Dry Needling and Intramuscular Electrical Stimulation for a Patient with Chronic Low Back Pain with Movement Coordination Deficits: A Case Report

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ABSTRACT

Background and Purpose: The clinical practice guidelines match the classification of chronic low back pain and movement coordination deficits (CLBPMC) with lumbopelvic stabilization exercise. The purpose of this case report is to describe a multimodal treatment for a patient with CLBPMC, which includes stabilization and dry needling with intramuscular electrical stimulation. **Methods:** Case description of a patient with a 9-year history of recurring low back pain despite manual therapy and stabilization interventions. **Findings:** Over the course of 4 visits, the patient reported a 50% reduction in pain and a decrease from 34% disability to 18% disability per the ODI. The patient was able to return to all work and recreational activities without limitation. **Clinical Relevance:** Based on the rapid improvements experienced by this patient, who was previously a non-responder to stabilization training, it is likely that dry needling with intra-muscular electrical stimulation may have enhanced multifidus strengthening in this case. **Conclusion:** Physical therapists may consider dry needling with electrical stimulation when strengthening the multifidus for patients with CLBPMC.

Key Words: stabilization training, treatment-based classification, trigger points

INTRODUCTION

The clinical practice guidelines (CPG) for the treatment of low back pain published by the Academy of Orthopaedic Physical Therapy of the American Physical Therapy Association (APTA) recommend an impairment-based classification for the diagnosis of low back pain by physical therapists.[1] This type of diagnosis is based on clinical findings versus imaging and shifts the focus away from pathoanatomic explanations for pain and towards items such as strength, muscle flexibility, joint mobility, and maladaptive pain behaviors. The impairment based-classification system is an adaptation of the treatment-based classification system (TBC) proposed by Delitto et al[2] in 1995. Evidence supports the efficacy of this approach, showing that patients matched to the appropriate treatment group within the TBC had statistically significant improvements in disability scores over those that received unmatched treatments.[3,4] Allocation to specific patient subgroups has also been shown to be reliable between therapists.[5]

Of particular interest to this case report is the classification of *chronic low back pain with movement coordination deficits*. Per the intervention portion of the CPG, this low back pain classification group is matched with a progressive course of lumbopelvic stabilization training.[1] Despite the existence of the CPG since 2012 and the TBC since 1995, the majority of studies investigating the use of lumbopelvic stabilization continue to use heterogenous populations in their study populations, instead of patients classified with movement coordination impairments.[6,7] Due to this, the evidence supporting the use of stabilization training within this subgroup is limited.

Dry needling (DN) is an intervention used by physical therapists that has been experiencing a surge in use over recent years. Multiple systematic reviews have been published regarding the use of DN for the treatment of low back pain.[8,9] Results of these systematic reviews and meta-analyses do not provide definitive evidence for the use of DN alone for the treatment of low back pain but do show that it is beneficial when used in combination with other therapy approaches, such as exercise.[10] No studies have investigated the use of DN in specific low back pain subgroups to date. However, there are multiple studies that show DN may cause immediate changes in contractility of the multifidus,[11-13] which one could hypothesize to be beneficial for those with decreased trunk strength, such as those with movement coordination impairments.

To date, there have been no studies that investigate the combination of DN with intramuscular electrical stimulation (IES) and stabilization training for patients that fall within the movement coordination deficits classification. The purpose of this case report is to describe the use of a multimodal treatment for a patient with chronic low back pain and movement coordination deficits (CLBPMC), which includes stabilization and DN with intra-muscular electrical stimulation.

CASE DESCRIPTION

The patient was a 30-year-old female political campaign advisor and volunteer fire fighter with a 9-year history of recurring low back pain that began after awkwardly lifting a heavy weight. Following initial onset, she had episodic low back pain that was occasionally associated with lateral left lower leg pain (L5 dermatomal distribution). The patient's primary aggravating factors included prolonged sitting and standing. The patient's primary occupation as a political advisor entailed significant hours at a desk and standing at public events. She also reported pain with end range motions that limited her ability to participate in yoga. She reported attending yoga 2 to 3 times a week as her schedule allowed. In addition to these limitations, her role as a volunteer firefighter required yearly training, where she reported limitations in her ability to carry heavy items, such as a fire hose. She was concerned that this would affect her ability to perform at full-capacity in a fire emergency.

The patient reported that she received physical therapy multiple times over the past several years for her low back pain with minimal changes in her symptoms. When asked to describe previous bouts of physical therapy, she described a general lumbopelvic stabilization approach with minimal use

of manual therapy techniques. She reported being adherent to a home exercise program for a time, but eventually discontinued these exercises when it was apparent the exercises were not helping.

PHYSICAL EXAMINATION

The physical examination included range of motion testing, strength testing, sensation testing, neurodynamic mobility testing, functional core strength testing, palpation/mobility testing, and special tests. The results of the physical examination can be found in Table 1.

Table 1. Physical Examination Findings for the Patient in this Case Report

Sensation	Light touch intact for L1-S2 dermatomes
Strength	Strong and painless resisted isometric contractions of L1-S2 myotomes
Range of Motion	(+) pain with sustained end range lumbar flexion and extension (-) changes with repeated motions (flexion/extension) (-) aberrant motions
Neurodynamic Mobility	(-) seated slump test (-) straight leg raise (both tested bilateral)
Functional Core Strength	Impaired (see below)
Palpation/Joint Mobility	Pain with unilateral and central posterior-anterior testing bilaterally L3-5 Hypermobility of the L3-5 segmental levels
Special Tests	(+) Active straight leg raise >91° (+) Prone instability test

The CPG describes chronic low back pain with movement coordination deficits based on subjective and objective examination findings. The subjective description of this classification is "chronic, recurring low back pain with associated (referred) lower extremity pain." Physical examination findings may consist of one or more of the following: low back/lower extremity pain that is worsened with sustained end-range movements or positions, lumbar hypermobility with segmental motion assessment, mobility deficits of the thorax and/or hip regions, diminished trunk or pelvic muscle strength or endurance, movement coordination impairments while performing community/work related recreational or work-related activities.[1]

Based on the guidelines put forth by the Academy of Orthopaedic Physical Therapy, APTA, this patient is consistent with a classification of low back pain with movement coordination deficits. In addition to the guidelines, this patient fits a previously proposed clinical prediction rule for patients with low back pain that respond well to stabilization training[14] This clinical prediction rule is considered positive if 3 or more of the following 4 items are positive/present: age <40, average straight leg raise >91°, (+) prone instability test, aberrant motion with range of motion testing. This prediction rule was not replicated in an attempted validation study, but it was likely underpowered.[15] Despite this, the rule may still offer a valuable framework to use as a guide when diagnosing those with movement coordination deficits.

The primary findings that led to this diagnosis were the subjective complaints of pain with prolonged positioning and end-range motions, as well as the objective findings of lumbar hypermobility, pain with sustained end range of motion testing, (+) prone instability test, anterior straight leg raise >91°, and core strength deficits. The functional core strength test used in this case was the ability to hold a quadruped position with contralateral upper and lower extremities extended ("bird dog" position) for 30 seconds with good form. The patient was unable to do so without substantial sway and momentary loss of balance. Although this has not been studied as an assessment technique, this exercise is a common component in many stabilization programs and is used as an assessment of "rotary stability" in the Functional Movement Screen.[16] By using the "bird dog" position as an assessment tool, it allows the therapist to set a baseline that can be used when prescribing the home exercise program. Additionally, patients are able to track their own progress as they are able to achieve longer hold times as strength improves.

In addition to the above findings that helped rule in the patient's diagnosis, competing diagnoses were effectively ruled out. Due to the presence of lower extremity pain associated with the patient's low back pain, the main competing diagnoses were low back pain with radiating pain and related (referred) lower extremity pain. As both neurodynamic mobility tests (slump, straight leg raise) were negative, the radiating pain diagnosis was ruled out. Timeframe and absence of centralization or peripheralization with repeated motion testing was used to rule out related (referred) lower extremity pain.[1] All red flag items were ruled out through a combination of subjective and objective examination.

The patient answered "no" to both screening questions from the Patient Health Questionnaire-2. This short survey has been shown to be a valid screening tool for depression.[17] Additional outcome measures used for detecting maladaptive pain behaviors or beliefs were not issued to this patient. The patient reported that she viewed exercise as a healthy activity and denied avoiding activity or exercise due to pain.

Visit 1 Treatment (Day 0)

Following the physical examination, the patient was educated on physical examination findings, most appropriate treatment plan, and positive prognosis. Based on the diagnosis of low back pain with movement coordination deficits, a treatment plan primarily consisting of lumbopelvic stabilization was selected.

As lumbopelvic manipulation has been shown to improve the contractility of deep lumbopelvic muscle stabilizers, a sidelying high-velocity low-amplitude (HVLA) lumbopelvic manipulation was performed.[18,19] The cited studies investigating changes in muscle function following spinal manipulation have used a supine lumbopelvic manipulation. Although not studied for its effects on muscle function specifically, the sidelying manipulation has been shown to provide equivalent changes in pain and disability for those who meet a clinical prediction rule.[20] This may lead one to believe that these two manipulation techniques operate by a similar mechanism and would therefore cause similar changes in muscle contractility. Following the HVLA manipulation, lumbar flexion was performed again without any change in symptoms in low back or lower extremity. The patient also reattempted the "bird dog" position, which continued to be difficult

and she was unable to maintain the position without significant sway and loss of balance.

Based on a lack of response to joint manipulation, dry needling was performed in an effort to assist with multifidi recruitment. Needles were inserted on either side of the L3-5 vertebrae (6 total) deep enough to contact the ipsilateral lamina. No pistoning of the needle was used with this patient. Following insertion of the needles (.30 x 60 mm), electric stimulation was applied to each side via inserted needles until a small pulsing was visible in the paraspinal muscles (Figure 1). Electric stimulation was applied using an ITO ES-130 3 Channel Electro Simulation Unit at an intensity of 4 and frequency of 1 Hz. This was done to stimulate the multifidi, as multifidus strength and contractility have been shown to play a major role in low back pain.[21,22] Needles were left in place with intramuscular stimulation for 5 minutes. As no guidelines have been established regarding the length of time needles should be left in place, this length of time was based on previous clinical experience and practicality.

Following the removal of needles and cessation of electric stimulation, the patient was reassessed. At this time, lumbar flexion was full (palms to floor) without pain and the patient was able to perform the bird dog exercise with 30-second holds without significant sway. She did report fatigue in the low back paraspinals by the end of the exercise but denied pain. She was given bird dogs, side bridges, and prone hip extensions as an initial home exercise.

Visit 2 (Day 8)

The patient returned to clinic reporting a 1- to 2-day period following the initial session that she was pain-free. She reported a current pain level of 3/10 on the Numerical Pain Rating Scale (NPRS). She went on to say that she was having significant fatigue when performing the bird dog exercise at home but was not experiencing pain during her home program.

Treatment during the second visit consisted of DN and IES in the same fashion as the first visit. Additionally, the patient's home program was reviewed and dosage was increased slightly. Details regarding the contents of each visit are displayed in Table 2.

Visit 3 (Day 15)

The patient returned to clinic reporting a 3- to 4-day pain-free period after the second session of therapy. She reported a current pain level of 2/10 on the NPRS. She reported continued fatigue with bird dog exercises but was tolerating longer holds and felt as though she could maintain form more consistently. At this visit, side bridges were progressed to full side planks and dosage was updated for the remainder of her home program.

Visit 4 (Day 30)

The patient returned to clinic reporting that she had just returned from camping. She was able to hike, carry a pack, and participate in yoga without limitations or significant pain. She reported a current pain level of 2/10 on the NPRS. On this day, DN was not performed due to a lack of functional limitation. Instead, self-treatment techniques were reviewed in order to assist in the event of a future recurrence. Once again, the patient's home program was reviewed and updated to remain challenging. The patient scored a 9/50 (18%) on the Oswestry Disability Index (ODI) and a 5+ (quite a bit better) on the Global Rate of Change scale (GROC). The patient was discharged to an independent home exercise program.

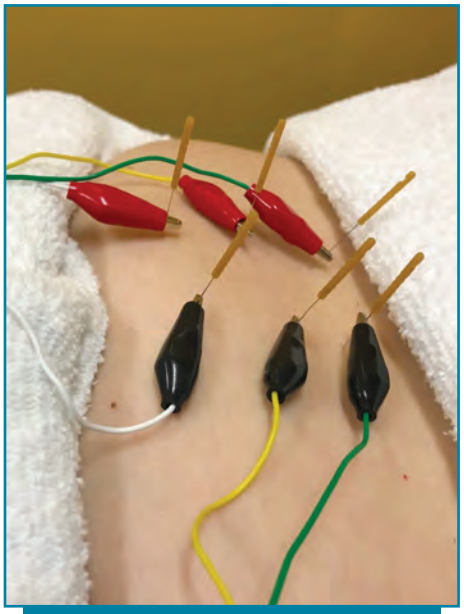

Figure 1. Dry needling L3-5 with intramuscular electrical stimulation.

DISCUSSION

This case report describes a patient with chronic low back pain that was previously a non-responder to a traditional stabilization treatment plan. Subjective complaints and findings per the physical examination led to a diagnosis of low back pain with movement coordination deficits.[1] This presentation generally calls for lumbopelvic stabilization training. Based on this patient's lack of response to previous physical therapy with this approach, DN and IES were used to assist with stabilization training.

The minimal clinically important difference (MCID) for the ODI is published as 10 on a scale of 0-100.[23] This episode of care was considered to be successful having exceeded the MCID (-16) for the ODI and having achieved a 5+ on the GROC, which corresponds with a subjective patient response of "quite a bit better." Additionally, the patient reported a change in pain equal to the MCID for the NPRS (2 points).[24] Beyond the outcome measure scores provided, the patient reported a full return to yoga and firefighter training without limitation due to back pain.

There is no definitive timeframe by which patients with this diagnosis generally respond to stabilization programs but considering the chronic nature of this patient's condition and her previous lack of success with physical therapy, the results achieved within 4 weeks during this episode of care were likely at an accelerated pace. It is unlikely that DN directly affected the patient's rate of muscle hypertrophy, but it may have assisted in the rate at which she gained motor control.

A recent study shows that there is a subset of patients that show an improvement in multifidi contraction and nociceptive sensitivity one week following DN.[13] This subset of patients showed a larger improvement on the ODI than patients who did not exhibit these physical responses to DN. As the necessary examination items (pain pressure threshold algometry, ultrasound imaging) were not performed post-DN to confirm that this patient experienced these physical changes, the authors are unable to determine if the patient falls into this subgroup. However, this does provide support for a potential mechanism by which the patient achieved these results. An additional study showed improved multifidus contraction following DN in healthy adults.[11] Although it cannot be assumed that this mechanism is present in those with back pain, this does lend further support towards this mechanism of improvement.

Two published studies discuss the use of DN combined with IES for the treatment of back pain.[25,26] The case study pertains to a patient with low back pain, while the case series describes the episode of care for two patients with thoracic spine pain. All 3 patients from both studies show clinically meaningful changes in pain and disability, in addition to improvements in pain-free range of motion. Each of these case examples use multi-modal approaches, which include DN

Table 2. Content of Treatment Sessions and Home Program with Relevant Patient-Reported Outcomes

Visit	Manual Therapy	Home Exercise (2x/day)	Patient-Reported Outcome
1 (Day 0)	Lumbopelvic HVLA Dry needling and electric stimulation to L3-5 multifidi	Bird dogs: 10 sec holds, 10 repetitions per side Side bridges: 20 sec holds, 5 repetitions per side Prone hip extensions: 5 sec holds, 2 sets of 10 per side	NPRS 4/10 ODI 34/100
2 (Day 8)	Dry needling and electric stimulation to L3-5 multifidi	Bird dogs: 10 sec holds, 10 repetitions per side; 10 elbow to knee touches per side (alternating) Side bridges: 30 sec holds, 5 repetitions per side Prone hip extensions: 5 sec holds, 2 sets of 10 per side	NPRS 3/10
3 (Day 15)	Dry needling and electric stimulation to L3-5 multifidi	Bird dogs: 20 sec holds, 5 repetitions per side; 10 elbow to knee touches per side (alternating) Side planks: 30 sec holds, 5 repetitions per side Prone hip extensions: 5 sec holds, 2 sets of 10 per side	NPRS 2/10
4 (Day 30)	Instrument assisted soft tissue mobilization with instructions on how partner could perform at home	Bird dogs: 20 sec holds, 5 repetitions per side; 10 elbow to knee touches per side (alternating) Side planks: 45 sec holds, 5 repetitions per side Prone hip extensions: 5 sec holds, 2 sets of 10 per side	NPRS 2/10 ODI 18/100 GROC 5+

Abbreviations: HVLA, high-velocity, low amplitude; NPRS, Numerical Pain Rating Scale; ODI, Oswestry Disability Index; GROC, Global Rate of Change Scale

with IES and exercise. The authors did not classify any of these patients into impairment-based subgroups and speculated that improvements in patients were due to treatment of myofascial trigger points, versus changes in contractility of deep trunk stabilizers. However, it is possible that enhanced muscle contractility is responsible for these patients' successful outcomes. It should also be noted that all 3 of the above examples presented with acute back pain in contrast to the chronic nature of the patient's symptoms in this case study.

Although no high-level evidence exists pertaining to electric stimulation in combination with DN for the treatment of low back pain, electric stimulation is widely used for improving the contractility of inhibited musculature, most commonly the quadriceps during postoperative knee rehabilitation.[27,28] It is possible that IES may help to decrease inhibition in deep spinal stabilizers, such as the multifidi.

There are several limitations to this study being a single case report with no control group, which limit our ability to determine the effects of DN or IES. It could be argued that stabilization training alone was responsible for the decrease in symptoms experienced by the patient; however, the patient's history of ineffective prior therapy episodes of care leads us to believe that the interventions used in this episode were more effective than stabilization training alone would have been. Additionally, this case study describes a tissue-based explanation for the patient's improvements. Considering the importance of the biopsychosocial pain model, it is possible that the therapist's emphasis on movement and positive prognosis were more responsible for the positive results achieved in this study than any specific manual or exercise-based interventions. Although maladaptive pain behaviors were not detected during the subjective examination, it is possible that outcome measures assessing specific pain behaviors such as catastrophizing and fear-avoidance may have better determined the presence of these behaviors. Long-term follow-up is also needed to determine lasting effects of treatment.

CLINICAL APPLICATIONS

Although it is beyond the scope of this case report to definitively determine the specific mechanism by which DN affects local musculature, it does point to a potential treatment for those affected by low back pain associated with movement coordination deficits. Clinicians may consider using DN to facilitate training of the multifidus in patients with low back pain associated with movement coordination deficits.

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