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CASE REPORT

ACUTE EFFECTS OF DRY NEEDLING ON POSTERIOR SHOULDER TIGHTNESS. A CASE REPORT

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ABSTRACT

Background and Purpose: Posterior shoulder tightness has been associated with numerous shoulder disorders. Methods to increase posterior shoulder mobility may be beneficial. The purpose of this case report is to report the outcomes of a subject with posterior shoulder tightness treated with dry needling as a primary intervention strategy.

Case description: The subject was a 46-year-old man who was referred to physical therapy with primary symptoms of shoulder pain and loss of motion consistent with subacromial impingement syndrome. Clinical findings upon examination revealed glenohumeral internal rotation and horizontal adduction losses of motion and reproduction of pain symptoms upon palpation of the infraspinatus, teres minor, and posterior deltoid. A single treatment of trigger point dry needling was used to decrease pain and improve range of motion.

Outcomes: Following the intervention, clinically meaningful improvements were seen in pain and shoulder range of motion.

Discussion: This case report describes the use of trigger point dry needling in the treatment of a subject with posterior shoulder tightness. The immediate improvement seen in this subject following the dry needling to the infraspinatus, teres minor, and posterior deltoid muscles suggests that muscles may be a significant source of pain and range of motion limitation in this condition.

Level of Evidence: Level 4

Keywords: Dry needling, myofascial trigger point, shoulder pain, subacromial impingement syndrome.

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BACKGROUND AND PURPOSE

Posterior shoulder tightness (PST) has been suggested to be a causative or perpetuating factor in impingement syndrome, labral lesions, and rotator cuff tears encountered in clinical rehabilitation and sport activities.[1] The mechanism by which PST is associated with abnormal glenohumeral biomechanics has been elucidated in both cadaveric and clinical studies.[2,3,4,5,6] In cadaveric studies, selective tightening of the posterior capsule by plication has been shown to increase anterior and superior translation of the humeral head during flexion, cross-body adduction and external rotation, and posterior translation during external rotation at 90° of abduction, with markedly decrease internal rotation.[2,3] In clinical studies, PST have been demonstrated in overhead athletes with internal impingement and in subjects with secondary impingement and frozen shoulder.[4,5,6]

Typically, PST is identified by measuring the range of motion (ROM) of glenohumeral internal rotation (IR) and horizontal adduction (HA).[7] The decreased HA and IR ROM is thought to be a multifactorial condition that involves sport-specific bony adaptations in the overhead athlete (increased humeral retroversion), tightness of dynamic restraints (infraspinatus, teres minor, and posterior deltoid) and/or posterior capsule contracture.[8,9,10,11,12,13,14,15,16] These potential mechanisms have provided rationales for treatment options. Stretching, joint mobilization techniques, and/or massage are commonly used to treat IR and HA ROM loss due to muscular or capsular limitation and related symptoms.[1,6,7,11,12,14,17,18,19,20,21]

Physical therapy treatment interventions focusing on posterior shoulder stretching have resulted in a decrease in the loss of IR and HA ROM, and a marked improvement in pain in several studies.[6,14,18,20] Techniques for stretching the posterior shoulder include the sleeper-stretch and the cross-body stretch, passively performed by the therapist or by the patient.[6,14,18,20] Glenohumeral joint mobilization techniques (dorsal glide mobilizations in the scapular plane; grade III and IV in the Maitland classification) have been suggested to decrease stiffness of the posterior glenohumeral joint capsule and to increase IR ROM.[6,14,20,22] A protocol that includes posterior joint mobilizations in combination with the cross-body stretch appears to be an effective intervention to increase glenohumeral IR ROM and decrease posterior shoulder tightness.[7] The increase in ROM in asymptomatic individuals also suggests that stretching and joint mobilization may be an effective tool for the prevention of disorders related to PST.[7,14]

Soft tissue massage of the infraspinatus, posterior deltoid, and teres minor muscles is often included in rehabilitation of individuals with PST in order to increase glenohumeral internal rotation ROM deficit.[11,12,17] Similarly, muscle energy techniques have been shown to provide immediate improvements in both glenohumeral HA and IR ROM in asymptomatic individuals, further confirming the muscle contribution in the genesis of PST.[21] However, the optimal treatment for correcting PST remains unknown and it is also not known whether or not a home-based course of treatment is as effective as one that is administered by a clinician.[23]

Dry needling (DN) is a skilled intervention performed by physical therapists as part of clinical practice in combination with other physical therapy interventions, such us mobilization, manipulation, soft tissue massage, and exercises. DN uses a solid filiform needle to penetrate the skin to treat muscles, ligaments, tendons, subcutaneous fascia, scar tissue, peripheral nerves, and neurovascular bundles for the management of a variety of neuromusculoskeletal pain syndromes.[24,25,26] DN is not limited to myofascial intervention, although this case report's DN intervention was focused on treating myofascial trigger points (MTrPs) in the local tissue.[26] DN techniques are proposed to treat a host of pathological conditions, such us neck pain, chronic lateral hip and thigh pain, and chronic low back pain.[27,28,29] MTrPs have been studied extensively over the years as sources of pain, and the literature suggests a MTrP is identified clinically by palpation of a tender nodule in a taut band of muscle and subjective report of pain during tender spot palpation.[30] MTrPs are divided into active and latent MTrPs, both of which generate dysfunction.[24] However, the symptoms differ because active MTrPs may cause spontaneous pain, while latent MTrPs elicit pain when stimulated, for example, with digital pressure.[24,25] Although latent MTrPs are not spontaneously painful, they do contribute to nociception, muscles weakness, muscle fatigue, alteration of muscle activation patterns, and ROM restriction, therefore they need to be included in the treatment plan.[31]

Although the pathophysiology of MTrPs remains relatively unclear and is not universally accepted, DN is used in clinical practice to 1) quickly reduce local, referred, and/or remote pain, 2) remove peripheral sources of persistent nociceptive input, 3) improve ROM and muscle activation patterns, 4) relax the taut band, 5) reduce the concentration of numerous nociceptive, inflammatory, and immune system related chemicals, 6) reduce peripheral and central sensitization.[25,32,33,34] DN of MTrP in the infraspinatus muscle has been demonstrated to be an effective intervention for subjects with chronic shoulder pain and IR ROM deficits.[35] A case series by Osborne and Gatt showed improved shoulder ROM, function, and pain in four volleyball players after DN of the infraspinatus and teres minor muscles.[36] In a case series by Ingber, three subjects with shoulder pain were treated with DN and stretching of the subscapularis muscle.[37] They achieved pain-free ROM at the end of their treatment, which persisted at a two-year follow-up. In a case report, Clewely described the clinical reasoning and outcomes leading to the use of DN to the upper trapezius, levator scapula, deltoid, and infraspinatus muscles as part of a plan of care in a subject with adhesive capsulitis.[38] The outcomes showed significant improvement in shoulder ROM, pain, and function, especially after the addition of DN.

However, there are no studies in the current literature supporting the use of DN as an effective intervention for loss of shoulder ROM and pain associated with PST. The purpose of this case report was to describe the acute effects of DN as a primary treatment intervention in a subject with PST. The subject featured in this case report gave written informed consent to participate in the study and was informed that the data concerning the case report would be submitted for publication.

CASE DESCRIPTION

The subject in this study was a 46-year-old right-handed male dance instructor, who was referred to physical therapy by his orthopaedic surgeon, with a diagnosis of subacromial impingement syndrome. He had a three-month history of right shoulder pain and stiffness, of insidious onset. There were no reports of trauma to the neck or shoulder, and he had no previous history of neck or shoulder symptoms.

His general health was good and absent of signs suggestive of non-musculoskeletal pathology. Anti-inflammatory medication had been previously prescribed for this condition, but the subject found no relief with this intervention. The subject described two areas of pain. The first area (P1, Figure 1) was located over the anterior aspect of the right shoulder. Using an 11-point Numeric Pain Rating Scale (NPRS), with 0 as no pain and 10 as worst pain imaginable, his pain intensity in this location was rated as 7/10. The NPRS has been demonstrated to be a valid and reliable tool for subjects with shoulder pain.[39] The subject described the pain as a sharp burning sensation provoked while maintaining a typical position of his working activity, with the right arm slightly in IR at 90° of abduction (Figure 2). Onset of pain was immediate with this posture, and reduction of

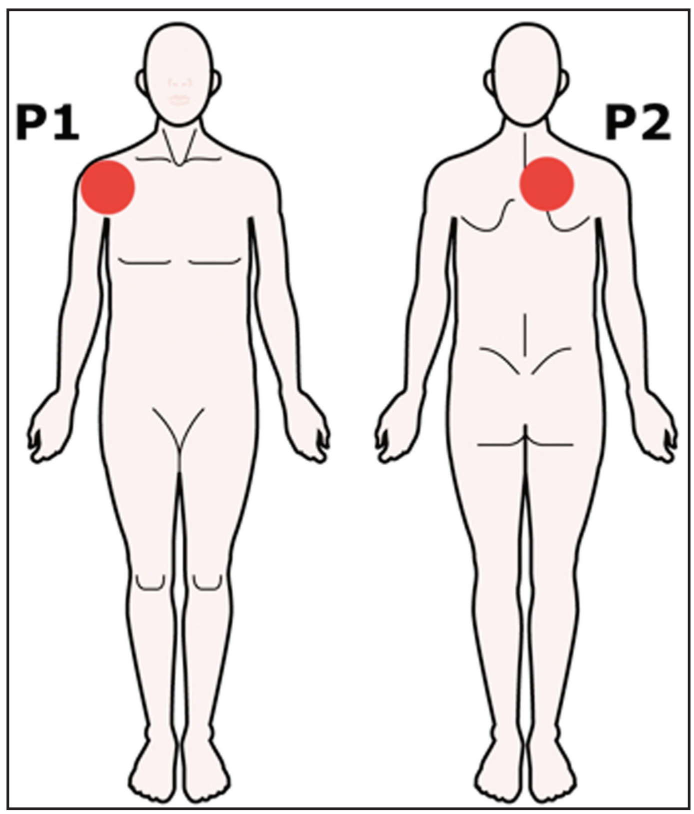

Figure 1. *Pain diagram. P1 and P2 indicate two distinct areas of perceived pain by the subject, P1 = primary pain area, P2 = secondary pain area.*

Figure 2. *Provocative posture.*

pain occurred immediately after taking his arm out of this position.

The second area of pain (P2, Figure 1) was defined as an area along the medial border of the right scapula. The intensity of pain on the NPRS was rated as 6/10, with the same aggravating/easing factors. However, in this region the pain increased only after a prolonged position of shoulder abduction. Pain affected his work and required him to take frequent breaks to reduce his pain symptoms. His goal was to reduce pain and stiffness to improve his ability to work. The outcomes measured at baseline and immediately after the intervention were pain intensity, shoulder passive ROM, and provocation tests.

EXAMINATION/EVALUATION

The subject's cervicothoracic spine was examined as a possible source of shoulder pain. A detailed exam in the sitting position that included observation, bony and soft tissue palpation, and assessment of active and passive cervical ROM with overpressure was performed. Additionally, the upper limb tension test A, the Spurling test, and cervical distraction test were performed to rule out cervical nerve root pathology.[40] None of the tests elicited pain in the shoulder or neck. The observation and palpation did not show any differences in shoulder muscle trophism or significant postural asymmetries.

The Hawkins-Kennedy, painful arc sign, and infraspinatus muscle strength tests were performed as a test-item cluster for subacromial impingement syndrome.[41,42] The post-test probability for this cluster that the patient will exhibit rotator cuff tendinopathy and/or subacromial impingement syndrome of the three above tests is 95.5% if all three are positive, and 91.0% if two of three are positive. Pain during the provocative tests was rated using NPRS. The Hawkins-Kennedy and painful arc of motion tests elicited 5/10 pain in the P1 region. Infraspinatus muscle testing did not show pain or weakness.

A Tracker Freedom® Wireless Dual Inclinometer (JTECH Medical, Midavele, UT) was used to measure bilateral passive glenohumeral IR, HA, external rotation, and abduction ROM. This device provides real-time digital reading of angles through the pressure of a pedal board, allowing the examiner to not change the location to look at the tool as it is using an inclinometer or a standard goniometer, thereby reducing a possible source of error. Each measurement was performed twice with a 10 second rest between repetitions to improve reliability, and averaged for further analysis. This procedure, using a wireless inclinometer to measure ROM of the shoulder, is reported to be reliable if carried out by the same examiner, with an intraclass correlation coefficient of 0.96 with a minimal detectable change (MDC) of 6.9° for IR, 0.96 with a MDC of 4.8° for external rotation, 0.92 with a MDC of 6.4° for abduction, and 0.85 with a MDC of 9.5° for HA.[43]

For assessment of shoulder IR, the subject was positioned in the supine position with the shoulder at 90° of abduction in the plane of the scapula (10-15° anterior to the coronal plane) and the elbow flexed to 90°. The inclinometer was placed on the dorsal surface of distal forearm. The examiner passively internally rotated the glenohumeral joint, controlling scapular movement by palpation of the coracoid process with the thumb and the spine of the scapula with the finger, to feel for motion, and minimize scapulothoracic contribution or compensatory movement that occurs at the end of IR motion.[20,44] When the scapula started to move into protraction and/or anterior tilt, the measurement was taken (Figure 3). This method of stabilization showed the optimal amount of scapular stabilization and also showed both high inter-rater and intra-rater reliability.[44]

For measurement of external rotation, the subject was positioned in the supine position with the shoulder abducted at 90° in the scapular plane and the elbow flexed at 90°. The inclinometer was placed on the dor-

Figure 3. *Measurement of glenohumeral internal rotation with scapula stabilized.*

sal surface of distal forearm. The scapula was stabilized by contact with the bed. The examiner passively externally rotated the humerus and the measurement was taken when resistance to any further motion was encountered and attempts to overcome the resistance caused a posterior tilt or retraction of the scapula. For measurement of glenohumeral abduction, the subject was in the seated position with the elbow flexed at 90°. The inclinometer was placed on the lateral surface of distal humerus. The examiner passively abducted the glenohumeral joint stabilizing the scapula and the measurement was taken when resistance to any further motion was encountered. The HA was measured with the subject in the side-lying position. The subject laid with the trunk aligned perpendicular to the treatment table with hips and knees flexed to 45°. The inclinometer was placed on the lateral surface of distal humerus. The lateral border of the scapula was manually stabilized in a retracted position. From a position of 90° of humeral abduction and neutral humeral rotation, the examiner passively lowered the arm into horizontal adduction by gripping the participant's forearm just distal to the humeral epicondyles (Figure 4). The arm was lowered until the humeral horizontal adduction end range was reached (Figure 5). Table 1 displays shoulder ROM measurements at

Figure 4. *Measurement of glenohumeral internal rotation with scapula stabilized starting position.*

Figure 5. *Measurement of glenohumeral horizontal adduction (ending position).*

initial exam. The differences in the pre-intervention condition observed in the glenohumeral IR and HA ROM between the right and the left shoulder were 24° and 8°, respectively, which could be considered clinically meaningful differences.

Following subjective history and physical examination, MTrPs in the infraspinatus, teres minor, and

Table 1. *Passive shoulder range of motion at initial exam*

Measures	Right shoulder	Left shoulder
Internal rotation	44°	68°
External rotation	74°	71°
Abduction	90°	96°
Horizontal adduction	10°	18°

posterior deltoid muscles were suspected as the underlying pathology. According to the literature, the ability to definitively ascertain the exact location of a MTrP is questionable, and examiner experience plays a positive role in determining the presence of a MTrP.[30,45,46] Identification of a tender nodule in a taut band of muscle along with reproduction of the subject's subjective report of pain is the most clinically accurate way to recognize the presence of a MTrP.[47]

Palpation revealed tender/taut bands in infraspinatus, teres minor, and posterior deltoid muscles. Deep palpation of infraspinatus reproduced 7/10 pain in the P1 region. Deep palpation of teres minor and posterior deltoid caused local pain and 5/10 pain in the P1 region.

DIAGNOSIS

Subject reports of anterior pain, a positive Hawkins-Kennedy test, and a positive painful arc sign were consistent with diagnosis of subacromial impingement syndrome. Decreased glenohumeral IR and HA ROM identified the presence of PST.[7]

INTERVENTION

Risks and potential complications were advised and written consent was obtained outlining common and serious adverse events associated with DN interventions. Common complications include bruising, vasovagal response, bleeding, and muscle soreness. More serious (but rare) complications include infection, broken needle, and pneumothorax.[48] There were no reported contraindications to the use of DN. Intervention was performed by a physical therapist with advanced training in DN.

DN was performed to the infraspinatus, teres minor, and posterior deltoid muscles at the areas determined by deep palpation as a possible locations of the MTrPs. The needles used for the treatment of the subject in this case report were solid monofilament Seirin J-type sterile needles, No. 8 (0.30 diameter) x 40 mm. in length. After skin inspection and cleaning with 70% isopropyl alcohol, the needle was inserted through the muscle belly in the tender nodule in the taught band. Each needle was held in the therapist's dominant hand for application of and manipulation of the needle within the tissue. The DN technique utilized ten fast-in/out movements in a cone pattern to attempt to target as many sensitive loci as possible within the tender nodule in the taut band of muscle. As soon as the needle was pulled out of the skin, the needle insertion site was compressed firmly for hemostasis for up 30 seconds and the needle discarded into a sharps container.

For the infraspinatus muscle, the subject was positioned prone with the arm slightly abducted. DN of the infraspinatus muscle was performed using flat palpation to identify the location of the tender nodule in the taught band of muscle located one-third the distance from the scapular spine. The needle was inserted to a depth of 100 mm perpendicularly through the skin directly into the taught band towards the scapula. For the teres minor muscle, the subject was positioned prone with the upper arm abducted to 90°. A tender nodule was located, using flat palpation, in the middle of the muscle belly and the needle was inserted to a depth of 100 mm. two fingerbreadths distal to the glenohumeral joint and directed to the lateral border of the scapula. For the posterior deltoid muscle, the subject was positioned prone with the upper arm slightly abducted. A tender nodule was located, using pincer palpation, in the middle of the muscle belly. The needle was inserted to a depth of 200 mm through the muscle and tangential to the humerus.

OUTCOMES

A clinically meaningful improvement was demonstrated in post-treatment shoulder pain intensity and ROM immediately following a single application of DN. The results of these outcome measures are shown in Table 2. Pain decreased from 7/10 to 2/10 in P1 and from 6/10 to 2/10 in P2 on the NPRS with this provocative position. Pain intensity decreased from 5/10 to 1/10 and from 5/10 to 0/10 during the performance of Hawkins-Kennedy and painful arc sign tests, respectively. For subjects with shoulder pain, the minimal clinically important difference for the NPRS has been reported to be 2.17.[49] IR ROM improved from 44° to 62°, HA from 10° to 29°, external rotation from 74° to 76°, and abduction from 90° to 96°. Changes in IR and HA ROM were greater than the MDC.[43]

DISCUSSION

The purpose of this case report was to describe the efficacy of DN for a subject with PST. The subject demonstrated improvements in pain and gleno-

Table 2. *Outcome measures*

Outcome measures	Initial exam	Following treatment
Pain in provocative posture at P1 (NPRS)	7	2
Pain in provocative posture at P2 (NPRS)	6	2
Internal rotation	44°	62°
External rotation	74°	76°
Abduction	90°	96°
Horizontal adduction	10°	29°
Hawkins-Kennedy test (NPRS)	5	1
Painful arc sign (NPRS)	5	0

P1=primary pain presentation, P2=secondary pain presentation, NRPS=Numerical pain rating scale.
Note: NPRS scores are reported during a provacative posture and the performance of special tests.

humeral IR and HA ROM. PST is often assessed by quantifying glenohumeral IR.[23] In this study, IR ROM increased 18° immediately after DN. Similar to previous studies and clinical experience, this finding suggests that tightness of infraspinatus, teres minor and posterior deltoid muscles may contribute to PST and loss of glenohumeral IR ROM.[11,12,17]

There is no consensus about the optimal position and measurement technique to quantify PST, but according to Kolber et al there is a need to isolate glenohumeral HA by restricting scapular protraction while performing the test.[50] A 19° improvement was observed after DN. Tyler et al. demonstrated a similar improvement in HA (27° ± 19°) after seven-week mobilization of the posterior shoulder, scapular-stabilization strengthening exercises and stretching.[6] Change in HA ROM in the present study is far better than the one previously reported by Laudner et al. showing a 3° marginal improvement immediately after two repetitions of 30 seconds of the sleeper-stretch, performed by the therapist.[19]

Although posterior capsular stiffness has been described as a primary factor contributing to PST, these results suggest that glenohumeral movement deficit and pain associated with this clinical issue may also be influenced by the posterolateral shoulder muscles. Palpable taught bands present in the infraspinatus, teres minor, and posterior deltoid muscles and reported pain reproduction in the shoulder region led to the clinical decision to use DN as the intervention. Although the etiology of PST is multifactorial, it is possible that neuromotor abnormalities, such as muscle weakness of the involved painful muscle and altered motor activation patterns, contribute to pain and ROM impairments, including the development of MTrPs in the shoulder muscles.[51,52] Results of preliminary investigations suggest that DN both modulates pain and improves ROM.[32,35,53] Analgesia may occur via the gate control theory occurring during needle insertion and/or via stimulation of the endogenous anti-nociceptive modulation system.[35,54,55] Restricted ROM may be observed secondary to a contracted taut band,[52] however, is unknown exactly why the ROM increase occurred. Improvement in the ROM observed in the subject after the DN might have been due to a decrease in pain, which allowed an increase in movement.

The subject tolerated the DN intervention very well with no side effects reported following treatment. The subject reported minimal muscle soreness at the area of needle penetration that lasted approximately three hours following treatment.

The results of this case report showed a reduction of pain in the scapular region after the treatment of the glenohumeral muscles. The referred pain in this region by one of the treated muscles has not been described in literature. The painful symptom could have been caused by an overload of the stabilizing muscles of the scapula (trapezius and rhomboids). Several authors have highlighted how limitations of the glenohumeral ROM can alter the scapulothoracic rhythm.[15,56,57,58,59] It is possible that the DN intervention decreased the mechanical load on the scapular muscles by improving glenohumeral ROM, thus reducing the pain.

This case report uses only a single subject, as is typical of a case report research. This is an inherent limitation to a case report, offering only results that relate to this subject that cannot be generalized. Larger randomized control studies looking at DN interventions need to be performed in order to fully assess the effectiveness of DN as a primary intervention for PST. Studies with additional assessment periods designed to investigate immediate versus longer term benefits of DN need to be conducted. Further research is recommended to determine if DN is clinically beneficial independent of other therapeutic interventions such as general or specific exercises targeting the affected musculature, or other manual therapy techniques such as mobilization or soft tissue massage.

CONCLUSION

This case report described the treatment of a subject with PST using DN. DN was tolerated well by this subject, demonstrating clinically meaningful improvements in shoulder ROM and pain, without adverse effects. The findings from this case report indicate that DN may be effective in the treatment of PST when the presentation includes stiffness of posterolateral shoulder muscles and the presence of clinically relevant MTrPs, identified as a primary source of pain and ROM restriction. Further research is recommended to determine the functional outcomes of DN for PST, as well as to determine long-term outcomes, before conclusions can be made regarding the effectiveness of this approach.

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