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A Preliminary Study to Determine if a Muscle Pain Protocol Can Produce Long-Term Relief in Chronic Back Pain Patients

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Abstract

Objective. To assess the effectiveness of a muscle protocol to treat patients diagnosed with neuraxial low back pain (LBP) before and after invasive treatments.

Design. Patients with chronic (>6 months) LBP—postinvasive treatment and pre-spine surgery—were assessed and treated. An electrical device rather than palpation was used to determine muscle(s) as possible sources of pain. Patients testing positive for muscle pain were treated with a comprehensive protocol and were followed for >3 months to determine the effect of treatment on pain severity and interference in function.

Results. Study 1: In 56 (postinvasive treatment) patients who had failed back surgery, epidural steroid injections, facet blocks, and/or trigger point injections, mean Brief Pain Inventory (BPI) pain severity dropped from 5.54 at baseline to 3.96 ($P < 0.001$) at a median follow-up of 77 weeks; mean BPI interference dropped from 6.09 to 3.4 ($P < 0.001$). Fifty-two percent of respondents reported over 50% relief. Study 2: Three of seven patients originally scheduled for spine surgery completed a substantial part of the muscle protocol, canceled their surgeries, and obtained significant relief at the 16–19 month follow-up point.

Conclusion. In patients thought to have neuraxial pain, identification and treatment of painful muscles had statistically significant long-lasting and clinically meaningful reductions in pain and improvement in function. Muscle and tendon attachments may be an important and treatable source of pain in patients diagnosed with pre and postsurgical neuraxial pain.

Key Words. Failed Back Surgery Syndrome; Low Back Pain; Sciatica; Muscle Pain; Spine Surgery

Introduction

Most acute low back pain (LBP) results from sprains and strains of soft tissue [1]. An analysis of diagnoses for LBP and neck pain has shown a paradoxical diminished use of diagnoses indicating soft tissue etiologies and an increase in diagnoses, suggesting that the pain is produced by the spine and neuraxis [2]. The extent of resolution of acute episodes of LBP is not clearly understood. LBP episodes may not be self-limiting as previously thought [3]. Many patients who experience back pain will have ongoing or recurrent discomfort [4,5]. It is reasonable to assume that if acute episodes are related to soft tissue dysfunction, ongoing residual discomfort may also be. Treatment of

putative pain-producing structures [6] often leads to overemphasis on the spine and neuraxis, and may result in unnecessary interventions with suboptimal results [7–9]. Thirty to fifty percent of spine surgery (SpS) for relief of back pain is unsuccessful, with 80,000–90,000 new cases per year of failed back surgery syndrome [10–12]. Without a better understanding of the multiple etiologies of chronic back pain pre- and postsurgery, no reliable treatment guidelines can be formulated.

Purpose

A previous paper noted the absence of reliable assessments and treatment modules for muscle-generated pain, and presented a study with a month follow-up of the protocol applied in this study [13]. Persistent posttreatment pain reduction and decreased interference in activities would support the utility of the protocol. This is a follow-up study of two back pain groups both treated with the same protocol with reassessment more than 14 months after treatment was ceased.

Background

The previous study [13] suggested that palpation to identify trigger points (TrPs) is, in practice, often not administered as suggested in authoritative literature, and has been shown to lack interrater reliability., The concept of TrPs themselves as the major source of muscle pain has been challenged [13,14].

Marcus et al. have suggested that a muscle produces pain as a result of stimulation of sensitized nociceptors in the entheses as well as in the myofascial TrPs [13]. Electrical stimulation causing a painful contraction along the course of a suspected muscle from its origin to its insertion may identify a painful muscle more accurately than palpation.

Treatment directed at a muscle causing pain rather than a muscle having referred pain should produce longer lasting, more profound pain reduction.

Methods

Description of the muscle protocol, used in both studies below:

Evaluation Method

Muscle pain typically occurs with activity; therefore, contraction of a muscle is a more physiological replication of pain-producing activity than pressure to the muscle belly. All patients were evaluated with an electrical instrument that produces an interferential current through an aluminum head that moves easily over the skin and causes the muscle to contract. If pain is produced in the entirety of a specific muscle and not in the adjacent muscles, and the pain remains with continued stimulation of the identified muscle for at least a minute, it is considered to be a source of muscle-generated pain and may respond to injections (see below). When used on an unaffected or "normal" muscle, the patient will experience an involuntary, painless contraction of the muscle. Each subject was tested with a signal strength determined by their response to the minimal amperage necessary to contract an uninvolved, non-painful muscle, as described in a previous paper [13].

Treatment

Injection Technique

Should pain persist with continued stimulation, structural change in the entire muscle is assumed, and the muscle is diagnosed as muscle pain amenable to injection (MPAI) in contrast to the commonly diagnosed TrPs. Each muscle is traumatized by needling into the region of the musculotendinous junction and bony tendinous attachment (entheses), as well as the muscle tissue, to potentially affect most of the areas of the muscle containing sensitized nociceptors. The injections are called muscle tendon injections (MTIs) rather than trigger point injections (TPIs). There are no studies that clearly explain the mechanism of the effect of needling painful muscles containing TrPs [15]. We postulate that the mechanism is the disruption of the small regions of muscle tissue and fascia that are contracted and contain neurovasoactive substances [16] thought to contribute to the mechanisms producing muscle pain. Needling, in addition to causing destruction of many myofibrils [15], produces an acute inflammatory reaction increasing blood and oxygen to the needled area. Damaged cells rarely produce deleterious clinically significant effects and generally regenerate in 4–6 weeks [17,18]. The injectate, lidocaine 0.5%, although used primarily for comfort [17], may be an additional factor in the disruption of the painful muscle tissue through its myotoxic effect [18].

Post-MTI Physical Therapy (PT) Protocol

To restore the normal length and flexibility of the treated painful muscle and minimize postinjection pain, a PT protocol is given for the next 3 days, including neuromuscular electrical stimulation (NMES) to the injected muscle, followed by gentle, limbering exercise. After the last postinjection PT session, all patients are encouraged to do 21 exercises at least once a day, along with building up to walking 1–2 miles per day indefinitely. This approach was applied to all treated patients.

Main Outcome Measures

A validated, commonly used measure of pain intensity and its interference in daily activities, the Brief Pain Inventory (BPI) [19,20], was administered to all patients. A numerical scale created by averaging four severity questions determines the severity score, while averaging seven interference questions determines the interference score.

Study 1—Posttreatment Study: Chronic LBP Patients Unsuccessfully Treated with Surgery, Epidural Steroids Injections (ESIs), or Facet Blocks

Design

A retrospective study was designed to evaluate the effectiveness of the muscle protocol in chronic back pain patients unresponsive to spine surgery and neuraxial injections. The study population was drawn from a pool of 100 patients who had pain for more than 6 months. They had been seen in an 18-month period in 2008–2009, and were found to have MPAI and agreed to receive the suggested treatment protocol. Three patients did not complete the treatment protocol, and therefore 97 patients were studied. All patients were evaluated by the senior author (N.M.) and completed a pretreatment BPI. When painful muscles were identified, patients were offered the treatment protocol, which consisted of MTIs and PT.

Long-Term Follow-Up Assessment

At an average of 77.7 weeks (median 76) from the last treatment, a follow-up phone call and/or e-mail was sent to the 97 patients who qualified for the study, 69 of whom were available. Of the remaining 28 patients, five patients refused to participate in the study and 23 patients did not respond to the phone calls or e-mail messages. Each patient was asked for their current BPI severity and interference scores, and if they sought further treatment for their back pain after completing the MTI protocol. If the patient answered yes, they were asked to identify what additional treatments they received and the dates of the treatments.

Excluded Patients

Thirteen of the 69 patients were then excluded from the analyses. Seven of the 13 reported other major treatments, such as spinal surgery (or significant benefit in one case after switching pain medications), and it would not be possible to attribute their changes to the study procedures. Two others had shorter follow-up times than we had intended, and one was pregnant, potentially confounding the results. Three had pain duration of 6 months or less at initial treatment, hence would have been considered acute pain patients. All but two of the 13 contacted-but-excluded patients had improved over time (several down to 0 pain or interference), thus excluding them was a conservative step.

Statistical Methods

BPI severity and interference were compared before and after treatment with paired *t*-tests, including comparisons within subgroups. Percentage change was also symmetrically distributed and is reported as a mean percent change (as a function of baseline).

Table 1 Characteristics of the patient sample

Total number of patients included = 56	
Age in years: mean (range)	49.91 (20–84)
Duration of pain in years:	5 (0.58–60, IQR: 2.54 to 13.5) median (range, interquartile range)
Sex (M/F)	26/30

Anatomical Abnormality	Number of Patients
Degenerative disc disease	15 (27%)
Spinal stenosis (central and/or foraminal)	7 (13%)
Disc herniation	18 (32%)
Spinal cord compression	1 (2%)
Bulging disc	3 (5%)
Degenerative scoliosis	3 (5%)
Lumbar spine fracture	1 (2%)
No significant abnormality found on magnetic resonance imaging	16 (29%)

Some patients had more than one anatomical abnormality. Thus, the total number in the table is more than the sample size of 56 patients.

Results

Patient Characteristics

As shown in Table 1, the mean age was 49.91 (range 20–84), there were 26 males and 30 females, and there was a wide range of duration of symptoms, with a median of 5 years and minimum of 0.58 years. Twenty-five patients reported radicular symptoms prior to treatment. Fourteen patients reported prior unsuccessful treatment with TPIs or prolotherapy (Table 2).

The mean BPI scores for severity at initial consultation and long-term follow up are shown in Table 3 and Figure 1. The mean BPI score for severity at initial consultation was 5.54 ± 1.7; median 5.8, which dropped to 3.96 ± 2.7 ($P < 0.001$ vs baseline, an improvement of 1.58 ± 2.45, with mean percentage change of 29%). The mean BPI score for interference at baseline was 6.1 ± 1.8; median

Table 2 Prior treatments

Prior Treatment	56 (100%)—Inclusion Criterion
Surgery (laminectomy and/or fusion)	23 (41%)
Trigger point injection or prolotherapy	14 (25%)
Facet blocks	17 (30%)
Epidural steroid injection	35 (63%)

Some patients have had more than one of the above-listed prior treatments. Thus, the total number is more than the sample size of 56 patients.

Table 3 Pre- and posttreatment Brief Pain Inventory scores for pain severity and interference in activities

		Preintervention		Postintervention: Recent	
		Severity	Interference	Severity	Interference
N		56	56	56	56
Mean		5.5400	6.0863	3.9554	3.3999
Median		5.7500	6.4300	4.1250	3.2350
Standard deviation		1.70270	1.82873	2.66665	2.85019
Skew		–0.413	–0.173	0.079	0.425
Minimum		1.50	2.00	0.00	0.00
Maximum		8.75	9.57	9.00	9.43
Percentiles	25	4.5000	4.7475	1.9850	0.5125
	75	7.0000	7.3575	5.9700	5.6600

6.431, which dropped to 3.4 ± 2.9 ($P < 0.001$ vs baseline, an improvement of 2.7 ± 2.3, with mean percentage change of 47%).

Patients were broken down into the following subgroups for statistical analysis: herniated nucleus pulposus (HNP), degenerative disc disease, spinal and foraminal stenosis, presence of radiculopathy symptoms, and multiple abnormalities. Multiple abnormalities included a combination of two or more of the findings.

Despite small sample sizes, results in various clinical subgroups were generally consistent with the overall results. Notably, both scores improved significantly in patients with HNP, degenerative disc disease, spinal and/or foraminal stenosis, and radiculopathy. In the eight patients with multiple abnormalities, interference improved ($P = 0.011$), but severity did not.

The 14 patients who had previously unsuccessful TPIs or prolotherapy improved 33% and 47% on severity ($P = 0.005$) and interference ($P = 0.002$), respectively.

In addition to BPI pain and severity scores, patients were asked at the time of the long-term follow-up phone call if they continued to have pain relief, and if so to rate their reduction in pain intensity as a percentage of their original pain. Of the patients, 71.4% (40/56) reported continued pain relief at the time of the follow-up interview, 52% (29/56) of patients reported over 50% relief at follow-up, and 16.1% (9/56) reported absence of pain at follow-up.

Even if the worst-case scenario is assumed, namely that the patients who were not contacted or were excluded were assumed to have failed to improve, that would still leave 40/100 (40%) showing improvement and 29/100 (29%) showing 50% or more improvement.

Using a reliability estimate of 0.70 for both scales [19], 10 of the 56 patients were shown to have changed beyond chance on severity and 20 on interference, using standard reliable change methods.

Study 2—Presurgery Study: Chronic LBP Patients Scheduled for Spine Surgery

We postulated that presurgically, some patients might have treatable muscle pain, and therefore if identified prior to a scheduled surgery, muscle treatment might result in the elimination of the planned surgery.

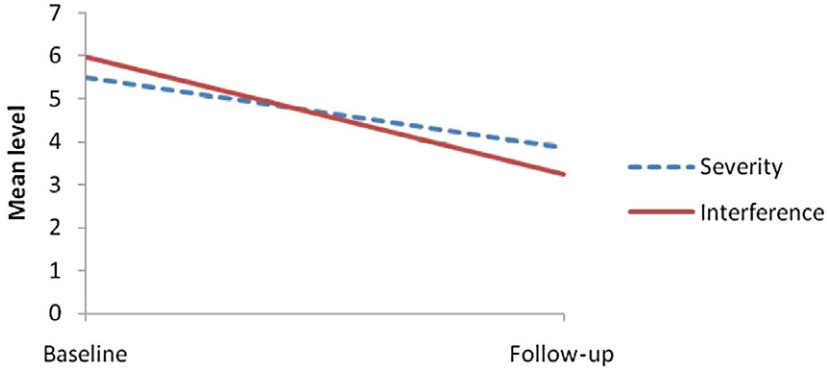

Figure 1 Mean severity and interference over time.

Design

The Kaiser Permanente (KP), San Diego, Spine Surgery Section, Family Medicine Pain Treatment Division, and the Department of Physical Therapy agreed to offer a pilot study to patients already scheduled for spine surgery.

Methods—Patient Selection

Inclusion criteria:
1. Back pain for >1 year and failed attempts at conservative treatment or prior back surgeries.
2. Age 18–70.
3. Reasonable level of overall function and activities of daily living prior to pain onset.

Exclusion criteria:
1. Obvious cauda equina syndrome demonstrating muscle atrophy and sphincter disturbance.
2. Workman's compensation or motor vehicle accident-related pain problem.
3. Morbid obesity.
4. Anticoagulation treatment currently.
5. Pregnancy.

Eleven patients, who were already scheduled or were seen at the time of being scheduled for back surgery for chronic pain, were offered the opportunity to be referred by the Spine Surgery Division for evaluation for the presence of muscle pain. The Primary Investigator traveled to San Diego to evaluate all patients with KP clinicians and to provide injections to selected patients. Follow-up PT was provided at KP. Reevaluation and, if needed, MTIs to any additional untreated muscles took place every 2–3 months for a total of 3–4 times.

Results

Seven of 11 patients were identified with muscle pain. Three of seven patients completed treatment with significant reduction in pain and impairment, and did not have the planned surgeries (disc replacement in one, and laminectomy and fusion in the other two). N.M. was only able to treat the patients a maximum of four 2-day visits. Positive responders had significant reductions in pain and interference for at least 17 months following their last treatment.

Patient Demographics

All patients were scheduled for spinal surgery. The patients who received completed treatment are listed in Table 4.

Each of them had a different pattern of response to the treatment, as shown in Table 5. Beck Depression Inventory (BDI) and Oswestry Low Back Pain Scale were also obtained on each visit. All three patients exhibited substantial drops in pain and interference by the end of

Table 4 Data for patients who completed treatment

Sex	Age	Duration of Pain	Diagnosis by Surgeon	Planned Surgery	Pain Diagnosis by Primary Investigator	Number of Muscles Treated	Number of Physical Therapy Sessions
M	38	9 years	Recurrent disc herniation left L5-S1 vs peridural scar tissue	Intervertebral disc replacement	Myofascial pain syndrome, enthesopathy of hip and spine	5	10
F	62	10 years, exacerbation for past 2 years	Spinal stenosis and spondylolisthesis at L4-5	L4-5 laminectomy fusion and instrumentation	Enthesopathy of spine and hip, myofascial pain syndrome	11	21
F	64	30 years, exacerbation for past 10 years	Severe L4-5 stenosis	L4-5 laminectomy transforaminal lumbar interbody fusion and instrumented fusion	Myofascial pain syndrome, enthesopathy of spine and hips, muscle spasm	12	24

Table 5 Summary of pre- and posttreatment assessment scores

	Patient 1				Patient 2				Patient 3			
	BPI—Intensity	BPI—Interference	BDI	Oswestry	BPI—Intensity	BPI—Interference	BDI	Oswestry	BPI—Intensity	BPI—Interference	BDI	Oswestry
Evaluation	6.00	9.14	5	36	7.25	7.14	7	26	5.75	5.57	1	25
Post-Rx 1	1.50	0.43	0	7	1.75	1.43	3	19	6.25	4.14	1	18
S/P 1 Mo Rx 1	2.50	1.29	1	16	3.50	3.00	3	21	4.50	3.71	1	21
Pre-Tx 2	1.75	0.43	2	14	2.25	2.14	2	14	1.00	1.00	0	14
Post-Tx 2	0.63	0.00	0	6	0.75	1.00	2	14	5.00	2.86	0	14
S/P 1 Mo Rx 2	2.25	0.57	0	12	0.75	1.14	2	10	5.75	4.14	1	19
Pre-Rx 3								14	4.25	2.57	0	13
Post-Rx 3					3.00	2.14	2	15				
S/P 1 Mo Rx 3					4.25	7.33	3	19	5.00	2.71	0	18
Post-Rx 4					3.00	2.29	3	19	3.50	1.86	0	13
S/P 1 Mo Rx 4					1.5	1.29	1	13	2.50	0.57	0	11
S/P 6 Mo Rx	2.00	0.43	0	17	3.5	1.86	1	17	2.75	0.57	0	17
S/P 16 Mo Rx	1.75	0.71	5	21	4.25	2	1	20	2.75	2.71	1	20

BPI = Brief Pain Inventory; BDI = Beck Depression Inventory.

treatment, some sooner, and all persisting at 6 and 16 months post-therapy. All three also exhibit declines in Oswestry, which presented soon after the start of treatment and did not consistently decline further. None of the patients were clinically depressed (the highest BDI score at any time was 7). One of them never had a BDI greater than 1.

Patients were seen for varying lengths of time based on the number of muscles identified. PT was administered by KP physical therapists.

The patients in Table 6 were also diagnosed by the spine surgeon as having spine-related back and/or leg pain and were scheduled for spinal surgery. They dropped out of the study or failed to respond to the muscle treatment protocol.

Discussion

We suggest that the long-lasting reductions in pain and interference in daily activities found in both populations may be the result of multiple aspects of our protocol.

In Study 1, our postinvasive treatment population, our data suggest that in a group of patients with persistent pain thought to be predominantly the result of, and treated for, pathology in the spine and neuraxis with ESIs, RFAs, and spinal surgeries, muscle treatment could have benefits for more than 1 year.

Patients had pain for an average of 5.5 years, with a range of 7 months to 60 years. It is unlikely that spontaneous remission accounted for the lasting positive results. Although the reduction of pain intensity was less than 2 points (1.59), the improvement in activity score was 2.7. Our results suggest that a subset of these patients may be able to obtain elimination or significant reduction of pain intensity and increased capacity for activities. We believe that restoration of activity is at least as important as pain intensity and that a significant increase in activity could account for some of the residual pain, which otherwise might be scored lower with less activity.

In Study 2 of patients scheduled for spine surgery, three of the seven patients identified and treated for painful muscles had prolonged clinically significant reductions in pain and interference in activities, and elimination of the planned surgeries. Two of the three patients were only partially treated (they had more muscles identified in the initial examination than could have been injected). In addition, in our experience with patients who had been in pain for more than 10 years, successful treatment of muscles apparently causing the most severe pain frequently resulted in the detection of other muscles whose presence had been eclipsed by the more potent pain-generating muscles. We believe that if we had regular access to the three patients, we would have been able to treat newly declared painful muscles with commensurate additional increases in function. Of the seven patients, four did not complete treatment or were noncompliant with the

Table 6 Data for patients with incomplete or failed treatment

Sex	Age	Duration of Pain	Diagnosis by Surgeon	Planned Surgery	Pain Diagnosis by Primary Investigator	Reason for Failed Treatment
M	33	27 years, exacerbation for past 4 years	Small central disc protrusion at T7-8 without cord compression, healed fracture at L1 with local kyphosis	Multilevel fusion and instrumentation with Smith-Petersen osteotomies	Myofascial pain syndrome, muscle spasm, enthesopathy of spine and shoulder	Psychiatric comorbidity and noncompliance
M	45	6 years, exacerbation for past 1 year	Degenerative disc disease	Left L4-5 laminotomy discectomy	Post-laminectomy syndrome—lumbar, enthesopathy of spine, myofascial pain syndrome, muscle spasm	Decreased pain after first treatment to one muscle, but dropped out of the study and opted for surgery nevertheless
F	50	6 years	Mild disc bulge L5-S1 without significant compression of thecal sac	Laminectomy at L5-S1	Nonspecific enthesopathy, myofascial pain syndrome, muscle spasm	Did not believe the treatment would help her pain
M	48	11 years	Degenerative disc disease	Two-level interbody and posterolateral fusion and instrumentation	Post laminectomy—lumbar, myofascial pain syndrome, muscle spasm, enthesopathy of spine, enthesopathy of hip	Complicated psychological comorbidity and multiple untreated muscles—inpatient pain Rx program suggested; although he declined surgery, he did not have significant reduction in pain after limited treatment

protocol. Patients evaluated for surgery and given a surgery date may be less committed to an alternative therapy. Evaluation and treatment (when appropriate) of all patients scheduled for spine surgery with a protocol to identify the presence of muscles as a source of pain could result in pain reduction, improved function, and avoidance of surgery.

The suggestion to continue the exercises indefinitely, along with walking for more than one mile a day, if adhered to, could alone be a source of improvement. We believe, however, that as most of the patients seen in both studies were exposed prior to our interventions to PT, which often included some form of exercise, that exercise alone could not reasonably be assumed to be the source of improvement. In addition, Tulder et al. [21] report that even with successful studies of exercise in chronic LBP, the effects are minimal (10 points or less on a scale of 100) and significantly less than our results.

It appears that researchers and clinicians have had difficulty showing that the identification of TrPs by palpation and the injection of TrPs can consistently result in a reliable means of identifying and subsequently treating muscle pain. New technology to identify TrPs, such as ultrasonography and magnetic resonance imaging elastography [22], has not shown that such identification identifies primary vs referred TrPs, or leads to more profound, longer lasting pain reduction. Our results suggest that identifying painful muscles by electrical stimulation rather than palpation may be a preferable diagnostic approach, leading to a more accurate identification of a muscle that is a source of pain [13].

Study Limitations

As noted in our initial paper [13], the diagnostic and treatment protocol incorporates multiple variables, each of which should be investigated for their individual contribution to the overall outcome: further studies to validate the electrical detection device to identify a pain-producing muscle, comparison of injections of muscles identified as containing TrPs through palpation vs through the use of the electrical device, the muscle injection procedure itself (muscle tissue and musculotendinous and bony tendinous attachments, vs TPIs), and the injectate (0.5% lidocaine). The postinjection protocol variables that should be studied for their role in the total outcome are the following: the use of a NMES to provide a rhythmic contraction and the use of a specific structured exercise protocol. If muscle protocols with positive outcomes can be replicated, common pain syndrome treatment guidelines [23] in the future could include a step-care model where painful muscle identification and treatments could ideally occur before more invasive evaluations and treatments.

This long-term pilot study of patients who failed prior treatments is a retrospective non-controlled observational study. A previous controlled study suggested that the protocol we used did have sustained benefit, but the control group was a waiting list control. A randomized controlled study of the injection procedure vs an active invasive control should be performed. We are planning a randomized controlled trial of back and leg pain patients appropriate for ESIs who are also found to have painful muscles, randomizing them to muscle or ESI treatment.

We assumed that the natural course with these patients might be a variable report of pain and incapacity, but that significant relief of pain or dysfunction was unlikely to occur spontaneously. It is not possible to know if interventions not tried may have been as effective as the MTI protocol. However, patients who reported that they had received other treatments following ours were excluded from the analyses. Without more data points, it is not possible to know if there were remissions and exacerbations of pain in the period following the active treatment period.

The study population of patients scheduled for spine surgery was very small and not randomized. The patients may have self-selected because of an aversion to surgery, and therefore may not have represented a true sampling of spine surgery patients. The experience with these patients does not bear this out. Patients who did not complete treatment were noncompliant even in one case when the first injections were reported as very effective. Multiple data points are recorded in the presurgical surgery with variations in the report of pain and function, but the outcome does not return to baseline severity at the end points. The initial drop in Oswestry scores could possibly be a placebo effect, but the decrease in scores is consistently seen in both the Oswestry and BPI.

The claim that the electrical device can accurately detect a muscle causing pain should be further validated. We plan to study volunteers who will receive nerve growth factor (NGF) injections into selected muscles and determine if an investigator can identify the NGF-injected muscle with the device.

Statistical methodology limitations are as follows: The very small, selected sample size (three patients) included in the presurgery study obviously precluded any statistical analysis. Likewise some of the subgroup analyses in the postsurgery study had small numbers, rendering comparisons difficult. Fortunately, the pattern of effect is similar in all subgroups, in many of which there were significant benefits in spite of small Ns. We did not attempt to determine the pattern of effects with non-responders included (perhaps as a carry forward of baseline) because this seemed overly conservative. Nevertheless, the results must be interpreted as applying to a self-selected subset of those who had the treatment.

Conclusion

Studies of comprehensive protocols for the evaluation and treatment of muscle pain could result in an effective addition to the current pain treatment standard of care. We suggest that organized medicine, particularly pain medicine, addresses muscles as an important organ system

contributing to various pain syndromes. As muscle pain is complicated, to establish an academic and heuristic concept of a muscle paradigm, the pathophysiology of muscle pain should be part of medical undergraduate and pain medicine training. Reimbursement affects treatment decisions, and therefore addressing the inequality in reimbursement for muscle evaluation and treatment vs pain treatment directed at the neuraxis would encourage all clinicians to consider muscles in their pain assessments.

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