Changes in Shoulder Pain and Disability After Thrust Manipulation in Subjects Presenting With Second and Third Rib Syndrome

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Abstract

Objective: The purpose of this preliminary study was to investigate changes in shoulder pain, disability, and perceived level of recovery after 2 sessions of upper thoracic and upper rib high-velocity low-amplitude (HVLA) thrust manipulation in patients with shoulder pain secondary to second and third rib syndrome.

Methods: This exploratory study evaluated 10 consecutive individuals with shoulder pain, with or without brachial pain, and a negative Neer impingement test, who completed the Shoulder Pain and Disability Index (SPADI), the numeric pain rating scale (NPRS), and the global rating of change. Patients received 2 sessions of HVLA thrust manipulation targeting the upper thoracic spine bilaterally and the second and third ribs on the symptomatic side. Outcome measures were completed after the first treatment session, at 48 hours, 1 month, and 3 months.

Results: Patients showed a significant decrease in SPADI ($F = 59.997$; $P = .001$) and significant decrease in resting shoulder NPRS ($F = 63.439$; $P = .001$). For both NPRS and SPADI, there were significant differences between the pretreatment scores and each of the postintervention scores through 3-month follow-up ($P < .05$). Large within-group effect sizes (Cohen's $d \geq 0.8$) were found between preintervention data and all postintervention assessments in both outcomes. Mean global rating of change scores (+6.8 at 3 months) indicated "a very great deal better" outcome at long-term follow-up.

Conclusion: This group of patients with shoulder pain secondary to second and third rib syndrome who received upper thoracic and upper rib HVLA thrust manipulations showed significant reductions in pain and disability and improvement in perceived level of recovery. (J Manipulative Physiol Ther 2015;xx:1-13)

Key Indexing Terms: *Shoulder Pain; Manipulation; Spinal; Manual Therapy; Thoracic Vertebrae; Ribs*

Only 50% of all new episodes of shoulder pain conditions resolve within 6 months, whereas at 12 months, more than 40% of the individuals are still disabled during work and leisure activities.[1,2] Although infrequently reported,[3-13] dysfunction of the cervicothoracic vertebrae[6,10-24] and/or upper ribs[7,10,13,20,25-29] has been suggested as a causative factor in patients presenting with shoulder and arm pain.[10-13] Dysfunction of the

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cervicothoracic spine and/or adjacent ribs (ie, the shoulder-girdle) triples the risk[30] for the development of shoulder pain and also appears to predict poor outcome in shoulder disorders.[11,30,31]

In 1988, Grieve[32] appears to have been one of the first to publish the name "second rib syndrome"; however, he refrained from providing any specifics on the actual clinical presentation, pain pattern, or neuroanatomy of the disorder. In 1999, Boyle[25] published a case report of 2 patients with "second rib syndrome." Furthermore, Boyle proposed, "a sprain or subluxation/displacement of the second rib spinal articulations in isolation, either acutely or chronically induced, is a cause of shoulder pain that is commonly misdiagnosed as shoulder impingement syndrome and/or rotator cuff muscle partial tear."[25] Notably, Boyle stated that second rib syndrome "may be a relatively common clinical presentation."[25]

In a prospective single-arm trial of 21 patients with a primary complaint of unilateral shoulder pain, Strunce et al[7] found cervicothoracic junction restrictions, upper thoracic restrictions, and unilateral rib restrictions in 71%, 100%, and 79% of patients with shoulder pain, respectively. Similarly, after examining 101 patients with shoulder pain and 75 healthy controls, Sobel et al[12] reported, "palpation of the second and third ribs were found to be painful significantly more often and the mobility of the cervicothoracic spine was found to be limited significantly more often" in patients with shoulder pain compared to asymptomatic controls.

In 28 of 32 patients with radiographically confirmed restrictions of mobility of the first rib with the inhale or exhale position, Jirout[33] detected rotational hypomobility and twisting of the C7 and T1 vertebrae. Jirout[33] concluded that hypomobility or positional faults of upper thoracic vertebrae affects the mobility, function, and position of the respective rib—that is, causes the rib on the side toward which the vertebral rotation occurs to elevate.[11,33] Moreover, restrictions of mobility and rotational positional faults in cervicothoracic vertebrae can cause restrictions of mobility in the scapulohumeral joint through restrictions of the upper ribs.[11,12,33,34]

The neuroanatomical rationale for the complaint of shoulder girdle and/or upper arm pain is thought to be an "anterior and superior subluxation or sprain of the second rib in isolation"[25] that subsequently entraps or irritates the dorsal ramus of the second thoracic nerve as it passes through a vertical opening limited caudally by the rib and laterally by the superior costotransverse ligament.[35] Furthermore, the dorsal ramus of the second thoracic nerve provides the cutaneous distribution to the posterolateral shoulder.[35-40]

A recent randomized and sham-controlled trial[41] reported reductions in shoulder pain after midthoracic high-velocity low-amplitude (HVLA) thrust manipulation in individuals with shoulder impingement syndrome; however, the between-group difference was not statistically significant, the within-group change scores did not exceed the minimum clinically important difference (MCID) or the minimum detectable change for the numeric pain rating scale (NPRS), and the longest outcome measure was taken just 3 minutes after the treatment. Nevertheless, 3 prospective single-arm trials[6,7,23] and 3 randomized-controlled trials[10,13,24,42] have previously demonstrated the effectiveness of nonthrust mobilization and/or HVLA thrust manipulation to the cervicothoracic spine, upper thoracic spine, and upper ribs in patients with shoulder impingement syndrome and/or shoulder girdle disorder.

However, to date and to our knowledge, only 1 case report[25] involving 2 patients has been published in the peer-reviewed literature that has directly named second rib syndrome as the primary cause or underlying pain generator in patients presenting with shoulder pain. In addition, no study to date has targeted exclusively the upper thoracic (T2-T3) spine and the second and third ribs with HVLA thrust manipulation for the management of patients with shoulder pain. Therefore, the purpose of this study was to investigate changes in shoulder pain, disability, and perceived level of recovery after upper thoracic and upper rib HVLA thrust manipulation in patients with shoulder pain of any duration secondary to second and third rib syndrome.

Methods

Subjects

We recruited 10 consecutive patients (5 males and 5 females) with nonmidline, posterolateral upper thoracic, and unilateral posterior shoulder girdle pain with or without posterolateral upper brachial pain, who presented to 1 of 3 private physical therapy outpatient clinics in Italy (Brescia, Lecce, and Bari) between December 2012 and January 2014. Their ages ranged from 18 to 61 years with a mean (SD) of 33.6 (13.4) years. Height ranged from 158 to 185 cm with a mean (SD) of 170.0 (9.5) cm. Weight was 50.1 to 83.0 kg with a mean (SD) of 69.6 (10.7) kg. The duration of symptoms ranged from 1 and 270 days with a mean (SD) of 67.3 (89.3) days. Baseline characteristics of the 10 patients in this case series can be found in Table 1. This study was approved by the Ethics Committee of Universidad Rey Juan Carlos (URJC 12-1065), and all patients provided informed consent before their participation in the study.

To be eligible for inclusion, patients had to (1) exhibit a primary complaint of unilateral, posterior "shoulder girdle" pain[12,24]—that is, "pain between the neck and the elbow at rest or during movement of the upper arm"[10]—with or without brachial pain of any duration; (2) demonstrate findings on physical examination linking "shoulder pain with dysfunction of the cervicothoracic spine and the adjacent ribs"[10]; (3) be between 18 and 70 years of age;