

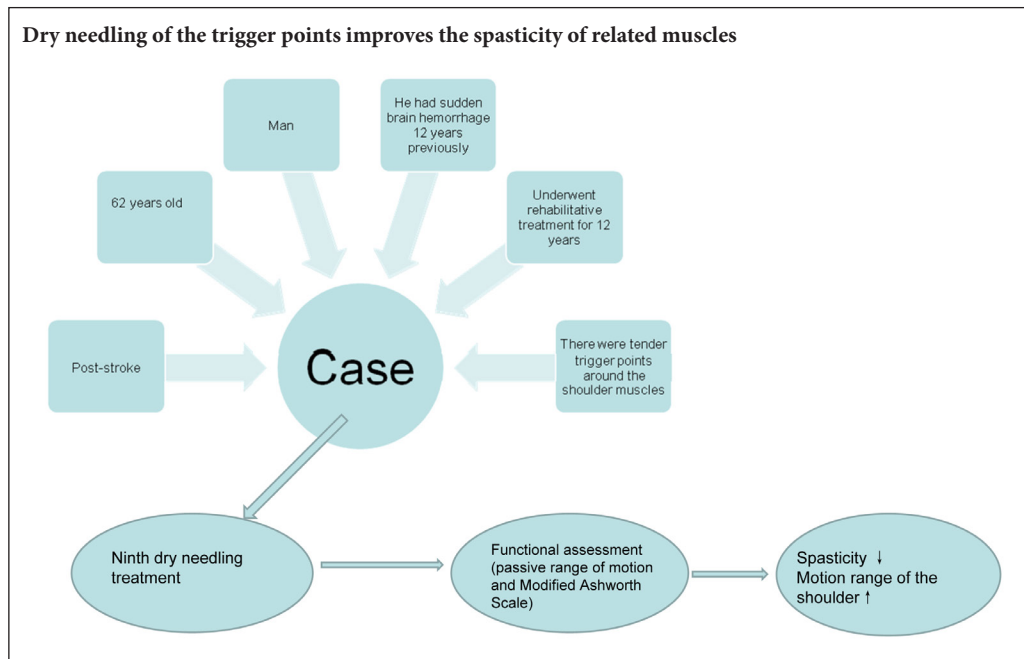
# Dry needling at myofascial trigger points mitigates chronic post-stroke shoulder spasticity

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## Graphical Abstract



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## Abstract

Post-stroke spasticity is associated with restriction in the range of motion of the shoulder. Reducing muscular dystrophy may help relieve muscular dysfunction in patients with post-stroke shoulder spasticity. Dry needle therapy is a method of needling the trigger points using a syringe needle without the use of a drug. Dry needle therapy is commonly used for pain at the shoulder, neck, waist, and back. In this case study, a 62-year-old male patient affected with cerebral hemorrhage of the right frontal lobe had received rehabilitative treatment for 12 years. However, he still experienced shoulder spasticity. The patient received daily dry needling at the trigger points of infraspinatus, teres minor, posterior deltoid, and pectoralis major on 9 days. After the first and ninth treatment, the Modified Ashworth Scale and the passive range of motion of the shoulder was used to assess the effect of the treatment. The spasticity and range of motion of the shoulder showed obvious improvement. These results indicate that dry needling at the myofascial trigger points can effectively treat chronic post-stroke shoulder spasticity.

**Key Words:** nerve regeneration; stroke; dry needling; shoulder spasticity; Modified Ashworth Scale; passive range of motion; neural regeneration

## Introduction

In recent years, stroke has fallen from the third to the fourth leading cause of death but without any large decline in its incidence or case fatality (Burke et al., 2012). Kwakkel et al. (2003) demonstrated that the paretic arm remained nonfunctional in 30–66% of patients with stroke. Spasticity developed in 42.6% of patients 6 months after the first stroke (Urban et al., 2010). Similarly, Watkins et al. (2002) established that the prevalence of spasticity at 12 months after stroke was 38%. Stroke mainly damages the nervous system and leads to spasticity, which, along with a number of other factors, contrib-

utes to functional impairment. Increasing evidence shows that spastic muscle contractures can decrease the length of the muscle cells and the number of sarcomeres (Lieber et al., 2004; Salom-Moreno et al., 2014).

Fresno et al. (2004) introduced the dry needle therapy to treat incomplete spinal cord injury. There are reports of its use decreasing hypertonia, spasticity and dysfunction after nervous system damage. The use of dry needle therapy in myofascial trigger points to improve dystonia is becoming increasingly accepted. An open-label, randomized investigation found that dry needling during early rehabilitation could improve hemiparetic shoulder

pain syndrome (DiLorenzo et al., 2004). A randomized controlled trial found that a single session of dry needling decreased spasticity and widespread pressure sensitivity in individuals with post-stroke lower limb spasticity (Salom-Moreno et al., 2014). Another study found that dry needling decreased upper limb spasticity and improved the function of forearm supinators after a stroke (Ansari et al., 2015).

There are only a few reports on the application of dry needling to increase shoulder range of motion and improve post-stroke spasticity. This report aimed to show the effects of the application of dry needling on the shoulder range of motion and spasticity in the infraspinatus, teres minor, posterior deltoid, and pectoralis major after stroke.

## Case Report

### Patient

This is a case of a 62-year-old, right-handed man who had a sudden brain hemorrhage in the right frontal lobe 12 years previously. Relevant medical history includes hypertension and diabetes. He underwent rehabilitation treatment for 12 years, including passive motion on the hemiplegic side, activities of daily-living training and balance training in the hospital. However, the spasticity around his shoulder did not improve and had almost no active movement. Although he did not report any spontaneous pain when he presented to our hospital, there were tender trigger points around the shoulder muscles. The patient was a college graduate, and he scored 25 points in the Mini-Mental State Examination (Mai et al., 2016), showing a good cognitive level. We explained the treatment and its goals to the patient and then obtained informed consent. The patient was admitted for the dry needling treatment as an inpatient to comply with hospital policy. We obtained informed consent from the patient.

### Treatment

The trigger point, *i.e.* the most sensitive spot in a taut band of muscles, was identified through palpation. After cleaning the surface of the skin, a dry needle (0.3 × 40-mm disposable needle: Wuxi Jiajian Medical Instrument Co., Ltd., Wuxi, China) was introduced through the skin into the subcutaneous tissue to a depth of approximately 15–20 mm. Before the needle was inserted further into the muscle tissue, the patient was reminded about the possible pain, muscle twitching, or unpleasant sensation when the needle contacts with the sensitive spots in the taut band. The muscle fibers of the taut band were explored with multiple needle insertions. A local twitch response was elicited in some insertions. The movement of the needle was “fast in–fast out” until no more local twitch responses were elicited to keep a straight track

of needle insertion and avoid muscle fiber damage. This technique has been described previously (Hong, 1994), when it was used for pain healing. In our patient, upon application to the infraspinatus, teres minor, posterior deltoid, and pectoralis major, the local twitch responses were obvious. We spent approximately 45–60 seconds on each trigger point until the local twitch responses disappeared or until the patient could no longer bear the pain. The patient underwent dry needling and rehabilitation once every day, except on weekends, for a total of nine treatment sessions (**Figure 1**).

### Assessment

Spasticity was assessed with the Modified Ashworth Scale before and after the treatment. This scale is probably the most widely used test for the measurement of muscle spasticity in research and clinical practice, and it has been demonstrated to be moderately reliable (Bohannon and Smith, 1987; Pandyan et al., 1999; Gregson et al., 2000). The degrees of passive range of motion (flexion, extension, abduction and horizontal adduction) were assessed in the shoulder joints using a bubble goniometer before and after the treatment. Each motion was assessed three times, and the mean value was reported.

### Treatment effect

The primary outcome measure was the severity of spasticity of the target muscle group, which was assessed using the Modified Ashworth Scale. A clinically significant improvement in spasticity was reported for all muscles treated (**Table 1**). After the first dry needling treatment, the spasticity of the shoulder flexors, extensors, abductors, and horizontal adductors decreased from grade 3 to grade 2. Before and after the ninth dry needling treatments, the spasticity of the shoulder flexors, extensors, abductors and horizontal adductors remained in grade 2, showing no change.

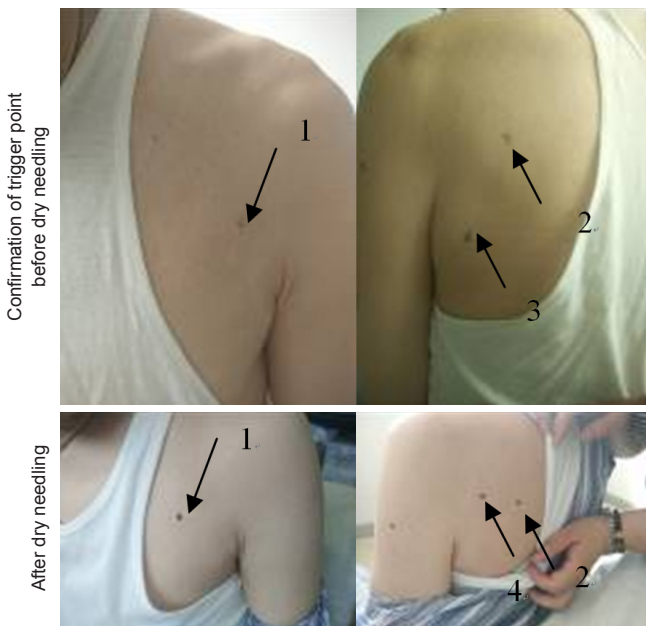
The other outcome measure was the degree of shoulder passive range of motion (**Table 2**). There was a notable improvement in shoulder passive range of motion after the treatment. Furthermore, the patient reported that turning over on the bed became easier, that he could shrug his shoulder slightly, and that his shoulder generally felt better.

### Discussion

The myofascial trigger point is a sensitive spot in a taut band of muscle fibers (Hong, 1994). The shoulder of our patient, whose stroke occurred 12 years previously, had no movement. The physical therapist noted that passive movement of the patient’s shoulder was severely limited. Initially, the patient did not report any pain in the shoulder, but palpation of the infraspinatus, teres minor, posterior deltoid and pectoralis major brought about pain.

**Table 2** Change in the degree of shoulder passive range of motion before and after the dry needling treatment in a patient with chronic stroke

	Flexion	Extension	Abduction	Horizontal adduction
Before the first treatment	95.33	36.33	60.67	26.67
After the first treatment	104.00	50.67	65.33	35.00
Change between before and after the first treatment	8.67	14.33	4.67	8.33
After the ninth treatment	125.00	51.67	71.33	35.67
Change between before the first treatment and after the ninth treatment	29.67	15.33	10.67	9.00



**Figure 1** Dry needle treatment.

A 62-year-old male patient suffered from cerebral hemorrhage of right frontal lobe and underwent rehabilitative treatment for 12 years. However, he still experienced shoulder spasticity. The patient received dry needling on 9 days at the trigger points of infraspinatus, teres minor, posterior deltoid, and pectoralis major. 1: Pectoralis major; 2: infraspinatus; 3: teres minor; 4: posterior deltoid.

Furthermore, local twitch responses were evoked during the dry needling treatment, which implies the trigger points were present in these muscles (Hong, 1994).

Clinically, dry needling of the myofascial trigger point has been used as a rehabilitation technique, along with articular mobilization, manipulation, and exercise therapy, for other pathological muscle conditions (Rainey, 2013; Pavkovich, 2015a, b). A study reported that dry needling of the trigger points of the infraspinatus was effective in improving conditions with restricted movement and lessening shoulder pain (Hsieh et al., 2007). Dry needling of the trigger points of the soleus led to a notable improvement in ankle dorsiflexion (Grieve et al., 2011). Osborne and Gatt (2010) reported an improvement in shoulder range of motion, function, and pain condition of four elite volleyball players after dry needling of the trigger points of the infraspinatus and teres minor. Ingber (2000) reported a long-term alleviation of pain (2 years) in three cases of shoulder impingement in tennis/racquetball players who underwent dry needling of the trigger points

**Table 1** Modified Ashworth Scale scores before and after the first and ninth dry needling treatments in a patient with chronic stroke

	Modified Ashworth Scale scores
First treatment	
Before	3
After	2
Ninth treatment	
Before	2
After	2

of the subscapularis.

These studies show that dry needling of trigger points mainly alleviates pain and improves the range of motion of related joints. The latter improvements are in accordance with our results. After the first dry needling treatment to the trigger points, the degree of shoulder flexion, extension, abduction, and horizontal adduction improved (8.67°, 14.33°, 4.67°, and 8.33°, respectively). The change in degrees of range of motion was noted immediately after treatment, which implies that dry needling of the trigger points of the infraspinatus, teres minor, posterior deltoid and pectoralis major can immediately increase shoulder passive range of motion. After the first treatment, the classification of spasticity changed from grade 3 to grade 2 in each of the shoulder flexor, extensor, abductor, and horizontal adductor muscles. Our patient did not report autonomous pain, except when his shoulder moved. We infer that a full stretch range of motion is limited by pain. A passive range of motion restriction may be caused by trigger points, perpetuated by spasticity. Lieber et al. (2004) reported that spasticity can change the structure of the muscle by increasing the stiffness in muscle cells and tissues. We believe that dry needling changes the integrity of local soft tissues and muscle fibers, thus decreasing resistance when stretching the muscle. This could explain the improvement in related muscle spasticity and shoulder passive range of motion in our case.

Our findings suggest that dry needling of the trigger points may have a prolonged effect. Spasticity is a sensorimotor disorder, and we believe that during dry needling, the mechanical sensory stimulation evokes a sensory transduction that not only affects the needling areas, but the nervous system as well. Encouragingly, after the ninth treatment, the patient was able to shrug his shoulder.

In conclusion, dry needling of the trigger points improves the spasticity of related muscles that in turn gives the nerve control of the relatively undamaged muscles, allowing movement of the shoulder.

**Author contributions:** *LT wrote this paper and treated the patient. YL and QMH revised this paper, and YY was in charge of measurement. All authors approved the final version of the paper.*

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**Data sharing statement:** *Datasets analyzed during the current study are available from the corresponding author on reasonable request.*

**Plagiarism check:** *Checked twice by iThenticate.*

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