DRY NEEDLING

Dry needling is a technique similar to acupuncture that is used for the treatment of trigger points and muscle pain. This article describes its effects, dangers and technique as well as providing details of how to treat common trigger points.

BY DR CHRIS NORRIS PHD, MCSP

Figure 1: Filiform needle used for dry needling (left) and a hypodermic needle for injections (right). (Photo credit: C. Norris, 2015)

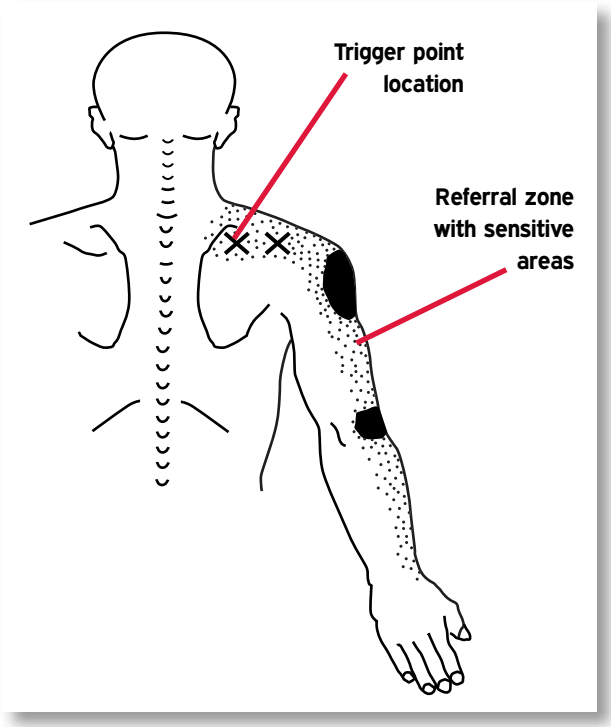


Figure 2: Pain referral pattern from a supraspinatus trigger point. (sportEX, 2015)

WHAT IS DRY NEEDLING?

Dry needling (DN) is becoming increasingly popular amongst manual therapists, with CPD (continued professional development) post-graduate courses offered by several educational providers (DNI 2014) (1). Guidelines for its practice are issued by the major physiotherapy/physical therapy regulatory bodies in the UK (AACP 2014), USA (APTA 2013), and Australia (ASAP 2007) (2–4). The principles outlined in these documents are equally applicable to any healthcare practitioner who has DN within their scope of professional practice.

DN uses a thin filiform needle that penetrates the soft tissues. Filiform needles are solid, flexible, and have a pointed tip in contrast to an injection needle which is inflexible and has a bore through the centre for the passage of a fluid drug. Injection needles have a cutting edge at their tip, whereas a filiform needle has a rounded tip (Fig. 1). Needles typically used for DN are acupuncture type, although some companies produce filiform needles aimed exclusively at the DN market. Needles are normally described in terms of length and width (gauge) of the needle shaft in millimetres, with common needle sizes ranging from 15×0.22mm for the head, face, hands and feet, and up to 60×0.32mm for the buttock. Needles used for DN are single use and disposable. Each comes pre-sterilised (by ethylene oxide gas) and protected in a plastic guide tube, which is used in the process of needle insertion. The needle and guide tube are wrapped in peel-open blister packs that are generally colour coded in some way. The combination of needle tip shape, polishing, and insertion technique has led to the term 'painless insertion' being applied to filiform needling, and although not strictly pain free, the sensation is usually that of a small local scratch on the skin surface followed by a diffuse dull ache.

The depth of needle penetration into the soft tissues has led to the differentiation into superficial (SDN) and deep (DDN) dry needling types of therapy, with SDN typically less than 1cm depth through the skin and into the subcutaneous tissue touching onto the muscle and DDN typically greater than 1cm into the muscle bulk. Needles are inserted either perpendicular to the skin or at an angle, and once in place the needle may be stimulated manually or using an electrical impulse generated by a purpose-designed electrical stimulator (electroacupuncture or EAP) unit.

DN typically has effects on pain, healing and in the release of myofascial trigger points. The precise effect of DN depends on the target tissue penetrated, and the method used.

DRY NEEDLING EFFECTS

One of the primary reasons for applying DN is to release trigger points. To understand needling effects in this area we need to take a brief look at trigger points themselves.

Trigger points

A trigger point (TrP) or myofascial TrP, is a hypersensitive region within a muscle or myofascial region. They are characterised by pain which is familiar to the patient and present as nodules or tight bands within a muscle. Pain is typically referred into a distal area with lessening intensity the further from the TrP the pain travels (Fig. 2). The referral pattern may change with movement and throughout the day. The muscle containing the TrP

TABLE 1: TRIGGER POINT CLASSIFICATION. (C. Norris, 2015)

Character	Name	Location
Anatomical position	■ Central	■ Within the thickest portion of the muscle. Close to the motor point within a fusiform muscle. ■ Close to the musculotendinous (MT) to tenoperiosteal (TP) junction.
Clinical importance	■ Primary	■ Reproduces most intense patient familiar pain, close to body centre at most proximal region of pain distribution.
	■ Secondary (satellite)	■ Reproduces patient familiar pain, distal to primary TrP.
Effect on pain production	■ Active ■ Latent	■ Painful at rest (spontaneously painful). ■ Painful when stimulated.

is typically tight and overactive, but may be lax on occasions where the muscle is failing to stabilise a joint, for example. Altered postural alignment is often a sequela of TrP formation, and should be included in the patient assessment. When stimulated through direct manual therapy or DN, the TrP may respond with a sudden, brief local muscle contraction called a *local twitch response* (LTR), said to be a defining characteristic of TrP identification (5). The discomfort of the LTR may cause the patient to wince or withdraw their limb, demonstrating a *jump sign*. TrPs may be classified by their position (Table 1).

Central TrPs are located within the thickest portion of the muscle, often close to the motor point. In a fusiform muscle, such as the biceps for example, this will be within the well-defined belly central to the muscle, but in a flat sheet-like muscle such as the supraspinatus, it is likely to be over the thickest portion of the muscle close to the scapular spine rather than within the centre of the suprascapular fossa. Knowledge of the underlying muscle structure is therefore an essential aid to palpation when assessing TrP location in a patient. An *attachment* TrP is found within the fascial layers of the muscle at its tendon (musculotendinous) or bone (periosteal) regions.

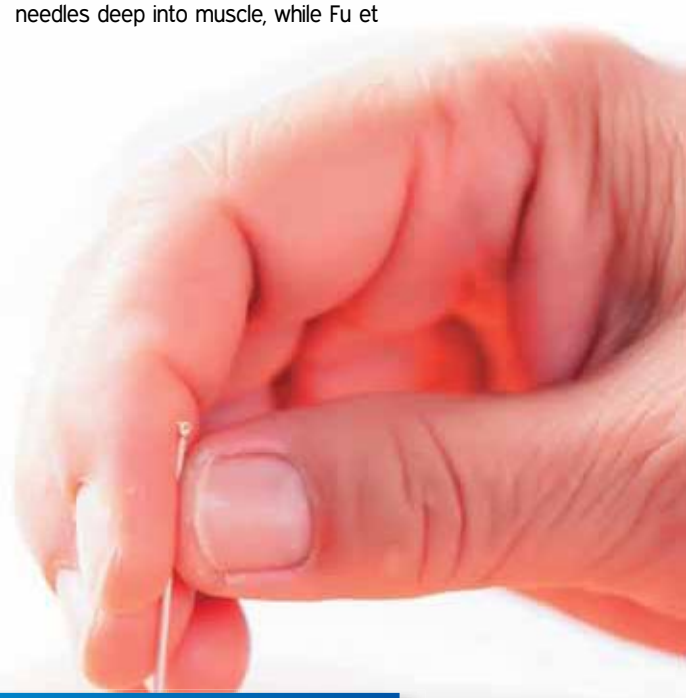
A *primary* TrP can be considered as the most important from the symptomatic perspective. It is the dominant point and will normally produce an area of dermatomal referral. Where this referral area extends across another muscle, a *secondary* TrP may be formed to create a symptomatic chain. For example, a TrP from the piriformis muscle (primary) may extend from the buttock to the posterior thigh, exciting a hamstring TP (secondary) which refers below the knee. In extreme circumstances this in turn may excite a gastrocnemius TrP (tertiary) referring to the ankle. Releasing the primary TrP using DN will often desensitise the remaining points within the symptomatic chain.

Many TrPs produce pain at rest and the patient will have often been able to identify these themselves. These are *active* TrPs, a typical example of which is the TrP within the middle trapezius which occurs as a painful, burning knot when sitting at a computer for a prolonged time. A TrP may also exist, but not produce local symptoms. This type is termed *latent*, an example being the supraspinatus TrP above. This may not be painful locally at rest but may give pain referred to the front of the shoulder, which is familiar to the patient when it is stimulated.

TrPs may be identified in the clinic by their effects on patient symptoms, and the tissue feel to palpation. In the laboratory, however, a TrP can

> "ONE OF THE PRIMARY REASONS FOR APPLYING DRY NEEDLING IS TO RELEASE TRIGGER POINTS"

demonstrate spontaneous electrical activity (SEA) or endplate noise, which changes as a result of DN. Typically a TrP demonstrates 10–100 times greater electrical frequency than a normal motor endplate. The taut band in which the TrP lies shows a low amplitude of background activity (10–50µV) which increases to a high amplitude spike (500µV) upon discharge (5), as a result of acetylcholine imbalance at the neuromuscular junction. DN has been shown to discharge the SEA, often giving rise to a LTR where the area of the TrP is seen to contract while the rest of the muscle bulk remains inactive. Using a rabbit model, Chen et al. (6) showed reduction in SEA of active TrP from 0.93µV down to 0.56µV (mean average integrated value from 15 different points) inserting needles deep into muscle, while Fu et



KEY POINT 1

A muscle *motor point* (motor entry point) is the region within a muscle where the motor branch of the nerve enters. It is traditionally used for the placement of an electrode to stimulate muscle contraction when applying neuromuscular electrical stimulation (NMES).

al. (7) showed similar discharge of SEA (5.79µV down to 4.73µV) inserting the needle superficially through the skin to simply touch the muscle layer.

Additional DN effects are seen on local tissue healing, and on general pain reduction; the latter response being similar to that of classical acupuncture.

Local tissue effects

Needling into local soft tissue elicits a classic triple response (redness, heat, swelling and pain) demonstrating the beginning of an inflammatory reaction. The response is due to the release of pro-inflammatory mediators including prostaglandin [see Norris 2011, chapter 1 (8)] for details of tissue healing responses). Additionally, calcitonin gene-related peptide (CGRP) is released as a response to needling giving trophic (healing) effects, and nitric oxide (NO) begins to reverse ischaemic effects which occur commonly with musculoskeletal conditions. Ischaemia changes are the result of the ability of NO to relax smooth muscle cells, causing local vasodilatation of the capillary bed (9). In studies of DN, blood flow was assessed using near-infrared reflectance spectroscopy and showed increased blood flow and oxygen saturation which remained for 30 minutes following needle removal. DN treatment of a burn skin lesion in mice has been shown to decrease wound size and induce epidermal regeneration with significantly increased levels of fibroblast growth factor and leukocyte infiltration (10).

> "A TRIGGER POINT (TRP) OR MYOFASCIAL TRP, IS A HYPERSENSITIVE REGION WITHIN A MUSCLE OR MYOFASCIAL REGION"

KEY POINT 2

Purinergic signalling **is a form of extracellular (outside the cell) communication between cells through the release of chemicals (called purine nucleotides) from the cell membrane. The chemicals are taken up by receptors (purinergic receptors) in adjacent cells.**

KEY POINT 3

Opioids are morphine-like chemicals such as ß-endorphin, enkephalin, and dynorphin, which act on the nervous system to relieve pain through decreased pain perception, decreased pain reaction and increased pain tolerance.

The physical act of needling also affects the soft tissue mechanically. As the needle is inserted through the skin it passes into the loose subcutaneous fascia. Stimulating the needle by twisting or thrusting (as is common practice) winds and adheres the fascial fibres to the needle shaft to create a whorl (11). Once the fascial fibres are attached to the needle, further movement pulls the fibre along the tissue plane from the periphery towards the needle. The loose connective tissue glides independently of the skin creating a localised tissue stretching effect (12). Maintaining the fascial stretch by leaving the needles in place causes viscoelastic relaxation and change in the shape of the fibroblast cells. This process in turn gives rise to remodelling of the cellular cytoskeleton, and extracellular ATP signalling, also called purinergic signalling (13).

Effects on pain

The effects of DN on pain have been well researched with reference to acupuncture. Pain relief essentially occurs at four levels: local, spinal, brain stem and higher centre (Fig. 3). At a local level, the release of opioid chemicals (neuromodulators) has an effect on pain mechanisms. This effect builds to a peak within 20 minutes of needle retention and then subsides after the needles have been removed, and is reversed by the opioid antagonist naloxone.

At a spinal level, the sensory nerve synapses in the dorsal horn of the spinal cord, and at that point desensitisation occurs, reducing the pain experience. Through interneuron effects at the dorsal horn, the sympathetic nervous system is also stimulated, opening the possibility for effects on internal organs, and changes in skin responses such as sweating. The pain pathway from the dorsal horn ascends in the spinal cord via the spinothalamic tract to the brain stem.

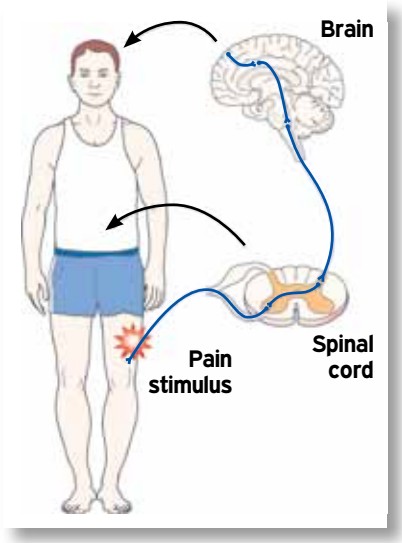


Figure 3: The pain pathway. [Figure credit: David Gardner. Reproduced with permission from Norris CM. The Complete Guide to Sports Injuries. A&C Black 2011 (14)]

In the brain stem, pain suppression occurs not just to the injured body part, but to the whole body. This type of 'top down' pain inhibition occurs via several brainstem structures including the periaqueductal gray matter (PAG) and the rostral ventromedial medulla (RVM). The effect is not especially powerful, but from this region neurons ascend to higher centres in the brain to affect the pituitary gland and hypothalamus. Through action on these two centres, and by affecting the limbic system deep within the brain, neurohormonal effects are created which target not the pain sensation per se, but the emotional experience of pain. This later effect is particularly important where long-lasting or chronic pain is part of the clinical picture.

DANGERS AND CONTRAINDICATIONS

Manual therapists have a variety of techniques that can TrPs. Importantly, however, these techniques do not penetrate the skin and so are said to be non-invasive. The big difference with DN is that it is an invasive technique,

TABLE 2: RISKS ASSOCIATED WITH DRY NEEDLING. [C. Norris, 2015; sourced McEvoy 2013 (18)]

Common	Less common	Rare	Very rare
Approximate rate 1 in 100	Approximate rate 1 in 1000	Approximate rate 1 in 10,000	Approximate rate less than 1 in 10,000
■ Bleeding at insertion point ■ Bruising around site ■ Needle site pain	■ Inflammation and swelling ■ Strong post treatment pain ■ Nerve irritation or injury ■ Headache ■ Fatigue ■ Dizzyness and nausea	■ Local skin infection ■ Redness ■ Itching ■ Blood pressure change ■ Vomiting ■ Breathing difficulty ■ Loss of consciousness	■ Pneumothorax ■ Broken needling ■ Systemic infection ■ Affected speech

puncturing the skin and entering the body tissues. This change from non-invasive to invasive techniques brings with it some important potential dangers that the therapist must consider to make the technique safe.

Several studies have been conducted into the safety of needling (acupuncture and DN), and a number of negative events described. White et al. (15) investigated adverse effects from 32,000 acupuncture consultations, stating that minor negative events including bleeding and bruising occurred in 7% of treatments. MacPherson et al. (16) reviewed 34,000 treatments finding similar incident rates of 1.3 events per 1000 treatments (43 total events). Ernst et al. (17) examined 3535 acupuncture treatments and recorded minor adverse effects in 11.4% which included bruising, bleeding, dizziness, mild nausea, and pain. McEvoy (18) provides a synopsis of risks associated with needling (Table 2).

DRY NEEDLING TECHNIQUE

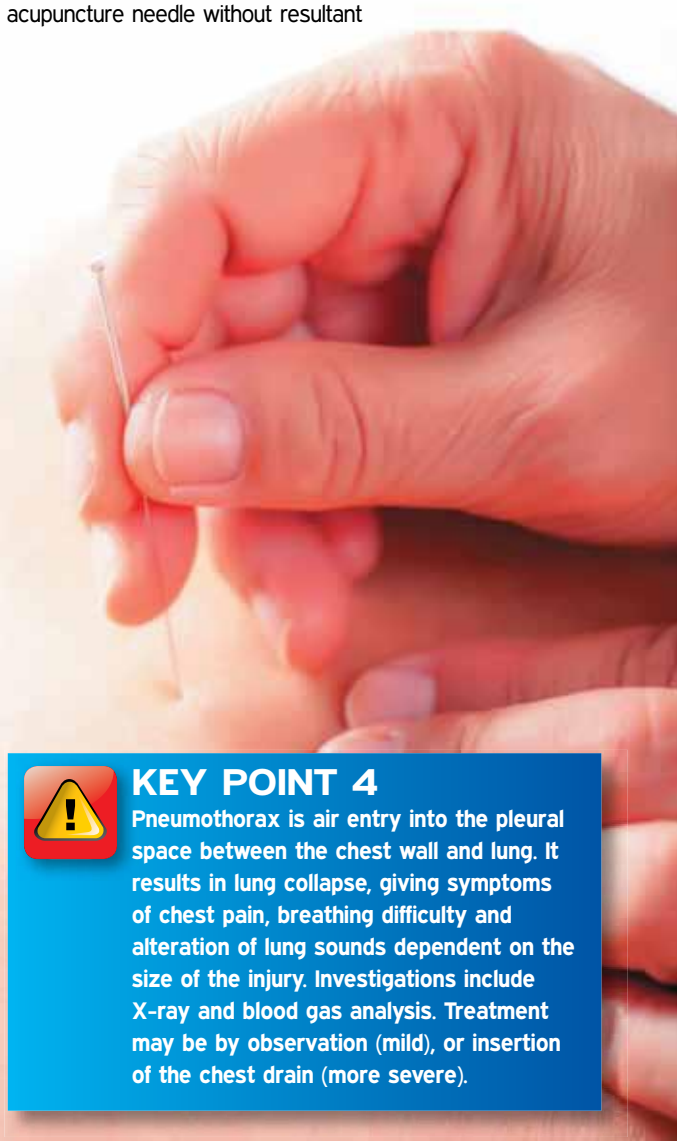
Risks associated with DN can be minimised by good technique. Firstly, before needle insertion a clean field should be established ensuring that the immediate treatment area is clean and any potentially infectious material such as dirty towels/clothing within a sporting environment is removed. The patient is treated in a recumbent position (prone/supine/side lying/long sitting) supported by pillows or folded towels to discourage movement.

The risk of infection due to resident bacteria on the skin surface is low unless the patient's immune system in compromised, so disinfection of clean skin in not generally a requirement (19). Infection with micro-organisms not normally resident on the skin (known as transient microflora) can pose a greater risk. The skin region to be needled should be clean and exposed, with the use of direct skin swabbing the choice of the practitioner. Gloves (single-use and disposable) may be used, especially on the palpating hand, and a hand-sanitising gel must be applied to all surfaces of the hands and fingers. A five-second application of hand-sanitising gel has been shown to reduce the microbial population by over 90% (20). Single-use disposable needles are used, which are protected by a plastic guide tube. The insertion technique is to hold the guide tube and tap the needle into the skin. Once the guide tube is removed, the portion of the needle shaft (sterile) that will enter the patient's tissues is never touched by the therapist, to minimise the risk of infection. Where the needle is manipulated the needle handle, rather than shaft, is gripped. As the needle is withdrawn, pressure is applied over the needle area using a sterile cotton wall ball or Q-tip until bleeding has stopped (haemostasis is established). The used needle is disposed of in a sharps bin and removed, and any cotton wool used in placed in a clinical waste container. All needle sites are inspected and the patient's general condition is assessed before they are allowed to move from the treatment couch.

Anatomical considerations are vital, as the risk of penetrating a neurovascular structure or the pleura is very real. Pneumothorax has resulted from DN to the intercostal region and also when treating scapular TrP (21).

It is important to remember that the lung depth is 15–20mm below the chest surface, and this distance may be reduced by tissue compression caused by TrP examination. At post-mortem a 10mm needle can reach the lung.

As filiform needles are flexible and non-traumatic (no cutting edge) slow/low force entry is less likely to damage neurovascular structures. As an example, Kessler and Streitberger (22) demonstrated perforation of the median nerve using an ultrasound-guided acupuncture needle without resultant



KEY POINT 4

Pneumothorax is air entry into the pleural space between the chest wall and lung. It results in lung collapse, giving symptoms of chest pain, breathing difficulty and alteration of lung sounds dependent on the size of the injury. Investigations include X-ray and blood gas analysis. Treatment may be by observation (mild), or insertion of the chest drain (more severe).

Figure 4: Dry needling of the hamstrings. (Photo credit: C. Norris, 2015)

Figure 5: Dry needling of the upper trapezius using a pinch grip. (Photo credit: C. Norris, 2015)

Figure 6: Dry needling of the supraspinatus using the step block technique (Photo credit: C. Norris, 2015)

Figure 7: Dry needling of the tibialis anterior. (Photo credit: C. Norris, 2015)

nerve damage, neurological impairment or radiating pain. Knowledge of the underlying neurovascular anatomy is, however, vital for the practice of DN to reduce the potential for injury. During palpation for TrPs close to an artery, a pulse should palpated and one finger kept over the pulse point to avoid needling the artery. Consideration of needle depth, angle of insertion, and insertion method reduces the risk of injury.

Use of a *pinch grip* (as demonstrated in Fig. 5) reduces the risk of injury to underlying structures. The muscle is held between the fingers and thumb and drawn away from the body. The needle is inserted halfway into the muscle aiming its tip towards the therapist's fingertip. Drawing the muscle away from the body places it at a distance to underlying structures, such as the pleura, and aiming at the fingertip provides a tactile cue to reduce the likelihood of the needle tip deviating away from its intended path. A *step block* (as demonstrated in Fig. 6) depresses the tissue at one point while maintaining a defined anatomical location at another. This is useful where deviation of the needle tip may endanger an underlying structure. Palpation accuracy is improved by maintaining contact with a bony landmark (less moveable) as the soft tissues (more moveable) are assessed.

Following DN treatment, the targeted muscle should be lengthened using static or PNF (proprioceptive neuromuscular facilitation) techniques to prevent the TrP reforming. Correction of movement dysfunction should follow. Details of stretching exercises may be found in the author's book, *The complete guide to stretching* (23).

Dry needling examples

Hamstring belly

A hamstring TrP refers into the back of the thigh and knee, and pain may travel as far as the calf, causing a secondary TrP within the gastrocnemius muscle. The pain may mimic that of sciatica or present alongside this condition.

Deep insertion of a needle into the hamstrings can endanger the sciatic nerve and in the case of the medial hamstrings the long saphenous vein, and for the lower hamstrings the femoral artery leading into the popliteal artery. To avoid the neurovascular bundle a pinch grip action is applied with the subject lying on their back in the FABER (Flexion, ABduction, External Rotation) position for the medial hamstrings or side lying with the knee flexed for the lateral hamstrings. In each case the leg is supported by a bolster or pillow to prevent movement during treatment. The muscle TrP is identified using palpation, and the muscle confirmed using manual muscle testing, in the case of the hamstrings resisted knee flexion. The pinch grip is applied using the whole hand rather than the fingertips (Fig. 4), and the needle is inserted halfway into the muscle fold in a frontal plane direction (across the body surface) rather than a sagittal place inwards towards the body centre. A 40mm needle is used of 0.32–0.35 gauge. Following needling the hamstrings are stretched using a straight leg raise action with the knee either fully (distal muscle emphasis) or partially (proximal muscle emphasis) locked.

Upper trapezius

A trapezius TrP often refers pain between the shoulder blades, with the upper portion referring into the neck and to the point of the shoulder. When needling the trapezius it must be borne in mind that the pleura extend above the lung apex to sit above the first rib. Deep needling of the upper trapezius with the needle angled in the frontal plane, towards the body centre, runs the risk of pneumothorax in lean or elderly subjects. Position the patient in prone lying, and elevate (shrug) the shoulder slightly to relax the muscle fibres. Identify the TrP and apply a pinch grip using the hand hold to draw the muscle bulk upwards and away from the body (Fig. 5). Needle halfway into the muscle fold aiming, the needle tip towards your finger tips, in a posteroanterior (PA) direction. An anteroposterior (AP) needle direction may also be used with the subject lying on their back, if this is more comfortable for the patient and/or therapist. As an alternative, a side lying position may be used with the upper arm placed on a pillow in front of the subject (flexion abduction). The

subject's head is placed on a high pillow to side flex the neck and relax the upper trapezius. Again a pinch grip is applied and the needle inserted half way into the muscle fold in an AP or PA direction towards the finger tips. A 30mm needle is used of 0.30–0.32 gauge. The upper trapezius may be stretched following needling by laterally flexing the neck away from the muscle and holding it in this position, and then passively depressing the scapula.

Supraspinatus

Supraspinatus TrPs refer pain into back of the shoulder and arm. The muscle sits above the scapular spine with the upper scapular body (suprascapular fossa) seemingly protecting the lungs and pleura from needle injury. However, the presence of a non-ossified scapula (scapular foramen) makes deep needling directly towards the scapula a risk. In addition a needle direction towards the top of scapula (PA) also risks damage to the suprascapular nerve and artery running through the suprascapular notch. With the subject in side lying on the unaffected side, the muscle location is confirmed using manual muscle testing (resisted lateral rotation). A medially directed oblique insertion is used close to the frontal plane. The needle is advanced through the upper trapezius fibres and into the supraspinatus, angling towards the scapular spine for safely. To aid palpation accuracy a step block is used, where one finger is placed flat over the edge of the scapular spine and the other depresses the supraspinatus (Fig. 6). The needle is introduced between the two fingers directed towards the scapular spine. A 30–40mm (0.32–0.35 gauge) needle is used depending on body size. The supraspinatus is placed on stretch using passive medial rotation of the shoulder joint with varying degrees of abduction.

Erector spinae

Erector spinae TrPs may give local spot pain within the low back, and refer distally into the sacral and buttock regions, and on into the leg. TrPs in the erector spinae are either located within the longissimus fibres 2–3 finger widths from the spine, or the more laterally

> "THE EFFECTS OF DRY NEEDLING ON PAIN HAVE BEEN WELL RESEARCHED WITH REFERENCE TO ACUPUNCTURE"

placed iliocostalis 4–5 finger widths from the spine. The longissimus is a thicker muscle running the length of the spine centrally, whereas the iliocostalis attaches to the ribs and therefore has a more lateral location. The longissimus is needled using a 30–40mm needle angled at 45° towards the spine while the iliocostalis is needled using a 25–30mm needle angled at 30° to the skin surface, again towards the spine. The subject may be positioned in prone with a pillow beneath their abdomen to flatten their lumbar lordosis, or in side lying with the affected side uppermost. Where the iliocostalis is needled over the ribcage, the muscle taut band is gripped between the sides of the fingers using a scissor action. The fingers stay within the rib spaces, and the needle is inserted in the gap between the fingers ensuring that it always remains over a rib. The insertion over the ribcage is shallow and oblique to avoid advancing the needle between the ribs and endangering the pleura. The erector spinae are lengthened using spine flexion. For the upper portion of the muscle, lumbar flexion should be initiated by thoracic flexion first (movement from L1 downwards), while for the lower portion lumbar flexion is initiated by posterior pelvic tilt (movement from L5 upwards).

Achilles tendon

The Achilles may be treated using a local herringbone technique to stimulate local blood flow (see above). The patient is in prone lying with their foot over the couch end, shin resting on a folded towel. A series are needles is inserted to a depth of 2–5mm in lines posteriorly, posterolaterally and posteromedially, with 3–5 needles in each line depending on the subjects height and body build. Small 15mm × 0.20 needles may be used, and stimulated using a limited range thrusting or twirling technique. As pain subsides, progressive Achilles loading may be begun. Modifications in the gait pattern, which coincide with Achilles tendinopathy, may often give rise to gastrocnemius and/or soleus TrPs which require separate management.

Tibialis anterior

The tibialis anterior is a common site of TrPs with anterior compartment syndrome. TrPs are located within the upper one third of the muscle approximately 1–1.5 hand widths below the lateral knee joint line. Referral is along the anterolateral aspect of the shin towards the lateral foot. The subject is positioned in crook lying with a pillow or rolled towel beneath their knee for comfort. The TrP is located and muscle identified using manual muscle testing to resisted ankle dorsiflexion. A 30mm needle is inserted perpendicular to the skin and slightly medially to avoid the anterior tibial artery and vein and the deep peroneal nerve which is positioned laterally (Fig. 7). Subsequent to DN, the tibialis anterior muscle is lengthened using passive ankle plantarflexion, typically kneeling and sitting back towards the feet.

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FURTHER RESOURCES

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2. The Dry Needling Institute website (www.thedryneedlinginstitute.net).
3. Dr Norris's course on Dry Needling (http://spxj.nl/1wDlvZX).

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KEY POINTS

- **Dry needling (DN) uses a solid, flexible filiform needle.**
- **Different depth of needle penetration has led to two types of DN – superficial (<1cm) and deep (>1cm).**
- **Needles are inserted either perpendicular to the skin or at an angle.**
- **Once in place, the needles may be stimulated manually or electrically.**
- **Trigger points (TrPs) are characterised by pain felt by the patient and present as nodules or tight bands within a muscle.**
- **Needling into local soft tissue elicits a classic triple response (redness, heat, swelling and pain) demonstrating the beginning of an inflammatory reaction.**
- **The physical act of needling also affects the soft tissue mechanically.**
- **Pain relief essentially occurs at four levels: local, spinal, brain stem and higher centre.**
- **DN is an invasive technique, puncturing the skin and entering the body tissues. This involves some important potential dangers that the therapist must consider to make the technique safe.**
- **Anatomical considerations are vital, as the risk of penetrating a neurovascular structure or the pleura is very real. Use of a pinch grip reduces the risk of injury to underlying structures.**

- How do the needles used for dry needling differ from other types of needle and how are their sizes described?
- List the different types of trigger points and how they affect the type of pain felt by the patient.
- What are the risks associated with dry needling?
- What is good dry needling technique and how can it minimise the risks?