Incorporating Lumbar Spine Interventions in the Treatment of Adults with Shoulder Pain: A Case Series

Zachary Walston, PT, DPT, OCS
Dallas Roberts, PT, DPT, CSCS
Dale Yake, PT, DPT, OCS, ATC

PT Solutions Physical Therapy, Atlanta, GA

ABSTRACT

Study Design: Case series. **Background and Purpose:** While shoulder pain is common among adults, short- and long-term outcomes remain inconsistent. The purpose of this case series is to describe how incorporating interventions directed at the lumbar spine in addition to traditional scapulothoracic treatment may lead to improved outcomes in patients with complaints of shoulder pain. **Case Description:** Three adults with complaints of shoulder pain were treated with manual therapy and exercise targeting the lumbar spine in addition to the scapulothoracic region. **Findings:** Each patient demonstrated clinically significant improvements in self-reported pain and perceived functional status allowing for return to prior level of all recreational activities. **Clinical Relevance:** This case series shows the use of lumbar spine interventions in the treatment of three adults with shoulder pain. Conclusion: Positive outcomes with shoulder pain and dysfunction suggest the addition of lumbar specific interventions may be beneficial for patients with shoulder pain.

Key Words: upper extremity, physical therapy, therapeutic exercise

BACKGROUND

Of adults with complaints of shoulder pain to general practitioners, the average age is 47 years old with 65% being female.[1] Successful management of patients with shoulder pain is important in order to restore function and improve long-term outcomes. In order to successfully manage these patients, physical therapists need to consider the influence of lower extremity and lumbar mechanics on upper extremity dysfunction and pain. This association between supposedly separate and unrelated anatomical regions can be explained by the concept of regional interdependence (RI). Regional interdependence is the concept that impairments in distant anatomical regions can be connected to a patient's primary complaints in another body region.[2]

Regional interdependence can be supported by looking at research on the influences of the kinetic chain that shows how treatment in one body region can improve outcomes in an anatomically distant region. One example of the influence of the kinetic chain is the anticipatory postural control. Before voluntary movement of your upper extremities, electromyographic studies have found activation and recruitment of postural muscles in the lower extremities, pelvis, and lumbar spine.[3-6] Proximal hip strength and mechanics are shown to be different in individuals with knee pain and therefore may need to be addressed in the treatment of these patients.[7-9] An association between scapular muscles and the kinetic chain can also be seen with increased serratus anterior muscle activation when coupled with activation of the lower extremity and trunk.[10]

Current recommendations for treatment approaches regarding nontraumatic shoulder pain can include nonoperative management with exercises for the scapular muscles or scapular stabilizers, as well as manual interventions to reduce pain levels.[11,12] Treatment strategies using specific and progressive exercises for the rotator cuff and scapular muscles strengthening is more effective at improving pain and function as compared to general, nonspecific movements of the neck and shoulder.[13] Also, interventions to improve scapular motor control have been shown to help reduce pain and improve function in patients with shoulder pain.[14] These approaches are focused on addressing impairments specifically related to the shoulder while other guidelines and strategies suggest addressing distal segments also within the kinetic chain, at the lower extremities, and trunk in shoulder rehabilitation.[15] With the concept of RI and a treatment approach with the inclusion of the kinetic chain, physical therapists can consider the use of interventions to the lumbar spine for the treatment of a patient's primary complaints of shoulder pain.

The purpose of this case series is to describe how incorporating interventions directed at the lumbar spine were used in the treatment of 3 patients with complaints of shoulder pain.

CASE DESCRIPTION

This case series includes 3 patients seen in an outpatient physical therapy clinic in Marietta, Georgia, from September 2017 to May 2018. All patients provided verbal consent to publish their data. Patients included were adults between 45 and 75 years old with primary complaints of insidious onset of unilateral shoulder pain. Exclusion criteria were patients with a traumatic mechanism of injury, fracture, and signs and symptoms of adhesive capsulitis. Subjective and objective measures were collected on the day of the initial evaluation and day of discharge and post-discharge, follow-up phone call performed in July 2018. Outcome measures included Numeric Pain Rating Scale (NPRS), Focus On Therapeutic Outcomes (FOTO), and Shoulder Functional Status Patient-Reported Outcome Measure (FSPROM). Objective examination was performed with assessment of strength, range of motion (ROM), motor control, and soft tissue quality (Table 1).

The NPRS is an 11-point scale from 0 to 10 of a patient's report of perceived pain intensity. A 0/10 pain rating indicated no pain and a 10/10 pain indicated maximal pain. Inter- and intrarater reliability for NPRS is excellent with 100% agreement between two raters. The minimally clinically important difference (MCID) for NPRS in chronic musculoskeletal pain patients is found to be 1 point and a 2.17-point change in patients with shoulder pain undergoing rehabilitation.[16,17]

The FSPROM is a computerized adaptive test aimed at measuring a patient's perceived functional status. Scores range from 0, low-perceived function, to 100, high-perceived function. Computerized adaptive testing (CAT) uses a computer algorithm that selects subsequent questions based on how the patient answers the previous question, which increases the efficiency of performing the outcome measure and reduces the possibility of floor and ceiling effects.[18] The use of CATs in patients with shoulder impairments is found to be both efficient and precise with producing clinically relevant measures of functional status.[19] In regards to shoulder

Table 1. Objective Outcome Measures of the Three Patients

	Initial Examination	Discharge
Patient A		
NPRS	4/10	0/10
FOTO Score	75%	78%
Patient B		
NPRS	3/10	0/10
FOTO Score	52%	71%
Patient C		
NPRS	5/10	0/10
FOTO Score	62%	72%

Abbreviations: NPRS, Numeric Pain Rating Scale; FOTO, Focus On Therapeutic Outcomes

functional status, the minimal detectable change is 11 points and the minimal clinically important improvement is dependent on baseline scores.[20]

Physical therapy objective examination of strength, ROM, motor control, and soft tissue mobility was performed using manual muscle testing, active and passive ROM assessment, observation, and palpation. Upper quarter strength was assessed using manual muscle testing grades in short sitting. Active shoulder ROM was assessed in short sitting and passive shoulder ROM was tested in supine. Scapular motor control was assessed posteriorly during shoulder elevation in short sitting. Soft tissue mobility was assessed in the upper quarter with the patient in supine.

Patient A

History

Patient A was a 49-year-old male who presented to physical therapy with complaints of an insidious onset of right shoulder pain over a 2.5-year period after moving furniture. Patient reported that he had a dull-ache in his shoulder occasionally with increased sharp pain during certain reaching or throwing movements. Patient's occupation required sitting at a computer for 6 to 8 hours of work a day. Patient had no significant past medical history affecting treatment.

Examination

Upon initial examination, patient had deficits in strength, motor control, and soft tissue mobility (Table 2). The active and passive shoulder ROM was within normal limits and equal to contralateral side. Strength deficits were noted in shoulder external and internal rotators and scapular retractors and upward rotators. Patient had impaired scapular upward rotation and aberrant movement with eccentric scapular control on the right compared to left. Impaired soft tissue mobility and irritability was noted in bilateral upper trapezius and right long head of biceps.

Patient B

History

Patient B was a 70-year-old female who presented to physical therapy with complaints of an insidious increase of right shoulder pain beginning 7 months prior after lifting a heavy suitcase up onto an overhead shelf. Patient reported increases in sharp pain with certain reaching movements. Patient was retired and spent her days occupied with various activities including reading, shopping, and travelling. The past medical history affecting treatment included osteoporosis.

Examination

Upon initial examination, patient had deficits in ROM, strength, motor control, and soft tissue mobility (Table 3). Impaired and painful active and passive right shoulder ROM. Strength deficits noted in shoulder flexors, abductors, internal and external rotators, and scapular retractors and upward rotators. Patient also demonstrated poor scapular motor control with impaired upward scapular rotation and scapular winging during right shoulder elevation. Soft tissue mobility deficits noted in bilateral upper trapezius, levator scapulae, supraspinatus, and infraspinatus.

Patient C

History

Patient C was a 65-year-old male presenting to physical therapy with complaints of insidious onset of right shoulder pain over a 1-year period without a known mechanism of injury. Patient reported a gradual progression of sharp pain with lateral and overhead reaching activities. Patient's occupation required 7 to 9 hours of sitting and paperwork activities. The only significant past medical history reported was allergies and previous prostate surgery.

Examination

Upon initial examination, patient had deficits in ROM, strength, motor control, and soft tissue mobility (Table 4). He exhibited deficits in active functional shoulder external and internal rotation and also decreased passive external rotation motion. Strength deficits were noted in shoulder flexors, abductors and internal and external rotators, and scapular retractors and upward rotators. Scapular motor control deficits with bilateral scapular winging and aberrant movement with eccentric right scapular control from elevation, as well as soft tissue mobility deficits in bilateral upper trapezius and right supraspinatus and infraspinatus were noted.

Treatment

Prior to initiating physical therapy, each patient provided signed informed consent for evaluation and treatment. Each physical therapy session consisted of a combination of manual therapy and exercise interventions. Manual therapy interventions were directed at homeostatic points and trigger points to assist in improving mobility and decreasing irritability. Exercise interventions were used to decrease irritability, improve motor control, and increase active mobility and strength.

Specific application of manual therapy techniques were individualized and dependent on how each patient presented to the physical therapy session. Homeostatic points assessed included spinal accessory, dorsal scapular, suprascapular, lateral antebrachial cutaneous, and deep radial. Soft tissue mobilization to trigger points was addressed in cervical and thoracic paraspinals, upper trapezius, levator scapulae, rhomboids, and infraspinatus. Thrust manipulation was used in the thoracic region for patient A, but not for patient B due to osteoporosis or patient C due to patient age and patient preference.

To address impairments found in the shoulder and scapular regions, specific exercise strategies are shown to be more effective than unspecified neck and shoulder exercises.[13] These specific exercises consisted of interventions for recruitment and strengthening of scapular stabilizers including the serratus anterior, middle trapezius, lower

Table 2. Patient A – Objective Measures

	Initial Examination		Discharge	
	Right	Left	Right	Left
Shoulder Active ROM				
Flexion	180 °	180 °	180 °	180 °
Abduction	180 °	180 °	180 °	180°
Function ER	C6	C6	C6	C6
Functional IR	T7	T7	T7	T7
Shoulder Passive ROM				
Flexion	180 °	180 °	180 °	180 °
Abduction	180 °	180 °	180 °	180 °
ER	100 °	90 °	100 °	90 °
IR	60 °	70 °	60 °	70 °
Shoulder/Scapular Strength				
Flexion	5/5	5/5	5/5	5/5
Abduction	5/5	5/5	5/5	5/5
ER	4/5	4/5	5-/5	5-/5
IR	5-/5	5-/5	5/5	5/5
Middle Trapezius	3+/5	3+/5	4+/5	4+/5
Lower Trapezius	3+/5	3+/5	4/5	4/5

Abbreviations: ROM, range of motion; ER, external rotation; IR, internal rotation

Table 3. Patient B – Objective Measures

	Initial Examination		Discharge	
	Right	Left	Right	Left
Shoulder Active ROM				
Flexion	110 °	180 °	180 °	180 °
Abduction	100 °	180 °	180 °	180°
Shoulder Passive ROM				
Flexion	160 °	180 °	180 °	180 °
Abduction	90 °	130 °	180 °	180 °
ER	80 °	110 °	110 °	110 °
IR	50 °	50 °	50 °	50 °
Shoulder/Scapular Strength				
Flexion	3-/5	4-/5	4+/5	4+/5
Abduction	3-/5	4-/5	4+/5	4+/5
ER	3-/5	3+/5	4/5	4/5
IR	4-/5	4-/5	4+/5	4+/5
Middle Trapezius	2+/5	2+/5	4/5	4/5
Lower Trapezius	2+/5	2+/5	4-/5	4-/5

Abbreviations: ROM, range of motion; ER, external rotation; IR, internal rotation

trapezius, and all rotator cuff muscles. Specific interventions included open-chain shoulder protraction, closed-chain shoulder protraction, banded horizontal abduction and overhead lower trapezius, weighted rows, latissimus pull downs, shoulder external rotation, scaption, and farm carries.

Incorporation of lumbar spine interventions focused on mobility, motor control, and muscle recruitment of lumbar multifidi and hip musculature in supine, prone, sitting, and standing. Specific exercises included supine bridging, band resisted hip abduction in standing, prone hamstring isometrics, seated instability with upper extremity perturbations, and seated hamstring isotonics. These combined interventions of lumbar spine and scapular strengthening focused on functional progression for reaching, lifting overhead, and away from center of mass.

RESULTS

Patient A was seen in physical therapy for 19 visits over a 12-week period. Objectively, he demonstrated increases in shoulder/scapular strength bilaterally (see Table 2). At the time of discharge, he reported 0/10 pain with all daily and recreational activities. He was able to return to work duties, fitness activities, and household activities with no reported limitations. The Shoulder FS score improved by 3 but still exceeded the MCID for patients with intake scores of 61 to 100.[20] Eight months after discharge, the patient was contacted by phone for follow-up. Patient reported no recurrence of pain with work duties, fitness activities, or daily household activities.

Patient B was seen in physical therapy for 22 visits over a 13-week period. Objectively, she demonstrated increases in shoulder active and passive ROM, and shoulder/scapular strength (see Table 3). At discharge, she reported 0/10 pain with all daily activities and was able to return to all lifting, carrying, and reaching duties for light and heavy household activities without limitations. Her Shoulder FS increased by 19, which exceeded the MCID for patients with intake scores between 44 and 52.[20] Six months after discharge, the patient was contacted by phone for follow-up. Patient reported no episodes of shoulder pain since discharge and was able to perform all daily and household activities.

Patient C was seen in physical therapy for 39 visits over a 29-week period. He had an extended length of physical therapy care compared to Patient A and Patient B due to a lapse and set back in plan of care after having abdominal surgery 8 weeks after initiating treatment. Objectively, he demonstrated increases in function shoulder active and passive ROM, and shoulder and scapular strength (see Table 4). At discharge, he had 0/10 pain with all daily activities and was able to return to all work duties, household activities, and recreational sporting activities without limitations. His Shoulder FS increased by 10, which exceeded the MCID for patients with intake scores between 61

Table 4. Patient C – Objective Measures

	Initial Examination		Discharge	
	Right	Left	Right	Left
Shoulder Active ROM				
Flexion	180 °	180 °	180 °	180 °
Abduction	180 °	180 °	180 °	180°
Function ER	C5	C7	C7	C7
Functional IR	L4	T10	T12	T10
Shoulder Passive ROM				
Flexion	180 °	180 °	180 °	180 °
Abduction	180 °	180 °	180 °	180 °
ER	90 °	105 °	100 °	105 °
IR	70 °	70 °	70 °	70 °
Shoulder/Scapular Strength				
Flexion	3+/5	4/5	5-/5	5-/5
Abduction	3/5	4/5	5-/5	5-/5
ER	3+/5	4/5	4-/5	4+/5
IR	4-/5	4/5	4+/5	4+/5
Middle Trapezius	3/5	3/5	4/5	4/5
Lower Trapezius	3-/5	3-/5	4-/5	4-/5

Abbreviations: ROM, range of motion; ER, external rotation; IR, internal rotation

and 100.[20] Two months after discharge, the patient was contacted by phone for follow-up. Patient reported occasional recurrence of pain with tennis activities but is able to do all daily activities without pain or difficulty.

DISCUSSION

The purpose of this case series was to describe how incorporating interventions directed at the lumbar spine in the treatment of 3 patients with complaints of shoulder pain. All 3 patients were treated with manual therapy and therapeutic exercise interventions based on impairments in the shoulder girdle and scapular regions along with interventions targeted at the lumbar spine. Over the course of treatment, all 3 patients demonstrated improvements in pain, function, soft tissue health, shoulder ROM, scapulothoracic and shoulder strength.

The 3 patients in this case series were adults with goals of return to performing functional activities of daily living without implementation. Though there is evidence to support the association between trunk dysfunction and upper extremity function during daily activities,[21] the current literature lacks high quality evidence for the incorporation of lumbar spine interventions to improve normal daily activities. Impairments in the lumbar spine may affect progression and full functional capabilities of the upper extremity may be in order to fully rehabilitate a patient with primarily shoulder complaints.

Addressing the lumbar spine in this patient population can potentially influence outcomes and recovery. There are numerous studies that show how thrust manipulation directed at the cervical and thoracic spine can influence pain and function of the shoulder.[22-24] Thrust manipulations and other manual therapy interventions work by initiating neurophysiological, peripheral, spinal, and supraspinal mechanisms in order to produce widespread clinical outcomes.[25] All 3 patients in this case series were treated with manual interventions that would have influenced their outcomes through the above proposed mechanism. Another potential influence is through biomechanical connections of the lumbar spine and shoulder. There are muscular and myofascial connections between the two body regions that influence the muscular activation of the scapular region.[10]

There are multiple limitations of this case series. One limitation is the small number of patients and no randomization and no control group. Thus, the study can show possible association but cannot establish any causation between interventions and results. Another limitation is the outcome measures used in the report. There were no objective measures used to document lumbar dysfunction throughout the plan of care. It would have been useful to monitor lumbar dysfunction and improvement throughout the progression and return to function of these patients when lumbar interventions were used in treatment. While follow-up communication post-discharge was completed for all 3 patients, the timeframe varied (2, 6, and 8 months). Contact was made at the time of writing this article and an established timeline was not prospectively determined prior to onset of care or once the patients were discharged. Future research may benefit from a structured follow-up assessment to analyze long-term outcomes.

Future research for patients with shoulder pain will be beneficial to determine kinetic chain incorporation and approaches to improve impairments and maximize functional recovery in adult populations wanting to return to daily activities including sports participation. Randomized controlled trials looking at intervention strategies incorporating the lumbar spine and lower extremities to improve shoulder pain and function are needed in order to determine the best and most efficient rehabilitation approaches. This case series shows that 3 patients with shoulder pain were successfully managed with the incorporation of lumbar spine interventions in conjunction with manual therapy and shoulder and scapulothoracic exercises.

ACKNOWLEDGEMENT

The authors certify that they have no affiliations with or financial involvement in any organization or entity with a direct financial interest in the subject matter or materials discussed in the article.

REFERENCES

1. Dorrestijn O, Greving K, van der Veen WJ, et al. Patients with shoulder complaints in general practice: consumption of medical care. *Rheumatology (Oxford)*. 2011;50(2):389-395. doi: 10.1093/rheumatology/keq333. Epub 2010 Nov 2.
2. Sueki DG, Cleland JA, Wainner RS. A regional interdependence model of musculoskeletal dysfunction: research, mechanisms, and clinical implications. *J Man Manip Ther*. 2013;21(2):90-102 doi:

10.1179/2042618612Y.0000000027.
3. Bouisset SZ. A sequence of postural movements precedes voluntary movement. *Neurosci Lett*. 1981;22(3):263-270.
4. Moseley GL, Hodges PW, Gandevia SC. Deep and superficial fibers of the lumbar multifidus muscle are differentially active during voluntary arm movements. *Spine (Phila Pa 1976)*. 2002;27(2):E29-36
5. Zattara M, Bouisset S. Posturo-kinetic organisation during the early phase of voluntary upper limb movement. 1. Normal subjects. *J Neurol Neurosurg Psychiatry.* 1988;51(7):956-965
6. van der Windt DA, Koes BW, Boeke AJ, Deville W, De Jong BA, Bouter LM. Shoulder disorders in general practice: prognostic indicators of outcome. *Br J Gen Pract*. 1996;46(410):519-523.
7. Souza RB, Powers CM. Differences in hip kinematics, muscle strength, and muscle activation between subjects with and without patellofemoral pain. *J Orthop Sports Phys Ther.* 2009;39(1):12-19. doi: 10.2519/jospt.2009.2885.
8. Vaughn DW. Isolated knee pain: a case report highlighting regional interdependence. *J Orthop Sports Phys Ther.* 2008;38(10):616-623. doi: 10.2519/jospt.2008.2759.
9. Welsh C, Hanney WJ, Podschun L, Kolber MJ. Rehabilitation of a female dancer with patellofemoral pain syndrome: applying concepts of regional interdependence in practice. *N Am J Sports Phys Ther*. 2010;5(2):85-97.
10. Kaur N, Bhanot K, Brody LT, Bridges J, Berry DC, Ode JJ. Effects of lower extremity and trunk muscles recruitment on serratus anterior muscle activation in healthy male adults. *Int J Sports Phys Ther*. 2014;9(7):924-937.
11. Diercks R, Bron C, Dorrestijn O, et al. Guideline for diagnosis and treatment of subacromial pain syndrome: a multidisciplinary review by the Dutch Orthopaedic Association. *Acta Orthop*. 2014;85(3):314-322. doi: 10.3109/17453674.2014.920991.
12. Kromer TO, Tautenhahn UG, de Bie RA, Staal JB, Bastiaenen CH. Effects of physiotherapy in patients with shoulder impingement syndrome: a systematic review of the literature. *J Rehabil Med*. 2009;41(11):870-880. doi: 10.2340/16501977-0453.
13. Holmgren T, Hallgren HB, Oberg B, Adolfsson L, Johansson K. Effect of specific exercise strategy on need for surgery in patients with subacromial impingement syndrome: randomised controlled study. *Br J Sports Med*. 2014;48(19):1456-1467. doi: 10.1136/bjsports-2014-e787.
14. Worsley P, Warner M, Mottram S, et al. Motor control retraining exercises for shoulder impingement: effects on function, muscle activation, and biomechanics in young adults. *J Shoulder Elbow Surg*. 2013;22(4):e11-9. doi: 10.1016/j.jse.2012.06.010.
15. Kibler WB, McMullen J, Uhl T. Shoulder rehabilitation strategies, guidelines, and practice. *Orthop Clin North Am*. 2001;32(3):527-538.
16. Michener LA, Snyder AR, Leggin BG. Responsiveness of the numeric pain rating scale in patients with shoulder pain and the effect of surgical status. *J Sport Rehabil*. 2011;20(1):115-128.
17. Salaffi F, Stancati A, Silvestri CA, Ciapetti A, Grassi W. Minimal clinically important changes in chronic musculoskeletal pain intensity measured on a numerical rating scale. *Eur J Pain*. 2004;8(4):283-291. doi: 10.1016/j.ejpain.2003.09.004.
18. Hart DL, Wang YC, Cook KF, Mioduski JE. A computerized adaptive test for patients with shoulder impairments produced responsive measures of function. *Phys Ther*. 2010;90(6):928-938. doi: 10.2522/ptj.20090342.
19. Hart DL, Cook KF, Mioduski JE, Teal CR, Crane PK. Simulated computerized adaptive test for patients with shoulder impairments was efficient and produced valid measures of function. *J Clin Epidemiol*. 2006;59(3):290-298. doi: 10.1016/j.jclinepi.2005.08.006.
20. Wang YC, Hart DL, Cook KF, Mioduski JE. Translating shoulder computerized adaptive testing generated outcome measures into clinical practice. *J Hand Ther*. 2010;23(4):372-382; quiz 383. doi: 10.1016/j.jht.2010.06.001.
21. Gillen G, Boiangiu C, Neuman M, Reinstein R, Schaap Y. Trunk posture affects upper extremity function of adults. *Percept Mot Skills*. 2007;104(2):371-380. doi: 10.2466/pms.104.2.371-380.
22. Bergman GJ, Winter JC, van Tulder MW, Meyboom-de Jong B, Postema K, van der Heijden GJ. Manipulative therapy in addition to usual medical care accelerates recovery of shoulder complaints at higher costs: economic outcomes of a randomized trial. *BMC Musculoskelet Disord*. 2010;11:200. doi: 10.1186/1471-2474-11-200.
23. Boyles RE, Ritland BM, Miracle BM, et al. The short-term effects of thoracic spine thrust manipulation on patients with shoulder impingement syndrome. *Man Ther.* 2009;14(4):375-380. doi: 10.1016/j.math.2008.05.005.
24. Haik MN, Alburquerque-Sendin F, Silva CZ, Siqueira-Junior AL, Ribeiro IL, Camargo PR. Scapular kinematics pre- and post-thoracic thrust manipulation in individuals with and without shoulder impingement symptoms: a randomized controlled study. *J Orthop Sports Phys Ther*. 2014;44(7):475-487. doi: 10.2519/jospt.2014.4760.
25. Bialosky JE, Bishop MD, Price DD, Robinson ME, George SZ. The mechanisms of manual therapy in the treatment of musculoskeletal pain: a comprehensive model. *Man Ther*. 2009;14(5):531-538. doi: 10.1016/j.math.2008.09.001.