis.

Keywords: Opioid Analgesic Dependence, Movement System Impairment, Chronic Neck Pain, Physical Therapy, MSI, Pain Management.

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INTRODUCTION

Epidemiological data indicate that neck pain affects a substantial proportion of the adult population each year [1]. Chronic neck pain is often unresponsive to treatment. It might prove expensive to treat [1]. Opioids are commonly used in the management of higher-intensity pain conditions [2]. However, the use of opioids can lead to several adverse effects. In 2016, the CDC reported the deaths of more than 17000 individuals due to prescribed opioids [3]. Studies have shown the effectiveness of the MSI approach in treating cervical pain [4, 5]. This case study examines whether a collaborative approach by a pain management specialist and a physical therapist, who is trained in using the MSI approach, can reduce pain, improve function, and decrease opioid consumption in a patient at risk for opioid dependence.

Patient Information:

Approval for this case report was obtained from the Rehabilitation Director at Rush Memorial Hospital. Written informed consent was obtained from the patient before data collection, and access to radiology reports, pain management notes, and other relevant medical records was available through the electronic medical record (EMR).

A woman in her early fifties was referred for outpatient physical therapy following evaluation by a pain management specialist for assessment and management of persistent neck and shoulder symptoms. The onset of symptoms occurred following a motor vehicle accident approximately five years before the presentation, with the patient reporting progressive worsening of symptoms over time.

Pain was reported bilaterally in the region superior and medial to both scapulae, with greater intensity on the left side. Additional pain was noted in the cervical paraspinal region. On the Numeric Pain Rating Scale (NRS), pain intensity was rated as 4/10 at rest and up to 10/10 with activity. The pain was described as aching with intermittent stabbing episodes. Aggravating factors included driving for more than 30 minutes, lying on the left side, and completing full eight-hour work shifts. The patient's occupation required repetitive lifting of approximately five pounds and placing items onto a conveyor belt.

The patient also reported intermittent paresthesia in the left upper extremity, described as a sensation of the arm feeling "dead and tingly." Pain relief was primarily achieved with tramadol 50 mg, which the patient had been taking daily for approximately five years. Previous conservative management included physical therapy focused on upper extremity strengthening and arm ergometry, as well as chiropractic care, with limited long-term benefit.

Magnetic resonance imaging (MRI) revealed moderate to advanced left-sided facet hypertrophy at C3–4 and C4–5 with associated foraminal stenosis. The medical diagnosis assigned was cervical spondylosis without radiculopathy. Past medical history was significant for arthritis and chronic neck pain. At initial evaluation, the patient demonstrated a Neck Disability Index (NDI) score of 36%, indicating moderate disability.

The patient's personal goals included completing full work shifts without pain, tolerating driving without exacerbation of symptoms, and reducing reliance on tramadol.

Physical Examination:

A comprehensive Movement System Impairment–based clinical assessment was used to evaluate cervical and upper extremity movement patterns. The examination was completed by a physical therapist with fellowship training in Movement System Impairment–based assessment. The assessment approach emphasizes identifying habitual movement patterns and postural tendencies that may be associated with symptom development [5,6].

Primary testing consisted of visual and tactile assessment of static alignment and dynamic movement patterns that reproduced symptoms. This was immediately followed by secondary testing, which involved modification of alignment or movement using examiner-applied tactile cues or examiner-directed muscle activation to determine whether symptom behavior changed [6]. A reduction in symptoms during secondary testing was used to confirm a movement-based diagnosis.

Alignment Assessment

Sagittal plane assessment from the left side revealed a forward head posture, scapular anterior tilting, and a reduced thoracic flexion curve. Forward head posture was characterized by increased upper cervical extension with lower cervical flexion [7]. Scapular anterior tilting was believed to reflect restricted pectoralis minor flexibility [8].

As a secondary test, verbal cueing was used to correct the forward head posture, resulting in partial symptom reduction. Manual correction of scapular anterior tilting by the therapist produced a greater reduction in symptoms. Notably, the patient's left upper-extremity paresthesia was significantly reduced following manual correction of scapular alignment.

Posterior view assessment demonstrated that the left scapula was more depressed and abducted than the right. Passive elevation of the shoulder girdle was performed as a secondary test, which resulted in symptom reduction [9]. Based on alignment findings, the movement-based diagnoses suggested were cervical extension–rotation syndrome and scapular anterior tilting with depression syndrome [9, 10].

Movement Impairment Analysis

Standing

Active cervical extension and left rotation were painful and limited. During cervical extension, the patient demonstrated a forward head movement pattern. As a secondary test, she was cued to perform cervical extension while correcting the forward head posture, which resulted in decreased pain and improved range of motion [3].

During cervical rotation, compensatory cervical extension was observed. As a secondary test, the patient was cued to rotate her head about a single vertical axis while the therapist manually assisted with scapular elevation [3, 9,

10]. This modification resulted in a significant reduction in symptoms and confirmed the suspected movement-based diagnoses.

Supine

The active cervical flexion test was positive. When asked to perform cervical flexion in the supine position, the patient demonstrated forward head movement characterized by upper cervical extension and lower cervical flexion rather than uniform cervical flexion. This movement reproduced pain. As a secondary test, the therapist manually guided the patient into upper cervical flexion with head support, resulting in symptom reduction [10].

Arm Elevation

During unilateral arm elevation, dynamic scapular winging was observed, accompanied by left-sided neck pain. As a secondary test, the therapist manually assisted to prevent scapular internal rotation and depression. This modification led to a significant reduction in symptoms [6].

Prone

During active cervical extension in the prone position, the levator scapula appeared to be the dominant cervical extensor, as evidenced by excessive posterior translation rather than sagittal plane rotation [13]. When cued to extend the head about an axis passing through the ears. When the movement was modified, symptom reproduction during task execution was reduced [11].

Quadruped Rock-Back

During the quadruped rock-back task, cervical extension was observed and was believed to be related to passive tensioning of the levator scapula. When cervical flexion was maintained through verbal cueing, movement control improved [10].

Manual Muscle Testing

Upper quarter muscle strength was assessed using standardized manual muscle testing procedures [12]. Assessment of upper quarter muscle performance indicated reduced strength in scapular stabilizing muscles, including key scapular stabilizers responsible for posterior tilt and upward rotation. Evaluation of lower trapezius performance revealed difficulty sustaining appropriate scapular upward rotation and adduction when the shoulder was positioned in prone abduction at 135°. Evaluation of the middle trapezius demonstrated reduced ability to maintain the arm at 90° of shoulder abduction without accompanying scapular winging or anterior tilt [12].

Muscle Length and Mobility

Assessment of cervical mobility revealed restrictions in left rotation and extension. The levator scapula was identified as the dominant cervical extensor rather than the intrinsic cervical extensors. This was evident during quadruped rock-back and active cervical extension, during which passive stretch of the levator scapula resulted in cervical extension.

Pectoralis minor muscle length was reduced. Supine assessment revealed asymmetrical acromial elevation, with greater prominence on the left side, suggesting bilateral pectoralis minor stiffness with left-sided predominance [12]. As a secondary test, the therapist manually applied downward pressure to the acromion while preventing rib cage rotation, which resulted in symptom reduction. These findings support the presence of anterior scapular tilting associated with pectoralis minor stiffness.

Diagnoses and Assessment

Screening for potential opioid misuse was evaluated in a pain management office using the Screener and Opioid Assessment for Patients with Pain (SOAPP), which indicated an elevated risk for opioid misuse.13 The patient was evaluated by a pain management specialist who identified an elevated Screener and Opioid Assessment for Patients with Pain (SOAPP) score, indicating increased risk for opioid misuse and dependence. Based on this risk profile, the specialist recommended limiting tramadol use to no more than two tablets per day and emphasizing non-opioid pharmacologic and conservative interventions.

Physical therapy assessment using the Movement System Impairment (MSI) framework resulted in the movement system diagnoses of:

1. Cervical Extension–Rotation Syndrome
2. Scapular Depression with Anterior Tilt and External Rotation Syndrome

The patient was prescribed duloxetine to address neuropathic pain symptoms and directed to physical therapy delivered using a Movement System Impairment–based approach.

Intervention:

Physical therapy care was delivered over 6 weeks alongside concurrent management by a pain management specialist. Physical therapy focused on reducing pain, improving cervical mobility, and addressing movement impairments using the MSI approach. The Movement System Impairment–based assessment findings were consistent with 1. Cervical Extension Rotation Syndrome 2. Scapular depression, anterior tilt, and external rotation syndrome. The principles behind the treatment were to 1. Avoid or modify postures that lead to forward head or scapular depression and tilting. Modify the range of motion that resulted in compensatory movement patterns, 3. Modify the functional mobility and work in ways to avoid preferred movement patterns, 4. Strengthen the weak muscles that contribute to movement faults, including the deep cervical flexor musculature and key scapular stabilizers such as the trapezius (middle and lower fibers) and serratus anterior. 5. Stretch the stiff muscles that are contributing to poor scapular alignment and motion. This was done using exercises listed in Table 1. Exercises were performed within a pain-free range with emphasis on accurate movement execution and avoidance of compensatory patterns. Dosage consisted of one to two sets of approximately ten repetitions, performed once to twice daily.

Table 1: Exercise prescription

Exercise	Starting Position	Instructions	Purpose	Frequency, Intensity and Duration
Capital Flexion	Sitting with back to the wall along with the head. The patient has 1-2 pillows on her lap supporting the elbows, with instructions to keep the scapulae elevated	The patient practiced rolling her head down with the axis going from ear to ear.	To encourage rotation in the sagittal plane instead of translation. Achieve cervical motion with correct scapular alignment	1-2x/week x 7 days/ week
Cervical Rotation	Same as capital flexion	The patient practiced rotating her head about a vertical axis.	To encourage cervical rotation without compensatory extension in appropriate scapular alignment	1-2x/week x 7 days/ week
Shoulder Abduction and Lateral rotation	Sitting with the back against the wall with shoulders in 90-90 abduction, lateral rotation, and elbow flexion. The patient was also instructed to avoid scapular anterior tilting or winging	The patient practiced sliding the arms up on the wall without compensatory cervical, thoracic, and lumbar extension	Strengthening cervical flexors to maintain ideal cervical alignment during arm elevation. Improve the performance of the Serratus Anterior and the trapezius muscle.	1-2x/week x 7 days/ week
Shoulder flexion	Sitting with the back against the wall with shoulders in 90-90 shoulder and elbow flexion. The patient practiced preventing scapular anterior tilt and winging	The patient practiced reaching up to the ceiling without compensatory cervical, lumbar, and thoracic extension	Same as shoulder abduction and lateral rotation	1-2x/week x 7 days/ week
Shoulder Abduction	The patient stood facing the wall, with the ulnar border of her hand in contact with it. Elbows flexed to the side of her body with GH lateral rotation	The patient practiced sliding her arms diagonally and reach overhead.	Exercise was intended to improve trapezius muscle performance to encourage scapular elevation and upward rotation.	1-2x/week x 7 days/ week
Shoulder Flexion	The patient was asked to stand facing the wall, with the ulnar border of her hand in contact with it. Elbows flexed to the front of her body.	The patient was asked to slide her arms along the wall, reach overhead, and lower them. Avoid scapular tilting and winging	The exercise was intended to improve the Serratus Anterior function	1-2x/week x 7 days/ week
Capital Flexion without head lift/with head lift and assistance/with head lift without assistance	The patient practiced lying supine and maintaining the scapulae in slight elevation and posterior tilt, using a towel under her elbows.	1. The patient practiced curling her chin towards her chest bone. 2. For progression, she was instructed to curl her chin in and lift her head and not to allow the chin to "jut out. The therapist would place their hand under the head for support. 3. Same as two but without the therapist's assistance.	The exercise was intended to improve the deep neck flexor strength.	1-2x/week x 7 days/ week
Pectoralis Minor self-stretch	The patient practiced lying supine and rolling to the left side in order to reduce the scapular anterior tilting	The patient practiced pressing on the coracoid process of the scapula in a postero-lateral direction. She was asked to hold this position for 30-40 seconds.	The exercise was intended to stretch the Pectoralis Minor and reduce the scapular anterior tilt	1-2x/week x 7 days/ week
Cervical Extension	The patient practiced lying prone with her hands under her forehead.	The patient practiced rolling her head back. She was asked to avoid any posterior translation of the head.	The exercise was intended to improve deep neck extensor recruitment and to discourage the use of levator scapula	1-2x/week x 7 days/ week
Trapezius Muscle Exercise Progression 1	The patient practiced lying prone with shoulders abducted, elbows flexed, and hands on the head. Towels were placed under the forehead to maintain neutral cervical alignment and on the shoulders to prevent scapular tilting	The patient practiced raising the arms and pulling the scapulae diagonally toward the spine. The patient was asked to prevent shrugging their shoulders	The exercise was intended to strengthen the lower trapezius muscle.	1-2x/week x 7 days/ week
Progression 2	The patient practiced lying prone with arm overhead and elbows flexed	Same as progression 1	Same as progression 1	1-2x/week x 7 days/ week
Progression 3	Same as progression 2, except the elbows were extended to increase the lever arm	Same as progression1	Same as progression 1	1-2x/week x 7 days/ week
Quadruped Rocking	The patient was asked to assume a quadruped position with the shoulders, hips, and knees in a 90-90 angle. She was instructed to correct the scapular winging using tactile cues.	The patient was asked to rock backward. She was instructed to keep the chin rolled in and to avoid cervical spine extension during the motion.	The exercise was intended to improve serratus anterior performance and stretch the levator scapulae.	1-2x/week x 7 days/ week

Pain Management Session

Pain management sessions consisted of patient education about opioid dependence, the importance of regular therapy and home exercises, and prescription of non-opioid medications.

Follow-up and Outcomes

Assessments were completed at the initial evaluation and repeated at four- and six-week follow-up intervals. 1. Numeric Pain Rating Scale (NRS), 2. NDI, 3. Patient's tramadol consumption. The outcome measures are listed in Table 2.

Table 2: Outcome measures

Measure	Initial Visit	4 weeks	6 weeks
Pain at rest	4/10	2/10	0-1/10
Pain with cervical rotation	6/10	3/10	0-1/10
Pain after work	10/10	5/10	3/10
Pain with driving	5/10	2/10	1/10
NDI	36%	20%	20%
Tramadol consumption	3-4 tabs of 50mg/day	1 per week	None for the past 2 weeks

Pain severity and neck-related functional disability were monitored using validated patient-reported outcome measures, including a numerical pain rating scale and the Neck Disability Index (NDI) [14, 15].

Neck Disability Index

Neck-related functional disability was evaluated with the Neck Disability Index (NDI), a validated patient-reported outcome measure. The Neck Disability Index is scored on a 0–50 scale, with higher scores indicating greater disability, and a 5-point change representing a meaningful clinical difference [15].

Manual muscle testing was performed as described by Kendall.

ROM was assessed using goniometry. Consistency of joint angle measurements using a goniometer is influenced by examiner technique and adherence to standardized assessment procedures [12].

DISCUSSION

As discussed in Table 2, the patient had improvement in pain, function, and reduction in opioid consumption at the end of 6 weeks. Although attendance at all PT sessions was inconsistent, the patient was consistent in their HEP and postural education. This study supports the effectiveness of a collaborative interdisciplinary approach of Physical Therapy and pain management, which was accompanied by reductions in pain intensity and gains in functional capacity, along with a decrease in opioid use. Evaluation of this approach in larger and more diverse patient populations may provide further insight into its clinical utility. Additional research may help further clarify the consistency and clinical applicability of this approach. It would also be helpful to evaluate the inclusion of additional disciplines, such as Pain Psychology, to further improve outcomes.

Conclusion

In this case, coordinated care involving Movement System Impairment–based physical therapy and pain management accompanied by reductions in pain intensity and gains in functional capacity, along with reduced reliance on opioid medication.

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