

REHABILITATION USING ACUTE DRY NEEDLING FOR INJURED ATHLETES RETURNING TO SPORT AND IMPROVING PERFORMANCE

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1. ABSTRACT

Dry needling, also known as trigger point dry needling and intramuscular stimulation,^{[1][2]} is a treatment technique used by various healthcare practitioners, including physical therapists, physicians, and chiropractors, among others. It involves the use of either solid filiform needles^[4] or hollow-core hypodermic needles for therapy of muscle pain, including pain related to myofascial pain syndrome. Dry needling is mainly used to treat myofascial trigger points, but it is also used to target connective tissue, neural ailments, and muscular ailments. The American Physical Therapy Association defines dry needling as a technique used to treat dysfunction of skeletal muscle and connective tissue, minimize pain, and improve or regulate structural or functional damage.³ Currently, dry needling is being practiced in the United States, Europe, Australia, and other parts of the world.^[1] Dry needling is most commonly used in the subacute and chronic phases of an injury; therefore, it is imperative to understand the use of dry needling in the acute phases of an injury. There are four main reasons to use dry needling during the acute phase of injury: to relieve pain, decrease edema, increase range of motion and flexibility, and increase strength and power. Dry needling can be used pregame, postgame, during half time or an intermission, or following an injury. Although further research is needed, acute dry needling can be used to bolster athletes' health and possibly improve sports performance.

2. KEYWORDS: Dry Needling, Athletes, Recovery, Returning to Sport, Improving Performance

Article History

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3. Abbreviations

DN, RTS, IP.

4. INTRODUCTION

Dry needling is defined as the insertion of solid fusiform needles at the particular area where the pain present in the body.¹ Dry needling applied on targeting muscle, neural, and connective tissues.¹ Physical therapist as well as other health care professionals does perform dry needling which is quite commonly seen in the United States.²

HISTORY

The dry needling technique applied since 70 years.¹ In the early article of dry needling, it was not specified which type of needle was used. This has become ongoing debate about the history of dry needling.² The founder of dry needling are Janet Travell and Lydon B Johnson, who are the former personal physician to presidents John F. Kennedy.² The debate of dry needling done heavily due to lack of specificity of the type of needle used.² In 1983 book, *Myofascial Pain and Dysfunction: The Trigger Point Manual*, the concept of injections is discussed.^{2,21} Corticosteroids and botulinum toxins are variety of substances used to inject for wet needling.¹ Physical therapists do not perform injections. One of the earliest known articles describing dry needling using a solid fusiform needle was published in 1979.² Dry needling started receiving tremendous popularity in the early 21st century.² When trigger point needling is applied to an affected muscle or trigger point, it will decrease muscle tightness, increase blood flow and reduce pain. Patients often report immediate relief after treatment. The needles remain in your muscle for a short period of time - between 10 seconds and 20 minutes - during treatment. The American Physical Therapy Association defines dry needling as a technique used to treat dysfunction of skeletal muscle and connective tissue, minimize pain, and improve or regulate structural or functional damage.

Dry needling is used to treat a variety of anatomic structures and for a multitude of reasons. Dry needling is used to stimulate neural, muscular, and connective tissues.¹ This includes scar tissue, tendons, and muscles ([Fig 1](#)). Some pathologies that have shown benefit from receiving dry needling include knee osteoarthritis, piriformis syndrome, and plantar fasciitis.¹ It is most common to see subacute and chronic conditions receive dry needling by a physical therapist. This may be due to the delay in time it takes a patient to see a physical therapist. Another possible explanation is that many physical therapists try to use other minimally invasive techniques before progressing along the continuum. This highlights the need to further investigate and discuss the possibility of dry needling in acute conditions and the athletes who hope to receive its short-term healing benefits.

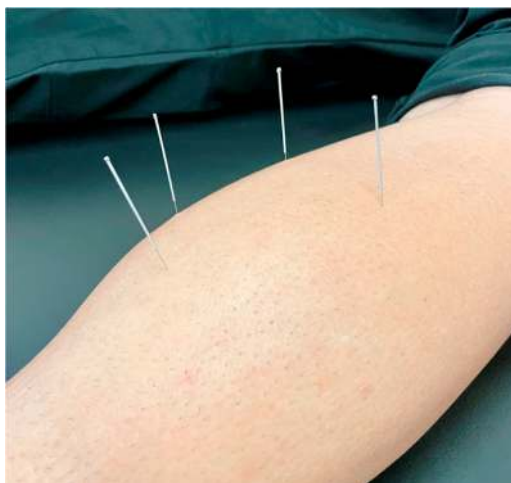


Figure of Dry Needle Application to the Right Calf Musculature.

Effects of Dry Needling

Dry needling will be beneficial for biomechanical, endocrinological, and also for vascular effects. The literature quotes by stating that microcirculation, pain, nerve conduction studies, connective tissue, oxygenation to targeted muscles and soft tissues, range of motion, and muscular strength all improve with dry needling.^{1,2} When functional electrical stimulation is

used, evidence shows hormones of pain such as an increase in β -endorphins and a reduction of cortisol.¹ The main mechanisms for the effects to control manipulation of pain gate control theory, endogenous opioid system, and purinergic signaling system.²

Physical Therapist in Sport

Sports physical therapists play the great role in the management of athletes and their athletic related injuries.³ Sports certified specialist (SCS) is a certified and earned through their time spent for rehabilitating athletes, learning about their injuries and working on their enhancement of athletes performance. Simultaneously also required additional training for an emergency responder certification.³ Physical therapists mandatory with additional training to be qualified to provide additional coverage.³ Physical therapists with their SCS certification are able to perform both manage of athletes injuries and rehabilitation of athletes, with pre hospital care as needed.³ Sports physical therapy residency programs educate on how to provide care for athletes with the goal of having the valid SCS certification. Dry needling are widely used in sport medicine.² Sports physical therapists gain opportunity to bring dry needling to athletes for their healing process .

Main Reasons to Implement Dry Needling

There are four main reasons to implement dry needling at the initial phase: to prevent pain, reduction of edema, focusing on range of motion and flexibility, and strength and power. Main aim of dry needling on immediate, short term, and acute effects . The literature will allow us to further enumerate how these effects can be benefitted for an athlete by under use of sports physical therapist.

Pain

Improvements in pain are one of the most commonest findings following dry needling treatment, but the degree of effect lasts is varied. In an article by Mejuto-Vasquez et al., subjects with acute neck pain were treated with trigger point dry needling.⁴ After 10 minutes and duration of 1 week after dry needling, the participants had shown effective with decreased pain intensity and an improve pain threshold to subside when compared to the control group.⁴ Similarly, a case report by Pakovich⁵ found at treating acute neck pain in an active 64-year-old female with dry needling and found effective in improvement in pain and disability following intervention.⁵ The subject's pain and functional improvement are shown after the initial treatment, which lasted till the completion of treatment session.⁵ If lasting effects from one session of dry needling are seen for up to time of session , it may be worth suggesting the use of dry needling to a game or during the subacute phase of an injury in the week leading up to a game.

In a Cochrane Review by Furlan et al.,⁶ subjects with chronic low back pain had got relieved at short-term.⁶ Many athletes suffer from chronic low back pain, and we neglect that this might negatively impact their performance. In another study by Kamali et al.,⁷ 40 athletes with one side shoulder impingement syndrome received dry needling therapy to trigger points in the upper trapezius and infraspinatus muscles. Dry needling of trigger points in the upper trapezius and infraspinatus both relieved from pain.⁷ For example, these results should be evident to clinical practice when using dry needling on a baseball pitcher with shoulder pain post-game. In a recent study, a group of subjects who had an acute ankle sprain resulted in chronic instability saw reduction in pain and improved function following a single dry needling session.⁸

Range of Motion

Mejuto-Vasquez et al.⁴ found significant relief in cervical range of motion at 10 minutes and 1 week of postintervention.⁴ In a systematic review, Bynum et al.⁹ found significant that dry needling improved cervical range of motion both actively and passively.⁹ Dry needling has been effective to improve athletes performance. In a 2013 article by Dembowski et al., dry needling was used combination with eccentric exercises to return a collegiate pole vaulter with a hamstring strain to sport. The college pole vaulter was seen 3 times a week for 3 weeks with dry needling.¹⁰ By day 12, the subject has significant improvement during active straight leg raise with no longer deficit in active range of motion.¹⁰ Returning an athlete to full range of motion may aid in their ability to progress through rehabilitation and return to performance. This article demonstrates a more well significant treatment approach, involving dry needling as an additive to a rehabilitation plan.

A recent study by Alaei et al. found that dry needling increases active knee extension as much as static stretching.¹¹ Simultaneously, passive movement improved more with dry needling than with static stretching in individuals with hamstring tightness.¹¹ In a 2016 case study by Passigli et al., a male dance instructor with subacromial impingement on his affected side received dry needling to target myofascial trigger points at his posterior shoulder.¹² Relieve from pain and improvement in range of motion were found following both the treatment.¹² The changes in intensity of pain and internal rotation and horizontal adduction of glenohumeral were found to be clinically significant¹²

Strength and Power

Dry needling is effective to improve strength and power in athletes. The case report by Luna,¹³ suggested that traditional acupuncture and Chinese techniques were used to increase range of motion, relieve pain, and improve grip strength in a Brazilian Jiu Jitsu athlete with proximal interphalangeal inflammation.¹³ In healthy college students dry needling improved for vertical jump height immediately following intervention.¹⁴ This brings into question that idea of using dry needling for athletic performance improvement. Jankowski et al. investigated the effects of dry needling at trigger points in ballet dancers. They found that left plantar flexion torque increased, but range of motion and pain were not effective.¹⁵ Jankowski surmised that further research is needed prior to implement dry needling technique prior to athlete performance.¹⁵

Edema

The use of dry needling to reduce edema following an acute injury. Acupuncture evident as shown to decrease swelling following a total knee arthroscopy in the postacute phase.¹⁶ In a 2012 article, Mikashima et al. found that the group receiving acupuncture treatment saw a relieve from pain and returned to preoperative range of motion earlier than a control group.¹⁷ In a study by Cassileth et al., they looked at acupuncture as the treatment of breast cancer-related lymphedema. They found that acupuncture will relieve from arm circumference. Eleven of 33 patients saw greater than 33% limb reduction with the mean circumference reduction being .90 cm.¹⁷ It is evident that research on dry needling with athletes is appearing in the academic literature, but require enough time to draw conclusive evidences.¹⁸

Pregame

Dry needling can be used in the acute phase of an injury. These program include pregame and in-game, postgame, and in the rehab setting. Dry needling can be used in several ways for the pregame and in-game program. Dry needling can also be treated during pregame is for muscle activation. This to be used as a warm-up with an apply-and-remove technique. This technique can be described as inserting the needle into the targeted muscle to elicit a response and taking the needling

out right away. This to be considered as warm up for athlete competition, but should be used with a dynamic on-field warm-up to ensure the athlete is ready to perform. apply-and-remove technique can also be used for a cramps or muscle spasm during the game. The current belief is that a needle will reset the muscle and allow the muscle to relax.

Post-Game

Dry needling can also be used after a game for a prolonged effects in an acute injury setting. The main reason to use dry needling after a competition would be for pain relieving mechanisms. To use dry needles for pain relieving mechanisms is to insert them on trigger points. This can be done with the apply-and-remove technique or with inserting the needle in for a set period of time. Inserted needle in for a set period of time can help to downregulate the nervous system after competition. Depending on targeted area where you are inserting the needle, the needle can be left in for various amounts of time. Treating a certain joint or segment of the body for the needle to be inserted in for 10 minutes.^{19,20} When treating systemically, leaving the needle at targeted area to get relieved soon.^{19,20}

Start the stimulation with the parameters of 2 Hz to release enkephalins, β -endorphins and endomorphins.^{21, 22, 23, 24} This will prove long-lasting pain relief but with a slower onset of pain modulation. If the athlete is experiencing severe pain signals, a setting of 100 Hz can be used for short-lived pain relief with a more immediate effect.^{19,20} Alternative way to downregulate the nervous system is to use primary passive trigger points (PPTP), which is based on the work of Houchi Dung.²⁵ Dung describes these trigger points as areas of improved sensitivity in several times of our lives. He noticed 6 points in the upper extremity, 9 points in the lower extremity, 7 points in the spine, and 3 points in the face that can provide athletes with a downregulation of the nervous system to allow for better recovery. For the purposes of this article, we will not go into depth about Dr. Dung's work beyond what has been noted above.

Acute Management of Injury

Dry needling be used for the acute management of injury in the rehabilitation setting. Dry needling used for pain gate theory as stated earlier and also used for muscle activation, edema control, and trigger point release. For muscle activation, one use the apply-and-remove technique, but the most common part is placing the needles inside by using electronic stimulation (e-stim) for muscle activation. The electrical stimulation to be set at 2 Hz or 100 Hz setting for not more than 5 minutes.^{19,20} The idea is to contract the muscle fibers and branches of the motor nerves to create a contraction. This is often used in patients with nerve damage for 6 or more weeks out after an operation when the patient is having difficulty in getting a strong muscular contraction.

Edema Control

Dry needling may also be used for relieve from edema. The practitioner will place needles around the injured site. These needles are often shorter 13-mm needles, and they are placed in for up to 30 minutes.^{19,20} This will reduces for both acute and chronic swelling. This technique has not nourished the research at this time.

Trigger Point Release

Trigger point release effectively done with dry needles. This technique administered by the practitioner applying a needle directly at trigger point to release the targeted trigger point. This should be done by placing the needle in the trigger point for 10 or more minutes.^{19,20} The practitioner will rotate the dry needle to release the trigger point. This technique is very painful for the athlete but have tremendous effect in making multiple insertions and releasing the trigger point.

5. Materials and Methods

Dry needling is thought to positively affect several bodysystem levels, including local, autonomic, and systemic.^{25–27} The insertion of a needle into the body stimulates both neurologic and hormonal processes including pathways for pain control, autonomic nervous system regulation, and cholinergic anti-inflammatory processes,^{25–28} all of which may positively support postexercise recovery. Researchers studying DN have suggested that the modality may positively affect pain perception postexercise and reduce fatigue.^{9,29} Dry needling has also been reported to increase regional blood flow and oxygen saturation and to decrease muscle tension, improving range of motion and muscle function.^{11,14,30,33}

Intervention

The ARSS Measurement Tool

The ARSS is a standard component of care. The ARSS consists of 32 Likert-style questions relating to the themes of recovery or stress. ³⁴ Questions related to recovery make up a recovery subscale, and questions related to stress make up a stress subscale. Questions on the ARSS include words and short phrases related to components of recovery or stress, and each specific question is assigned to 1 of the 8 subcategories (ie, 4 subcategories for recovery and 4 subcategories for stress). Recovery subcategories include physical performance capability (PPC), mental performance capability (MPC), emotional balance (EB), and overall recovery (OR). These recovery subcategories reflect perceived levels of strength and energy, alertness, positive mood, and global mental and physical recovery. ³⁴ Stress subcategories include muscle stress (MS), lack of activation (LOA), negative emotional state (NES), and overall stress (OS). These stress subcategories reflect perceived levels of muscle fatigue, motivation or energy, emotional health, or exhaustion. ³⁴ Kellmann and Kölling ³⁴ provided specific definitions for each of the subcategories of the ARSS. The response option for each question in a subcategory are scored from 0 to 6. For each subcategory, a total summary score is calculated by adding the responses for each question; the total score ranges from 0 to 24. Then the mean, which ranges from 0 to 6, is determined and used for analysis. ³⁴ When interpreting the scores, higher scores are better for recovery subcategories, and lower scores are better for stress subcategories. The English version of the ARSS has been translated from the original German version and has been found to have good validity and reliability.^{16,35}

Before administering the ARSS, we provided education and instruction on its purpose and completion via a video presentation to all athletes. The ARSS baseline assessments were administered to athletes on the ice hockey team during a time of low academic and physical stress before the start of the season. When trends in decreased recovery or increased stress were found or an athlete sought treatment because of muscle tightness, soreness, or fatigue, the ARSS instrument was administered, and scores were tracked over time. All data for the ARSS recovery and stress subscales are reported as average scores.

Dry-Needling Treatment

All athletes were managed using the same lower extremity systematic DN approach and protocol. This DN protocol was designed to decrease pain, assist in maintaining homeostasis, and stimulate the cholinergic anti-inflammatory processes. Static needles were placed in specific locations (Tables 2 and 3) that consisted of 5 bilateral points on both the anterior (Figure 1) and posterior (Figure 2) aspects of the lower extremity and lumbopelvic complex, originating from 24 primary points described by Dung.³⁶

Table 1

Case No.	Year and Position	Primary Concerns
1	Senior defenseman	Bilateral quadriceps and iliotibial band tightness Gluteal soreness
2	Junior forward	Lower extremity fatigue Bilateral quadriceps tightness
3	Sophomore defenseman	Lower extremity fatigue Feels like “legs are burning” Overall general fatigue
4	Sophomore goaltender	Sleeping and eating normally Minor tightness and soreness of lower extremity Overall fatigue Lower extremity soreness, tightness, and fatigue

Table 2: Anterior Systematic Recovery Dry-Needle Points³¹⁷

Primary Point	Acupuncture Point	Location Description	Needle Length and Gauge	Direction
Sural-I	BL57	Between the 2 heads of gastrocnemius muscle in musculotendinous junction	30 mm, 0.30	Perpendicular
Lateral popliteal	BL39	Inferior to the lateral edge of popliteal, on medial side of biceps femoris muscle ⁶	30 mm, 0.30	45° Angle away from midline
Inferior gluteal	GB39	Center of gluteal region between sacrum inferior lateral angle and femoral head	75 mm, 0.30	Perpendicular
Superior iliacal	YaoYan	Highest point of iliac crest	50 mm, 0.30	Tilted >45° downward and inferior to iliac crest
Posterior cutaneous of L5	BL25	Lateral margin (bulge) of erector spinae muscle, about 3 cm from spinous process L5	50 mm, 0.30	Inferomedial orientation

Table 3

Primary Point	Acupuncture Point	Location Description	Needle Length and Gauge	Direction
Deep peroneal	LR3	2 cm proximal to toe webbing between great toe and second ray	15 mm, 0.30	Perpendicular
Tibial	SP6	Medial aspect of distal lower leg, about 6 to 8 cm superior to medial malleolus	30 mm, 0.30	Inferomedial orientation, with anteroposterior insertion
Saphenous	SP6	Medial aspect of knee directly distal to the medial tibial condyle	30 mm, 0.30	Inferomedial orientation, with anteroposterior insertion
Common peroneal	GB34	Lateral aspect of lower leg inferior and anterior to fibular head	30 mm, 0.30	Perpendicular
Iliotibial	GB31	Center of lateral thigh between hip and knee on iliotibial band	75 mm, 0.30	Perpendicular

6. RESULTS AND DISCUSSION

Teasdale¹⁰ found a statistically significant benefit to dry needling, and noted that dry needling has been shown to reduce pain, increase quality of life, and increase range of motion beyond that produced with standard acupuncture.¹⁰ Four studies revealed that DN is superior to non-penetrating interventions aimed at decreasing myofascial trigger points.⁷⁵ Lastly, two studies provided contradictory results when comparing

7. CONCLUSIONS

In conclusion, dry needling can be used to help treat edema, to improve range of motion, to improve neuromuscular firing of a muscle, and to relieve pain. Dry needling has been used commonly in the subacute and chronic phases of an injury but has not been researched in the acute phase. On the basis of clinical experience and current research using dry needling for

acute injury, it has been helpful for athletes. More research is needed to confirm the effectiveness. Although there is little research that shows the effects of acute dry needling, medical providers should still consider this modality to help treat their patients in the acute phase of an injury.

Conflict of Interest

NO any conflict of interest exists.

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