Pain Medicine

Pain Medicine 2015; 00: 00–00
Wiley Periodicals, Inc.

LETTER TO THE EDITOR

Myofascial Trigger Points as a Cause of Abnormal Cocontraction in Writer's Cramp

Dear Editor,

Writer's cramp (WC) is a task specific focal hand dystonia characterized by abnormal movements and posturing of upper limb. Various treatments including invasive therapies like botulinum toxin (BTX) and thalamotomy have shown limited success [1,2]. We report the sustained complete reversal of painful WC in a 24-year-old doctor, till date at 2 years; with ultrasonography guided dry needling (USGDN).

The patient presented with WC of 3 years; unresponsive to supportive therapies by neurologists like using flat pen, left handed writing, tetrabenazine, and alprazolam. Brain MRI, nerve conduction, electromyography, and serum ceruloplasmin were normal. He was accustomed to daily, 2 hour violin practice for the past decade. His complaints were severe stiffness in his index finger and thumb causing cramping pain in the hand and forearm immediately on writing. The cramps prevented the flexion/extension movements at the metacarpophalangeal joints (MCPJs) and interphalangeal joints (IPJs) essential for writing. The pen would drop from his weakened grip after writing eight lines with pain aggravation to 8/10 on Numerical rating scale (NRS). Attempts at compensation with repetitive wrist flexion-extensions or using the thumb and middle finger for pen-holding did not help. Palpable bands could be felt in the muscles of forearm and neck. Figure 1 shows the grip strength, pinch gauge measurements and neck radiographs. The Burke Fahn Marsden Scale (BFM) [3] for movement disorder was 3/16 and dystonia disability score for handwriting was 2/4.

We explained to the patient that the digital stiffening and forearm cramping could be because of an abnormal cocontraction occurring as a result of incoordinate functioning of muscles having myofascial trigger points (MTrPs). The patient consented for weekly USGDN for specific treatment of MTrPs in muscles of neck and right upper extremity (Table 1) [4]. During USGDN, twitches in resting flexors and extensors of right forearm with exaggerated and painful local twitch responses (LTR) persisting for 5 minutes after introduction of 32G needles, were seen. The 20–40 mm needles were introduced in 2–3 mm increments to make DN painless. Needle removal after 30 minutes was followed by supervised physiotherapy.

Patient reported pain reduction (NRS 2-3/10) and ability to write 14 straight lines after first USGDN. Successive USGDN sessions significantly reduced the resting twitches, LTR, and enabled continuous legible writing of 6 pages at 6 weeks without pain/cramps. Subsequently he was advised to maintain this relief with physiotherapy alone. Two-years later, the right hand circumferences, muscle bulk on USG, and grip strength have shown a sustained improvement with BFM score reading zero (Figure 1).

Stable pen grip and the delicate, precise flexion/extension movements at MPJ and IPJ essential for writing are executed by the prehensile thumb, index, and middle fingers. The wrist flexors and extensors are required to actively cocontract throughout the movement of writing to stabilize the wrist in slight wrist extension essential for comfortable pen grip. This is a physiological cocontraction necessary for the fixator action at wrist [4] (Table 1).

We propose that the presence of active irritable MTrPs in forearm muscles causes an initial lack of the necessary intricate coordination which later progresses to an "abnormal cocontraction." These digital and thumb flexor/extensors are required to perform the highly repetitive and fine movements essential for writing. Constant use of these muscles impeded by abnormal cocontraction causes the painful spasm (cramps), tremors, and dystonia of WC.

Injury due to overloading of muscles has been shown to lead to dysfunctional motor endplate; subsequent energy crisis with hypoperfusion results in ischemia, and release of inflammatory mediators. The overuse of hand muscles in our patient could well have made them vulnerable to ischemic injury resulting in MTrPs which are exquisitely tender spots in discrete taut bands of tautened muscles. The acidic milieu inherent to MTrPs lowers the stimulation threshold of the muscle nociceptors, and causes muscle hyperexcitability [5–7] manifesting as twitches in the resting muscles and exaggerated LTR demonstrated on USG. The sustained contraction of irritable individual muscle fibres clinically perceived as taut bands palpated in the neck and forearm of our patient would logically predispose to repetitive strain injury (RSI) resulting in WC as explained in the following hypothesis: Starling's law states that initial length of the muscle determines its force and strength of contraction. We rationalize that when the agonists for finger flexion or extension contract, the shortened muscle fibres with MTrPs in their antagonists are the first to respond as they are the ones maximally stretched. The comparatively longer normal muscle fibers are likely to bunch

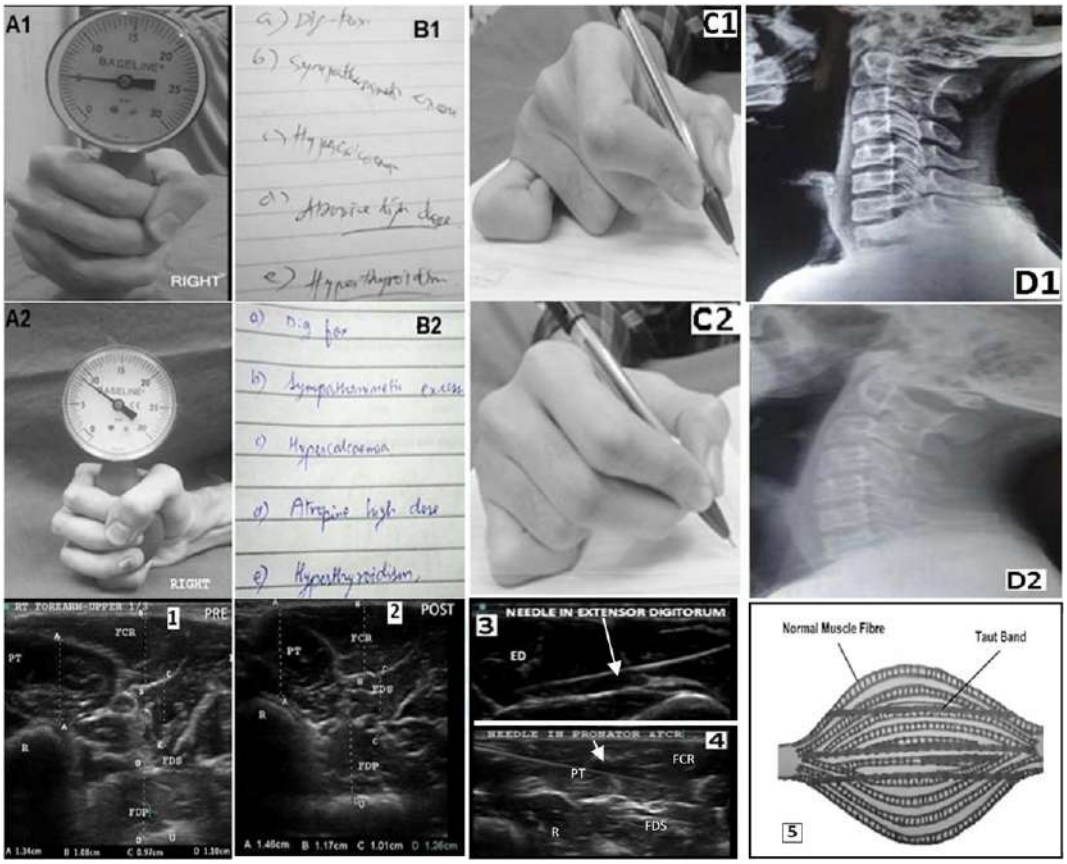

Figure 1 Comparative clinical and USG images showing changes achieved with treatment.

ROW 1: represents the pretreatment data. A1—pressure generated on a hand held dynamometer, showed a bilaterally equal grip pressure of 5 psi but gripping induced tremors in his right hand; B1—handwriting sample showing poor legibility and the inability to write in a straight line; C1: pen holding technique-tight grip using index finger and thumb. He had used considerable effort to flex the MCPJ and IPJ. The MCPJ of index and little finger would get into an extension cramp while the IPJs would get into flexion cramp leading to an abnormal pen grip. D1—note the straight spine with loss of normal cervical lordosis.

ROW 2 (18-months-later): A2—pressure generated shows an increase to 8 psi with a steady firm grip without tremors; B2—handwriting sample shows neat and clearly legible writing in a straight line; C2—pen grip between thumb, index and middle fingers with normal flexion at MPJ of index and little fingers; D2—the first three vertebrae responsible for flexion extension movements of head over neck show a normal lordosis at 3 months maintained at 18 months. We believe that acutely anterolateral neck flexion adopted for playing violin for years and the sudden increased workload as a fresh medical intern might have caused the RSI in neck extensors with taut bands causing the straight spine. USGDN released the taut bands to restore the normal lordosis.

ROW 3:

Figure 1: Pretreatment USG image taken with the probe kept at upper one-third on flexor aspect of right forearm shows muscle thickness of the forearm flexors as measured on day 1.

Figure 2: Posttreatment USG image taken with the probe kept at upper one-third on flexor aspect of right forearm showing the same muscles to have increased in thickness after treatment with dry needling. This explains, in addition, the increased grip strength of the hand.

Figures 3 and 4: Show needles in specific affected forearm muscles (antagonists–extensor digitorum; and agonists—pronator teres, flexor carpi radialis, flexor digitorum superficialis).

Figure 5: Is a schematic representation of the preferential contraction of muscle fibres shortened with MTrPs according to Starling's law while the surrounding fibers of normal length bunch around the taut bands [8] (Taken with permission from Wiley Global Permissions, Wiley Publication). This leads to preferential overuse of the taut muscle fibers shortened by MTrPs which are already hypoperfused, leads to further resource exhaustion.

Table 1 Dry needling done of following muscles

Movement	Agonist	Antagonist	Synergist
Wrist flexion	Flexor carpi radialis (FCR), flexor carpi ulnaris (FCU) and palmaris longus (PL)	Extensor carpi radialis (ECR), extensor carpi ulnaris (ECU) are the antagonists for wrist flexion.	FDS, FDP, FPL, EI
Finger flexion	Flexor digitorum superficialis (FDS) and flexor digitorum profundus (FDP). Thumb movements involve flexor pollicis longus (FPL) and brevis, the adductor and opponens muscles in the thenar eminence	Extensor digitorum (ED) for all fingers as a common extensor tendon, EP (extensor pollicis) and extensor digiti minimi (EDM) specifically. Extensor pollicis longus and brevis (EPL & EPB) extend the thumb while the abductor pollicis longus and brevis abduct the thumb for the prehensile grip on the pen essential for writing.	Intrinsic muscles of hand: interossei and lumbricals
The repetitive flexion/extension at the MCPJs and IPJs are performed by FDS and FDP as agonists; intrinsic muscles of hand (interossei and lumbricals) as synergists; and ED as antagonist. The index and little fingers have additional stabilization and finesse of extension with EP and EDM. In our patient, these added to a specific extension cramp at the MPJ of these 2 fingers as seen in Figure 1. When the muscle use exceeds its capacity to perform that activity or when normal recovery after activity is disturbed, MTrPs develop from RSI from occupational/recreational activities. We propose that the MTrPs might have had a cause-effect relationship in the development of an abnormal cocontraction of agonists, antagonists as well as the synergists that are responsible for the activity of writing. This abnormal cocontraction interfering with the repetitive flexion-extension finger movements of writing was relieved by a targeted dry needling of all these muscles under ultrasound guidance (Figure 1)			
Neck and shoulder muscles	Sternocleidomastoid, scalenes, levator scapulae, trapezius, semispinalis, the cervicis, and capitis parts of longissimus as well as ilio costalis cervicis muscles were needled weekly for 6 weeks. The supra and infraspinatus; pectoralis major and minor; deltoid; latissimus dorsi; teres major & minor; coracobrachialis; biceps & brachialis; triceps; brachioradialis were needled on alternate weeks for a total of 3 sessions as they were not primarily involved in the presentation of WC pain and stiffness. These sessions resolved the few MTrPs that were causing pain symptoms in the arm and shoulder.		

around these taut bands without contracting as they do not get stretched at all (Figure 1).The preferential overutilization of irritable taut bands manifests clinically as painful cramps, a contradictory association of weakness with stiffness and progressive reduction of writing time, dystonia, and tremors. Repeated provocation of pain eventually leads to the development of peripheral and central sensitization.

We preferred ultrasonography (USG) guided dry needling (DN) due to its beneficial effects in comparison to USG guided BTX especially in view of the sheer number of muscles involved in the complex kinematics of WC. BTX causes paralysis of myoneural junction [1] of both normal and abnormal fibers, compromising the muscle strength in the long run. USGDN innocuously, but accurately targets specific digital muscles with MTrPs as well as the marginally affected supportive muscles. The reported specific advantages of DN like MTrP release, muscle regeneration [1,8,9] were obvious in our patient as confirmed by clinical and USG findings. Serial resolution of MTrPs and taut bands relieved the pain and irritability causing cocontraction, replaced preferential overuse of shortened fibres with normal recruitment of the whole muscle bulk in all contractions allowing the gradual muscle strengthening essential for sustained RSI reversal.

We have presented a different understanding of WC that emphasizes the benefits of USGDN as the logical, physiologically appropriate, and minimally invasive therapeutic intervention for WC. However, its reproducibility in large group of patients awaits future elucidation. Knowledge of anatomy, sonoanatomy, and a thorough understanding of the kinematics of writing are essential to the successful performance of DN in a complex condition like WC.

Lakshmi Vas, MD, Renuka Pai, Diploma, Nishigandha Khandagale, MD, and Manorama Pattnaik, MD
Ashirvad Institute for Pain Management and Research, Mumbai, India

Disclaimer: This article has not been sponsored by any pharmaceutical or equipment company or institution. This article has not been previously published nor is under consideration for publication in any other journal either in whole or in part. The manuscript has been read and approved by all authors mentioned in the TITLE page and is an honest representation of each author's work. The authors report no actual or potential, financial and other conflict of interest in relation to this article. The patient willingly provided informed consent for the publication of this case report including the clinical pictures. The corresponding author is open to her e-mail address published and also will address any reprint requests. The copyright permission to include a Figure was duly taken from Wiley Global Permissions, Wiley Publication.

References

1 Kruisdijk JJM, Koelman JHTM, Ongerboer de Visser BW, et al. Botulinum toxin for writer's cramp: A randomised, placebo-controlled trial and 1-year follow-up. J Neurol Neurosurg Psychiatry 2007;78: 264–70.

2 Taira T, Harashima S, Hori T. Neurosurgical treatment for writer's cramp. Acta Neurochir Suppl 2003;87:129–31.

3 Burke RE, Fahn S, Marsden CD, et al. Validity and reliability of a rating scale for the primary torsion dystonias. Neurology 1985;35:73–7.

4 Johnson D (Section Editor). Pectoral Girdle and Upper Limb, Section 6, Chapter 47. In: Standring S ed. Gray's anatomy-the Anatomical basis of Clinical Practice. 40th edition. Elsevier, London: Churchill Livingstone; 2008:823–857.

5 Dommerholt J, Shah J. Myofascial pain syndromes. In: Ballantyne JC, Fishman SM, ed. Bonica's Management of Pain. 4th edition. Philadelphia: Lippincott Williams and Wilkins; 2010:450–470.

6 Sikdar S, Shah JP, Gebreab T, et al. Gerber: Novel applications of ultrasound technology to visualize and characterize myofascial trigger points and surrounding soft tissue. Arch Phys Med Rehabil 2009;90: 1829–38.

7 Gerwin RD, Dommerholt J, Shah JP. An expansion of simons' integrated hypothesis oftrigger point formation. Curr Pain Headache Rep 2004;8:468–475.

8 Vas L, Khandagale N, Pai R. Successful management of chronic Post-surgical pain following total knee replacement. Pain Med 2014;15:1781–1785.

9 Tough EA, White AR, Cummings TM, Richards SH, Campbell JL. Acupuncture and dry needling in the management of myofascial trigger point pain: a systematic review and metaanalysis of randomized controlled trials. Eur J Pain 2009;13:3–10.