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ORIGINAL RESEARCH

Short-Term Effects of Thoracic Spine Manipulation on Shoulder Impingement Syndrome: A Randomized Controlled Trial

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Abstract

Objective: To investigate the short-term effects of thoracic spine manipulation (TSM) on pain, function, scapular kinematics, and scapular muscle activity in individuals with shoulder impingement syndrome.

Design: Randomized controlled trial with blinded assessor and patient.

Setting: Laboratory.

Participants: Patients with shoulder impingement syndrome (N=61).

Interventions: Participants were randomly allocated to TSM group (n=30) or sham-TSM group (n=31) and attended 2 intervention sessions over a 1-week period.

Main Outcome Measures: Scapular kinematics and muscle activity were measured at day 1 (baseline, before the first intervention), day 2 preintervention (before second intervention), day 2 postintervention (after the second intervention), and day 3 (follow-up). Shoulder pain and function were assessed by the Disability of the Arm, Shoulder and Hand questionnaire and Western Ontario Rotator Cuff Index at baseline, day 2 preintervention, and follow-up. An assessor blinded to group assignment measured all outcomes.

Results: Pain decreased by 0.7 points (95% confidence interval, 1.3−0.1 points) at day 2 preintervention and 0.9 points (95% confidence interval, 1.5−0.3 points) at day 2 postintervention in the TSM group. The Disability of the Arm, Shoulder and Hand questionnaire ($P=.01$) and Western Ontario Rotator Cuff Index ($P=.02$) scores improved in both groups. Scapular upward rotation increased during arm lowering ($P<.01$) at day 2 postintervention (5.3°) and follow-up (3.5°) in the TSM group. Upper trapezius activity increased ($P<.05$) in the sham-TSM group. Middle trapezius, lower trapezius, and serratus anterior decreased activities in both groups during elevation and lowering of the arm.

Conclusions: TSM may increase scapular upward rotation during arm lowering. TSM does not seem to influence activity of the scapular muscles. The results concerning shoulder pain, function, scapular tilt, and internal rotation are not conclusive.

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Shoulder impingement syndrome (SIS) is a common diagnosis of shoulder pain.[1,2] Physical therapy for SIS includes evidence-based approaches such as strengthening and stretching exercises[3-9] as well as manual therapy techniques.[10-13] Individuals with shoulder pain tend to lack thoracic mobility as compared with asymptomatics.[14,15] This condition may support that thoracic spine should receive attention in the management of patients with shoulder pain. Thoracic spine manipulation (TSM) is one of the techniques that can be used to gain thoracic mobility in patients with shoulder dysfunction.[16,17]

TSM has been shown to immediately improve shoulder pain and function in individuals with SIS.[18-20] However, previous investigations failed to use a control group. More recently, 2 studies[21,22] have used a sham group as a comparator for the TSM group in individuals with SIS. These studies were analyzed in a systematic review[23] that showed low evidence toward benefits of TSM on the shoulder. No improvements in pain,

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pressure pain threshold, and scapular kinematics were demonstrated after only 1 single session of TSM. Nevertheless, no studies have observed the effects of >1 session of TSM on the outcomes mentioned above and on scapular muscle activity at short-term follow-up. Possibly, a cumulative effect may occur when TSM is applied more than once, leading to improved results.

It would be worthy to analyze the short-term effects of >1 session of TSM in individuals with SIS. This study investigated the short-term effects of 2 sessions of TSM on pain, function, scapular kinematics, and scapular muscle activity in individuals with SIS. This study also investigated within- and between-group effects of TSM and sham-TSM interventions on shoulder outcomes. It was hypothesized that individuals who received TSM compared to sham-TSM would show (1) decreased shoulder pain; (2) increased shoulder function; (3) changes in scapular kinematics; and (4) changes in the activity of the scapular muscles.

Methods

Design overview

This was a randomized controlled trial with short-term follow-up after 2 sessions of TSM and with blinded assessor and patient. The investigator responsible for data collection and the patient were unaware of the sort of treatment applied.

Setting and participants

One hundred eleven individuals with SIS were recruited from July 1, 2011, to June 30, 2014, by advertising at the local community, orthopedic clinics, and university buildings. Inclusion criteria were as follows: shoulder pain in the C5 or C6 dermatome region, age 18−60 years, and 3 of 5 of the following tests for SIS: (1) Neer[24]; (2) Hawkins[25]; (3) Jobe[26]; (4) pain during active elevation in the scapular or sagittal plane; and (5) pain or weakness with resisted shoulder external rotation.[27] A cluster of tests is suggested to provide better diagnostic accuracy.[27,28] All individuals had to reach ∼150° of arm elevation as determined by visual observation. Exclusion criteria were as follows: "red flags" for spinal manipulation (eg, fracture, osteoporosis, malignancy, infection, and active inflammatory process),[29] history of shoulder, cervicothoracic spine fracture or surgery, signs of cervical nerve root or central nervous system involvement, clinical signs of complete rotator cuff tear (positive drop arm test result), adhesive capsulitis, glenohumeral instability (ie, positive apprehension, anterior drawer, or sulcus test results),[30] physical therapy treatment within 6 months before the evaluation, analgesic pills within 1 month before the intervention, systemic illness, scoliosis, or pregnancy. All measurements and interventions were conducted at the Laboratory of Analysis and Intervention of the Shoulder Complex at the Federal University of São Carlos. This study was approved by the ethics committee of the Federal University of São Carlos (465/2011). Participants signed an informed consent to participate.

List of abbreviations:

DASH	Disability of the Arm, Shoulder and Hand
LT	lower trapezius
MCID	minimal clinically important difference
MT	middle trapezius
SA	serratus anterior
SIS	shoulder impingement syndrome
TSM	thoracic spine manipulation
UT	upper trapezius
WORC	Western Ontario Rotator Cuff Index

Randomization and intervention

Sixty-one patients were randomly assigned to 1 of the 2 groups: (1) TSM (n=30); and (2) sham-TSM (n=31). The website http://www.randomization.com was used to generate treatment assignments through a simple randomization process. The intervention was revealed to the therapist immediately before its application. The therapist was not allowed to interact with the patients, except to instruct them about the procedure of the intervention. Patients were blinded to treatment assignment and received general information about the purpose of the study so that an effective sham intervention could be conducted. An investigator blinded to group's assignment of each patient took all measurements.

Interventions were performed by a physical therapist with 4 years of experience in manual therapy. TSM was applied in the middle thoracic spine, with the patient seated with arms crossed over the chest. The therapist located behind the patient and performed a thrust technique with arms and chest around the thoracic region of the subject, as described elsewhere.[19,21,22,31] For sham-TSM, the positions of the patient and therapist were the same and the therapist held the position for few seconds, without performing the thrust. The technique was applied twice in a period of 3 to 4 days apart. Sham-TSM was previously reported as a believable active treatment.[32]

Outcomes and follow-up

Pain, scapular kinematics, and electromyographic data were collected during elevation and lowering of the arm in the sagittal plane at day 1 (baseline; before the first intervention), day 2 preintervention (3−4d after day 1), day 2 postintervention (immediately after the second intervention), and day 3 (follow-up at 3−4d after the second intervention) (fig 1). There was a 1-week interval from baseline assessment to follow-up. At the beginning of each day session, patients completed the Disability of the Arm, Shoulder and Hand (DASH) questionnaire and Western Ontario Rotator Cuff Index (WORC) according to their conditions in the past week.

Pain and function

Pain was measured with the 11-point Numeric Pain Rating Scale,[33] a reliable and valid scale for individuals with shoulder pain. The average of 3 ratings during each repetition of arm elevation and lowering was used for the analysis. Because the level of symptoms was low and of great variability at baseline, the percentage of change from baseline was used to calculate the clinically relevant difference using the following equation: [(follow-up − baseline)/baseline] × 100.[34] Improvement of 15% to 20% relative to baseline[35] was considered the minimal clinically important difference (MCID).

DASH questionnaire and WORC were used to assess shoulder pain and function. Both are valid and reliable to assess individuals with upper limb disorders[36] and rotator cuff disease.[37] MCID is