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Treatment of Shoulder Injuries using Dry Needling in Badminton Players

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Abstract: ***These case reports describe the short - term benefits of dry needling in shoulder injuries in five state level female badminton athletes during a month - long intense competitive phase, using both replicable subjective and objective measures. Dry needling of scapulohumeral muscles was carried out. Range of movement, strength and pain were assessed before and after treatment, with a functional assessment of pain immediately after playing and overhead activity, using the Pain Questionnaire. All scores were improved post - treatment and athletes were able to continue overhead activities. Other studies have suggested that myofascial trigger points may cause significant functional weakness and reduced range of motion, with referred pain. Trigger point dry needling has been successful in treating athletes with myofascial pain and impingement symptoms but with only subjective improvement and not during a competitive phase. These cases support the use of dry needling in elite athletes during a competitive phase with short - term pain relief and improved function in shoulder injuries. It may help maintain rotator cuff balance and strength, reducing further pain and injury.***

Keywords: dry needling, shoulder injuries, badminton athletes, pain relief, functional improvement

1. Introduction

These case reports describe Five athletes from the state level female badminton athletes who complained of recent onset anterior/anterolateral shoulder pain. Subjects (mean age 25±2) were right - arm dominant for hitting and serve. They were involved in an intensive 25 day overseas competitive summer tour at the time of assessment. Twenty matches were played in addition to training, averaging 5 hr a day. A brief history was taken, combined with assessment of range of movement (ROM), strength and pain. In abduction and internal rotation at 90° abduction, using a Goniometer, were used as objective measurements of function as dysfunction of these motions may be associated with overhead shoulder complaints. Power was manually tested in lateral rotation at 90° abduction and the 'empty can test' was used as a special test to identify supra spinatous problems. [1]

Myofascial trigger points (MTrPs) were identified manually as tender points eliciting the athlete's complaint. Taut bands were found mainly in infra spinatous and teres minor, with referred pain to the anterior shoulder, leading to functional problems in abduction and internal rotation at 90° abduction and impaired scapulohumeral rhythm to varying degrees. Dry needling was carried out with the aim of releasing these bands, supported by the literature in the review. [2–4]

Five to Fifteen needles were inserted into the muscles, perpendicular to the fibres, with a deep insertion of between half and two thirds of the whole length of the needle's shaft. Each needle was twisted until a local tenderness was felt and a referred sensation to the anterior aspect of the shoulder and left for 10 min. Muscle tone was assessed by palpation and in all subjects, there was a return to the perceived 'normal'. Other forms of therapy included were limited to soft tissue therapy around the shoulder, post - training icing strategies, exercises and stretching [4]. The treating therapist is lots of experience with elite sports with the recent 2 years focused on Badminton. To assess pain, the short form McGill Pain Questionnaire (SF - MPQ) [5] was used, consisting of three parts: (1) a pain rating index (PRI), 15 descriptors; (2) a present pain intensity (PPI) on a scale of 0–5; and (3) a visual analogue scale (VAS). It has been used previously in studies of pain including dry needling experiments. [6] and sports injuries [7] as a quick qualitative assessment tool. It was used directly after a Badminton session/match to indicate pain levels during activity. Verbal pain scores were taken immediately before and after treatment, combined with measures of active ROM. Measures of ROM were only taken on the day of treatment, while functional pain scores were assessed on day 1 (day of treatment) and 3rd day, written consent was obtained.

2. Outcome

ROM (previously restricted by pain) was markedly improved, for both abduction (improvement 100–120°) and internal rotation at 90° abduction (50–90°) along with notably lower movement pain scores after dry needling, compared to before (Table 1). Before treatment, testing of muscle power with lateral rotation against resistance was painful and weak in all subjects, most apparent in subject 1 and 2. Medial rotation power was normal. All five subjects showed a positive 'empty can test'. Post - treatment, both the 'empty can test' and muscle power, assessed using manual resistance were subjectively improved. All five subjects had one session of dry needling. And consecutive days as after match play on day 3, ROM scores had not improved enough to allow sufficient function. While the level of pain experienced during dry needling was higher on this second day, functional assessment on day 3 revealed full recovery of active ROM. The PRI for the four athletes ranged between 19 and 4 before dry needling to between 6 and 1 during day 2'ssession The VAS ranged from 7.1 to 3.1 before treatment to between 3.1 and 2.4 on day 2 The PPI was 2 or 3 for all five athletes on day 1, reduced by day two. These results indicate a trend of reduction in functional pain over the days following treatment. Subject 3 had the best results with an improvement on day 1–2 of 19 to 6 on the PRI, 7 to 2.5 on the VAS and 3 to 1 on the PPI. Subject 2 showed no change between day 1 and 2 after the first dry needling, but then reduced scores after day 2's treatment. Despite continued training and competition, none of the pain scores increased to near pretreatment levels in any of the five athletes.

Figure 1: Internal rotation at 90° abduction

Figure 2: Abduction using goniometer.

Table 1: Results

Subject	1	2	3	4	5
Shoulder history	Intermittent pain in right shoulder	Right arthroscopic capsular tightening before 18 months.	Intermittent pain over last 1 year with increased symptoms over training camp	Intermittent pain in left shoulder	Intermittent pain in right shoulder
Painful movements	overhead movement	abduction	abduction	overhead movement & abduction	overhead movement
Positive TrP muscles	Infraspinatous, teres minor	Infraspinatous, teres minor, anterior deltoid	Infraspinatous, teres minor, anterior deltoid	Infraspinatous, teres minor	Infraspinatous, teres minor
Verbal pain score prior to Rx (/10)	4	6	8	5	4
Verbal Pain score during Rx when TrP activated (/10)	7	8	9	7	8
Verbal Pain score after Rx (/10)	4	5	3	2	2
ROM Abduction: before Rx	Pain at 50° and 140°	Pain at 80° to 140°	Pain at 80°	Pain at 80° and 140°	Pain at 50° and 150°
ROM Abduction: after Rx	Full ROM	Full ROM	Full ROM but tender	Full ROM	Full ROM
ROM Internal rotation: before Rx	Pain from 0° to 80°	Pain from 40° to 60°	Pain from 40° to 80°	Pain from 20° to 60°	Pain from 40° to 50°
ROM Internal rotation: after Rx	Pain at 70° (end range)	Pain at 75° (end range)	Pain at 65 - 80° (end range)	Full ROM	Pain at 75–80° (end range)

3. Literature Review

This case report series describes the short term benefits of dry needling on shoulder problems in Badminton athletes, with replicable measures of functional pain scores on court and objective measurements of active ROM.

Badminton is an individual and non - contact sport which requires jumps and rapid arm movements from a wide variety of body positions. The physical demands of badminton suggested that severe injuries to the limbs may frequently occur. [8]

Shoulder problems have been described as the second most common overuse injury with an incidence of up to 20%, [9] and with an average loss of 6.5 weeks training and/or competition in this sport. This is most probably related to the high volume of hitting activities during a season, combined with the mechanics of the arm swing. [9] MTrPs, first introduced by Travell and Simmons, [10] are hyperirritable taut bands of skeletal muscle, which are exquisitely tender and exhibit fairly consistent muscle specific patterns of referred pain. They may develop due to muscle injury or repetitive overload in any part of the body during sport. [11] Trigger points (TrPs) can be active (with spontaneous pain), or latent (no pain), causing shortening, stiffness or weakness of muscle, reduced ROM and postural changes. [12] They can be identified by palpating a rope - like in duration that is locally tender with the characteristic referred pain associated with that muscle. [10]

Pathophysiology of MTrPs

Dysfunctional motor endplates are thought to play a role in MTrPs. [13] Damaged fibres of injured or overloaded muscles are thought to release excessive amounts of acetylcholine at the neuromuscular junction, shortening muscle fibres into taut bands. This sensitization and inflammatory response cause allodynia at the MTrP site and explain why they are so tender to touch. [13 - 14]

Mechanism of dry needling

Dry needling involves the direct insertion of a needle into the MTrP. William Osler, Regius Professor of Medicine at Oxford stated that "for lumbago, acupuncture is in acute cases the most effective treatment. [15] In 1979, Lewit was the first to suggest that needle insertion itself, rather than injected an aesthetic, was sufficient for analgesia. [16]

There are a number of proposed mechanisms that are not mutually exclusive:

1) Mechanical stretch by the needle stimulates a spinal reflex, causing a brisk transient contraction of the fibres, [14] called a local twitch response (LTR). The local stretch disentangles myosin from actin and allows it to resume its resting length. [12] Winding the needle may be beneficial as it provides greater stretch. [12 - 14]
2) The stretch is sensed by Aβ mechanoceptors in the fibre, which act via 'gating' afferent neurons to inhibit the intradorsal horn passage of C - fibre action potentials, thus alleviating pain. [14, 20]
3) Needle insertion activates cutaneous Aβ fibres, stimulating enkephalinergic inhibitory interneuron in the dorsal horn to release opioid - like peptides that also inhibit C - fibre transmission. [14, 20]
4) Chemical changes at MTrPs may be corrected after an LTR, which may reduce nocieptive stimulation. [12, 20]
5) Improved haemodynamics and muscle recovery have been correlated to reduced pain levels the day after needling. [17, 20]

Hong showed that for more immediate needling results, a series of LTRs had to be evoked by rapidly inserting the needle into separate loci within the MTrP, [18 - 19] suggesting that LTRs are key to obtaining the desired response. However, within 8 hr of needling, soreness that was different to the patient's original myofascial pain was noted in all patients who had LTRs. [19 - 20]

Dry needling in athletes and the shoulder

While dry needling has been shown to have positive analgesic effects, the significance of these results has varied. [1 - 3] In athletes, the placebo role in cortical top - down inhibition of pain is arguably important clinically. However, if TrPs are causing reduced ROM or weakness, then this effect alone would be insufficient for resuming full function. MTrPs can be associated with unilateral shoulder pain. [3 - 4] Dry needling case studies have been described in three overhead Sport athletes with shoulder impingement (tennis/racquetball players), who had not responded to a conservative approach. [3 - 4] Dry needling and stretching varied among athletes but all returned to full pain - free function within 2 years. This was based on reports of 'no pain', although without evidence of replicable assessments. When TrPs were present in these muscles, a significantly different temporal sequence of muscle activation was measured, compared to pre - intervention, which may predispose individuals to impingement of shoulder structures. This altered timing was shown to be normalized by dry needling and stretching.

4. Discussion

Studies have suggested a successful role of dry needling in treating acute myofascial pain [1 - 3] and a subjective improvement in pain when used in athletes, including those with overhead actions. [4] To our knowledge, these are the first case studies described in athletes during intense competition that combine short - term replicable assessments of sport - specific pain scores with an objective measure of ROM directly following treatment.

Targeting sport specific muscle TrPs

Dry needling was successful in treating acute shoulder pain by targeting specific muscles acting at the glenohumeral joint. [20] Hitting and serve movements that were causing these symptoms predominantly involve concentric internal rotation and eccentric external rotation of the joint. [20 - 21] Teres minor and infra spinatous were the primary muscles treated. It is therefore logical to assume that the location of ball contact relative to the shoulder and thus the ratio of rotator cuff muscle activation, can affect the load on the joint.

Wang et al showed that the mean strength ratio of external rotation to internal rotation of the shoulder differed between dominant and non - dominant arms for concentric contraction in male volleyball players, [21] of whom six out of 10 reported a diffuse pain located laterally on the dominant shoulder, similar to the pain described in this case report series. A strength imbalance may cause instability or overload the glenohumeral joint, and may predispose volleyball players to tissue damage and TrPs in weaker external rotator muscles. [21] This highlights the importance of maintaining optimal eccentric external rotator cuff biomechanics, such as by TrP dry needling.

Mechanism of dry needling

The main effect of needling occurred immediately after dry needling or within the first 24 hr, with minimal further pain reduction in the following days, but no relapses to pretreatment levels. [20] In theory, gradually improving muscle haemodynamics may also contribute to the response over days 1–3. [18] The immediate improvement in ROM could be explained by the needle stretching of muscle fibres, allowing them to resume normal length, on top of reduced pain inhibition of movement. Passive ROM was unaffected. Various studies have used weekly dry needling sessions and it has been suggested that a week is necessary between treatments to allow the muscle to recover. [22] However, these studies were not in elite athletes, where the cause of injury, for example, overhead activity must be repeated regularly. The second more painful session actually produced a better ROM and a delayed further reduction in pain the following day. Pain caused by the LTR - producing needling may also mask the extent of initial pain reduction, causing an apparent further improvement when this separate pain wears off.

As in any sport environment, athletes were required to maintain fitness on a daily basis, often needing combined treatment regimes. It was therefore felt that restricting treatment to dry needling in a competitive scenario would be impractical and unethical and that other forms of treatment, such as soft tissue therapy, may be required to maximize the effects. These subjects were sustained in a performing role over a high intensity period. This is very appropriate clinically as rest post - injury is not always possible during

competition. Combining the sport - specific pain scores with ROM enabled a better appreciation for the practical effects and reduced the impact of placebo.

5. Conclusion

This case report series supports the use of TrP dry needling in female athletes with short - term pain relief and improved active ROM in the management of acute shoulder injuries, during an intense competitive period. By the present study, concluded that dry needling is helps to shoulder injuries in Badminton Athletes.

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