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CASE REVIEW: MICROCURRENT TREATMENT OF LOW BACK PAIN

Microcurrent therapy: a novel treatment method for chronic low back myofascial pain

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Abstract Chronic low back pain associated with myofascial trigger point activity has been historically refractory to conventional treatment (Pain Research and Management 7 (2002) 81). In this case series study, an analysis of 22 patients with chronic low back pain, of 8.8 years average duration, is presented. Following treatment with frequency-specific microcurrent, a statistically significant 3.8-fold reduction in pain intensity was observed using a visual analog scale. This outcome was achieved over an average treatment period of 5.6 weeks and a visit frequency of one treatment per week. When pain chronicity exceeded 5 years, there was a trend toward increasing frequency of treatment required to achieve the same magnitude of pain relief.

In 90% of these patients, other treatment modalities including drug therapy, chiropractic manipulation, physical therapy, naturopathic treatment and acupuncture had failed to produce equivalent benefits. The microcurrent treatment was the single factor contributing the most consistent difference in patient-reported pain relief.

These results support the observation that rigorously designed clinical investigations are warranted.

Background

Myofascial trigger points (MTrPs) are a well-documented source of back pain (Gerwin, 1991; Njoo and Van der Does, 1995). In addition to the low back, trigger points that produce myofascial pain have been mapped in the muscles of the skull, jaw and cervical spine. MTrPs refer pain in characteristic patterns (Borg-Stein and Simons, 2002), for example low back pain of myofascial origin is associated with trigger points in the lower torso muscles. Trigger points in the iliopsoas refer pain to the low back in a vertical pattern, while those in the lower rectus abdominus refer pain in a horizontal direction across the lower back, and those in the gluteus medius and lumbar mutifidi refer pain in the low back, sacral and hip areas (Simons and Travell, 1983; Simons, 1993) (Figs. 1–4).

Myofascial pain can be severe and debilitating, and can cause restrictions in normal biomechanical joint function, impairment of neurological function, and impairment of circulation and lymphatic flow (Long et al., 1996). The collection of symptoms is recognizable as a distinct pathologic condition according to diagnostic guidelines, and successful treatment is highly dependent on a strong therapeutic relationship with a knowledgeable

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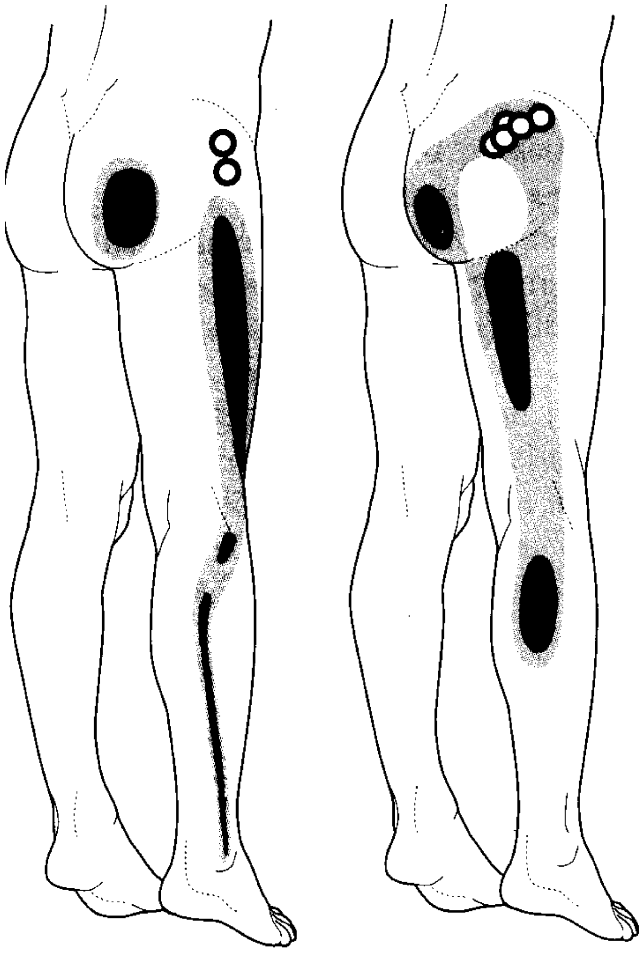

Figure 1 Referral pattern for gluteus minimus trigger points. (Reprinted with permission from Chaitow L. & Delany J, 2002, Clinical Applications of Neuromuscular Techniques Volume 2. Lower Body. Churchill Livingstone, Edinburgh.)

provider (Crofford and Appleton, 2000; Cymet, 2003). No universally accepted therapy exists for this condition, and few treatment modalities have been rigorously investigated in controlled, blinded trials (Kovacs et al., 1997). This paper builds on reporting trends toward successful treatments for patients with myofascial pain (Ingber, 1989; Harris and Clauw, 2002). Furthermore, this study contributes to the growing evidence of the need for formal investigation to allow effective clinical decisions to be made for this challenging group of patients.

A remarkable variety of clinical symptoms are associated with myofascial pain. Contributing factors include central nervous system sensitization, autonomic nervous system activation, neurohumoral perturbations and psychosocial and environmental stressors (Masi et al., 2002). From the patient's perspective, in general, there is a perception of pain and parasthesia as emanating from the referral site, with no appreciation of the location of the trigger point (Fricton et al., 1985; Escobar and Ballestros, 1987).

Physiological models, explaining myofascial pain, incorporate features such as muscle trauma or repeated exposure to stressors, eliciting muscle responses that include spasm or more commonly contracture (Alvarez and Rockwell, 2002). Contracture is a chemical rather than action potential-mediated shortening of the muscle fibers. The term *calcyphylaxis* refers to an induced hypersensitivity in which tissues respond to challenge by eliciting sudden calcification (Selye, 1975). Repeated sympathetic stress responses, including chronic illness, severe emotional trauma, multiple or severe tissue injuries, have been associated with predictable tissue changes (Starlanyl, 1996). Tissue alterations result in palpable tightening of the myofascia and muscle contracture, promoting the formation of trigger points. Another mechanical model has been proposed in which a traumatic, rapid overstretching of a muscle, or crush injury, causes rupture of the myofibrils, releasing calcium from the sarcomeres leading to contracture (Travell and Simons, 1983).

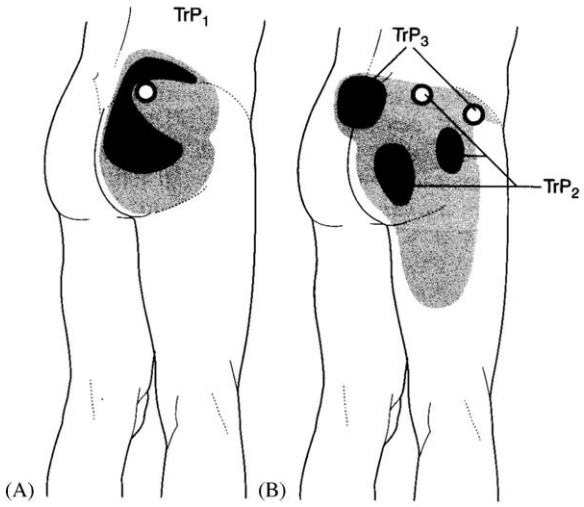

Figure 2 Referral patterns for various gluteus medius trigger points. (Reprinted with permission from Chaitow L. & Delany J, 2002, Clinical Applications of Neuromuscular Techniques Volume 2. Lower Body. Churchill Livingstone, Edinburgh.)

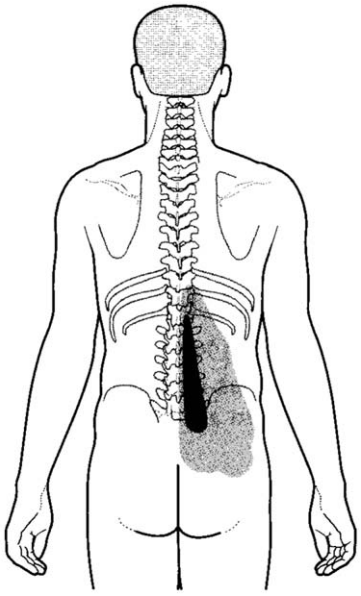

Figure 3 Referral pattern for psoas trigger points. (Reprinted with permission from Chaitow L. & Delany J, 2002, Clinical Applications of Neuromuscular Techniques Volume 2. Lower Body. Churchill Livingstone, Edinburgh.)

Physiological theories

Electrophysiological

A 1998 review of clinical and basic science studies on MTrPs implicates sensitized nerve fibers associated with abnormal endplates. This spinal cord mechanism, producing characteristic referred pain and local twitch responses, suggests a model in which multiple loci, in close proximity to nerve fibers and motor endplates, results in excessive release of acetylcholine in abnormal endplates (Hong and Simons, 1998).

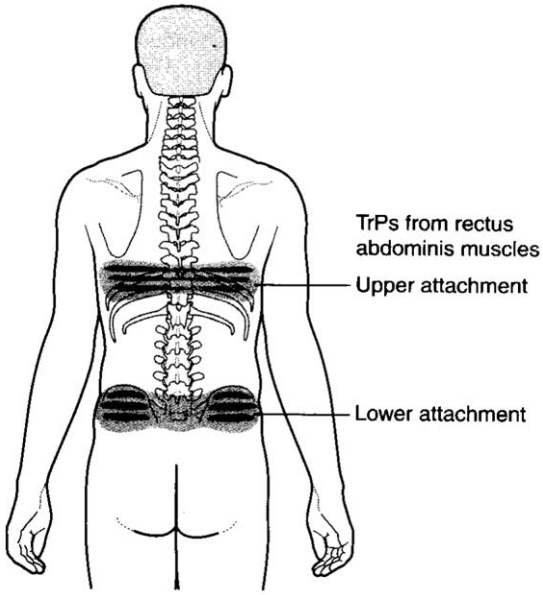

Figure 4 Referral pattern for rectus abdominus trigger points. (Reprinted with permission from Chaitow L. & Delany J, 2002, Clinical Applications of Neuromuscular Techniques Volume 2. Lower Body. Churchill Livingstone, Edinburgh.)

Connective tissue changes

Local ischemia in muscles that contain MTrPs causes a decrease in ATP production, disrupts the sodium pump and normal membrane conductance, and increases the presence of metabolic wastes, creating a self-sustaining cycle of dysfunction that encourages trigger point formation. Both spasm and contracture cause a reduction in local blood supply, decreasing oxygen transport and waste removal, leading to a further tightening of the myofascia. Dysfunction in the delicate fascial membrane encasing each myofibril disrupts the flow of neurotransmitters. Ground substance within the myofascia undergoes transformation from a solute, to a gel, to a solid state, further stiffening the myofascial tissues (Cheng, 1982; Travell and Simons, 1983). A localized cycle of strong nociceptive input, leading to the formation of MTrPs and ultimately to cell death of inhibitory neurons, has been proposed to explain the transition from acute low back pain to a chronic state (Mense, 2001).

Neurophysiological

Both electrophysiological and connective tissue models converge on a third proposal implicating the neurophysiological model as a dominant theory. Chronic muscle lesions, such as MTrPs increasingly sensitize nociceptors, resulting in the release of neuropeptides that affect local tissue integrity by means of vasodilation and edema (Mense, 2001).

Some researchers report a lack of consistent evidence of inflammatory changes in this process, and propose alternative central nervous system pain pathways involving sensitization and centralization (Staud and Smitherman, 2002). Regardless of the mechanism involved, there is compelling evidence that regional abnormal contractility associated with dysfunctional endplate physiology, predisposes toward trigger point formation (Mense et al., 2003).

As this summary indicates there is no single widely accepted model for the patho-physiology, or the management, of myofascial pain (Bradley et al., 2002). Manual treatment of MTrPs in low back pain can at times present a clinical challenge due to the delicate nature of the structures underlying abdominal muscles that may contain trigger points, as well as the size and density of the posterior muscles and their overlying fascia, which can make manual access difficult, and sometimes impossible. In some muscles, such as the psoas, the pterygoids and the suboccipitals, the location of the affected structures restricts accessibility (Travell and Simons, 1983). This report describes a novel treatment for trigger points, using microcurrent, applied with graphite/vinyl gloves, in which accessibility is not an issue.

Traditional microcurrent therapy

Microcurrent therapy has traditionally been used to increase the rate of healing in injured athletes, to manage pain, increase the rate of fracture repair, and to treat myofascial pain and dysfunction (Rowley et al., 1974; Manley, 1994; Bertolucci and Grey, 1995; Lambert et al., 2002). Microcurrent provides subsensory current to the tissues in the range of 10^{-6} amperes (μA). Other widely used electrotherapies provide current in the range of 10^{-3} A, or 1000 times the current of microcurrent.

In a rodent animal model, electrostimulation of skin with microcurrent resulted in remarkably increased ATP concentrations, protein synthesis and membrane transport. With currents from 50 to 100 μA, the ATP levels increased three- to five-fold. With currents exceeding 1000 μA, the ATP reached a concentration plateau and with 5000 μA, ATP concentrations fell slightly compared to non-treated controls (Cheng, 1982). In the same study, similar effects were noted with regard to protein synthesis. At approximately 500 μA, there was a substantial enhancement of protein synthesis, but when the applied current exceeded 5000 μA, the trend reversed into suppression.

Trauma affecting the electrical potential of damaged cells results in an injury site that has a higher electrical resistance than surrounding tissue. Inflammatory changes are enhanced and healing is impaired by decreased electrical conductance and decreased cellular capacitance. Healthy cell and tissue membranes behave as capacitors with a charged layer on each side and an uncharged lipid bilayer between the two charged membranes (Oschman, 2000). Healthy tissues conduct a bioelectric current throughout the body that is altered in the presence of injury and inflammation. Microcurrent therapy provides current flow to tissues at physiologic amperage reducing resistance, encouraging normal membrane function. The process of tissue repair has been observed to increase production with the use of microcurrent and is presumed to be due to the increase in ATP production, membrane active transport, intracellular flow of nutrients and extracellular flow of waste materials demonstrated in animal studies (Rowley et al., 1974; Manley, 1994; Mercola and Kirsch, 1995). The author hypothesizes that microcurrent reverses the ischemic changes and reduction in ATP synthesis in tissues containing MTrPs.

Development of a new treatment method

Traditional microcurrent therapies use a limited number of frequencies, most commonly 0.3 Hz for healing therapy, 3 Hz for stimulation of acupuncture points, 30 Hz for pain management and 300 Hz for treating edema and stimulating lymphatic flow (Manley, 1994). More recently, the use of specific electromagnetic frequencies to achieve therapeutic effects has been reported (McMakin, 1998). The frequencies were obtained from lists of frequencies thought to neutralize various conditions and address various tissues that were used in the early 1900s (Electronic Medical Foundation, 1934–1955). In the present study, a range of frequencies for treatment of chronic fibrotic myofascial tissue were applied using subsensory microamperage current as a frequency generator. Pain reduction and tissue changes were observed during the

treatment, in patients with chronic low back pain in which MTrPs were major contributing features.

Microcurrent instruments currently marketed for cosmetic purposes are supplied with graphite/vinyl gloves. The lightweight gloves have electric microjacks cemented to the dorsal surface, and are designed to conduct current and provide sensitive tactile perception. These gloves were used to apply microcurrent to muscular tissue. In the course of treating a series of 350 patients, referred to a private clinic, with intractable cases of myofascial pain, treatment techniques using this methodology were further refined.

Characteristics of the new treatment method

Unlike traditional trigger point therapy, which requires injections or firm and often painful pressure, application of microcurrent causes hypertonic tissue to release with minimal pressure. Upon observation, therapeutic frequencies have characteristic threshold effectiveness over time (data not shown). In thousands of patient visits, involving treatment of more than 300 patients, a sequence of microcurrent treatment frequencies have been established, regularly producing consistent immediate results, and characteristic sensations, culminating in pain relief.

Frequencies commonly in use, and considered to be effective in the treatment of specific conditions, including fibrosis, scar tissue formation, mineral deposition, allergic reaction, inflammation, viral infection and spasm, are combined with frequencies thought to be specific for muscles, fascia, connective tissue, arteries and nerves. Approximately 20 frequency combinations commonly used were graded, and observations of treatment at the gross anatomical level were recorded. A frequency-specific response was characterized as a softening of the affected tissue, and a reduction in pain, observed within seconds or minutes of treatment using an appropriate frequency, which was not observed even after prolonged treatment using other, ineffective, frequencies. For example, the frequency combination thought to reduce inflammation in nerves has been observed to reduce nerve pain and is not effective in reducing pain associated with other pain generators. Additionally the frequency combination thought to reduce scar tissue has been observed to increase range of motion, but does not change pain sensations, or inflammation. This observation has been confirmed in studies conducted at the testing facility where both the operator and the patient were blinded to the frequencies in use (data not shown).

The sequence of frequencies used is characteristic for each patient, depending on evaluation of the affected tissues being treated. A classification scheme was developed for therapy that progresses through three stages: treatment of fibrosis, mineral deposits, and acute and chronic inflammation. Interestingly, the frequencies that were found to be most effective were reported in the early 1900s (Electronic Medical Foundation, 1934–1955) to have therapeutic effect for treatment of fibrosis and calcium deposits, both of which were subsequently suggested as mechanisms in the progression of myofascial dysfunction (Selye, 1975; Travell and Simons, 1983).

Theoretical model

A working hypothesis explains the immediate tissue changes observed when myofascial tissue is treated with specific frequencies. Precise frequencies appear to interact through resonance with biological tissues and biochemical regulators in such a way as to neutralize specific conditions, and address specific tissues, possibly by altering membrane configuration. In order to explain the clinical observations of changes in tissue that have been exposed to specific frequencies, the possibility must be considered that a resonance state between a specific frequency and a biological molecular configuration may cause a shift within the tissue matrix that produces a therapeutic effect. Living tissue is not only a biological structure; it is also an integrated electromagnetic system that generates and is highly sensitive to coherent signals (Oschman, 2000). The coherent signal pattern generated by the frequencies is hypothesized to interact with the electromagnetic structure of the membranes in such a way as to change its configuration, producing an immediate shift, resulting in the therapeutic effect.

The tissue changes produced by exposure to the effective frequency combinations appeared to be permanent, in most cases in this study group, allowing lasting improvement of chronically painful tissue, after a minimal number of treatments. Consistent with thermodynamic theory, organic tissues exhibit intrinsic organizational stability, requiring energy input to shift its energy state, but remaining in a stable configuration unless energy perturbations occur. Microcurrent has been reported to increase ATP production, protein synthesis and membrane transport, all contributing to the energy status of tissue (Cheng, 1982). Current applied to a stable configuration may provide the requisite energy for such a shift in

state. Consistent with this hypothesis, the shift would occur rapidly and could be permanent, unless the energy in the system changed in such a way as to return the tissue to its former state. This hypothesis could account for the observed lasting changes.

Methods

Treatment protocol

Treatments included massage, specific microcurrent frequencies administered with graphite/vinyl gloves and/or pads, and joint manipulation as needed. Treatments were 20–40 min long, and did not exceed two treatments per week. Treatment frequency was reduced to once a week when the patient was pain free for two consecutive visits, and further reduced to once every 2 weeks until the patient was functional between visits. Treatment was discontinued when the patient remained pain free after 4 weeks without a treatment.

Microcurrent was the only electrical modality used to treat the myofascial tissue. Massage as a myofascial treatment modality and joint manipulation therapies had been previously ineffective in producing improvement in this patient group. The battery operated microcurrent instrument was a dual channel model with two-digit frequency and specificity, and three-place capacity. For example, the numerals 7 and 6 can be modified with a 0.1, 1 or 10 multiplier to form the numbers 7.6, 76 or 760. The machine was used with four leads that were attached to graphite conductive gloves. The current delivered was 100 μA, pulsed DC current modified by the circuitry to be in an alternating positive and negative ramped square wave form (Figs. 5–7).

Patients were usually given an exercise regime to perform at home within the first 2 weeks. Conditioning was gradual and gentle and designed to increase muscle oxygenation and mobility before increasing strength. Supplements such as magnesium and malic acid were prescribed, for some patients, to provide the nutrients for improving muscle metabolism; and complex low-dose antioxidants were suggested to enhance liver detoxification pathway function to prevent detoxification reactions after treatment (Lall et al., 1999). The use of supplements may contribute to some confounding of the source of long-term improvements, but many of the patients had been on similar supplement regimens previously, which had produced no change in their symptoms.

Results in clinical practice: 1996

In 1996, a total of 250 patients were treated including 137 cases of simple chronic myofascial pain, involving various body regions. These cases were uncomplicated by disc or facet dysfunction, neuropathy, or severe arthritic changes and most pain was the result of prior trauma or chronic overuse. Duration of symptoms ranged from 8 months to over 20 years. The majority of patients had received one or more prior treatment

Figure 5 Microcurrent unit and gloves. (Reprinted with permission from Chaitow L., 2003, Fibromyalgia Syndrome: A Practitioner's Guide to Treatment (2nd Edition). Churchill Livingstone, Edinburgh.)

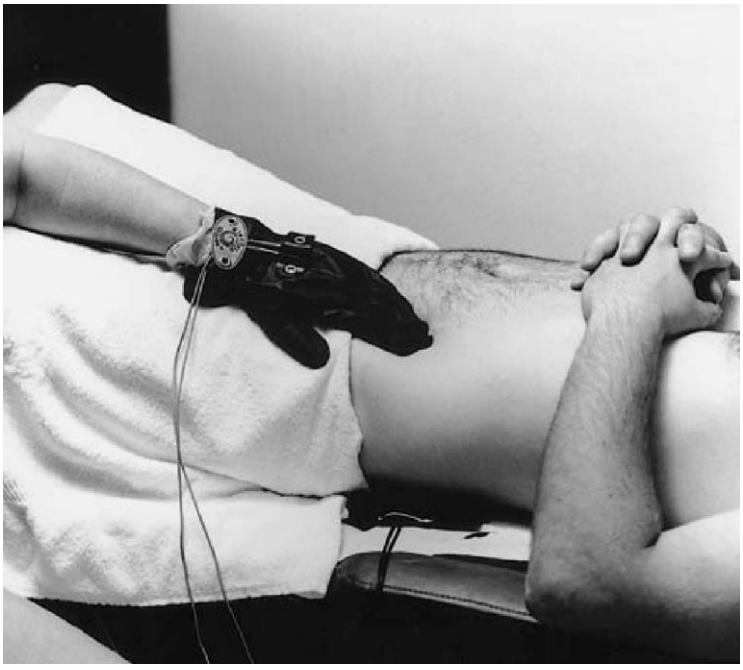

Figure 6 Patient being treated supine for psoas dysfunction. (Reprinted with permission from Chaitow L., 2003, Fibromyalgia Syndrome: A Practitioner's Guide to Treatment (2nd Edition). Churchill Livingstone, Edinburgh.)

modalities, including prescription medication, physical therapy, surgery, chiropractic, acupuncture, trigger point therapy and massage. Of the 137 patients, 128 completed the course of treatment. Patients were asked to rate pain on a 10-point visual analog scale. Pain was reduced in 126 cases from a range of 5–8 out of 10 to a 0–2 out of 10. Two patients reported pain reduced from the 5–8 range to the 3–4 range. Treatment duration varied between six and 60 visits, depending on the severity, complexity and chronicity of the case. Patients were instructed to return if the pain returned, or if motion in the affected area became limited. Only six patients have returned for intermittent follow-up treatments.

Results in clinical practice

During the following year, further refinements in treatment techniques and frequencies resulted in improved patient responses, and in a reduction in the number of treatments required to achieve pain relief. A retrospective chart review of 100 patients seen in the period between January and June of 1997 reveals encouraging results. Of these patients, there were 22 cases of chronic low back pain. Most of the patients were referred to the clinic by a medical physician, chiropractor, naturopathic physician or another patient. Chronicity was defined as pain lasting more than 1 year after the onset or precipitating trauma.

Outcomes in low back pain

The outcomes in low back pain cases are summarized in Table 1. In 22 cases of patients with chronic back pain, with an average duration of 8.8 years, all experienced significant and long-lasting pain reduction. One patient did not tolerate the treatment protocol and discontinued care after 4 weeks. Patients in this study group required an average of one treatment per week to achieve a 3.8-fold average reduction in pain intensity, over an average treatment period of 5.6 weeks.

Forty percent of the patients in this study had experienced chronic pain for 5 years or less. There was no difference in the magnitude of pain relief between this group and chronic pain sufferers reporting symptoms of more than 5 years duration. However, in the patient group reporting chronic pain of more than 5 years duration, the frequency of visits required to obtain the same magnitude of pain relief was greater. There were an average of 0.8 visits required, per week, for those in the 5 years or less chronicity group, compared to an average of 1.2 visits, per week, required for those in the more than 5 years chronicity group. The differences in pre- and post-treatment pain scores

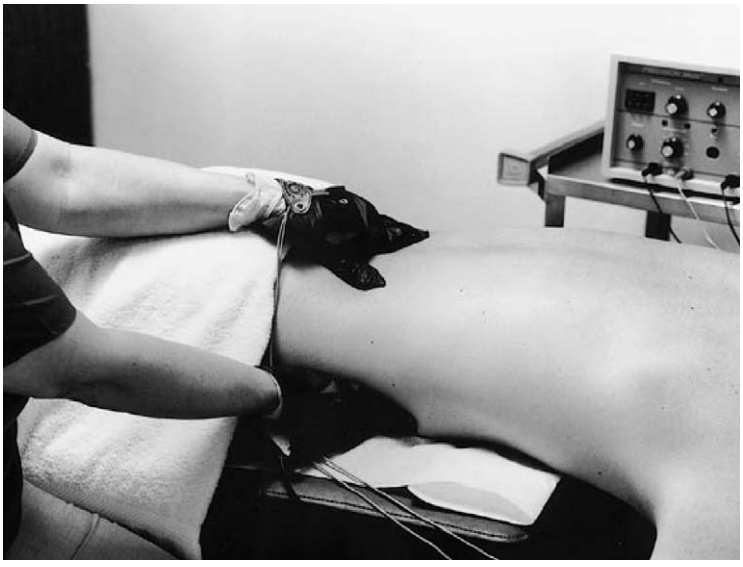

Figure 7 Patient being treated prone for lumbar paraspinal and gluteal dysfunction. (Reprinted with permission from Chaitow L., 2003, Fibromyalgia Syndrome: A Practitioner's Guide to Treatment (2nd Edition). Churchill Livingstone, Edinburgh.)

Table 1 Outcomes in chronic low back pain patients.

Clinical outcome	Average ($n = 22$)	Standard deviation	Range
Number of treatments	5.7	4.0	2–10
Treatment duration (weeks)	5.6	4.5	1–10
Pre-treatment pain	6.5/10	1.2/10	3–9
Post-treatment pain	1.7*/10	1.4/10	0–5
Chronicity (years)	8.8	5.4	1.5–20

*Statistically significant difference from pre-treatment mean ($P < 0.005$).

was statistically significant for the treatment group as a whole ($n = 22$); however, the number of patients in the chronicity subsets is not sufficient to determine statistical significance of these findings, and a larger number of patients would be required to verify these trends.

Other types of treatment, including drug therapy, chiropractic manipulation, physical therapy, naturopathic treatment and acupuncture had failed to produce lasting pain relief in 90% (20/22) of this patient group. Half of this patient group had previously used two or more of these therapies, with minimal to no long-term benefit. The application of microcurrent, and the specific frequencies used during treatment, produced immediate, palpable, changes in tissue, and reductions in patient-reported pain during the treatment. These effects persisted to create the observed long-term benefit of this procedure.

Discussion

Technical advantages

The clinical advantage afforded by the use of the graphite/vinyl gloves and the specific frequencies they transmit leads to improved treatment of sensitive, or dense, musculature. In order for the treatment to be effective, current must pass through the affected tissue, and compressive pressure is not essential for pain relief.

When treating the psoas, iliacus and rectus abdominus muscles, the patient is treated while supine, with the knees and hips flexed. The gloves are positioned with one graphite-gloved hand just medial to the ASIS, and the other graphite glove placed under the patient's back. The current passes through the psoas and posterior muscles simultaneously. The posterior muscles are treated with the

patient prone, with gloves positioned with one glove under the abdomen, and the other palpating the lumbar paraspinal muscles and multifidi. Pressure is applied only as required to palpate and note tissue change. The anterior and posterior muscles, and taut muscle bands, have been observed to change in both tenderness and hypertonicity, without the use of compressive force.

Side effects, cautions and contraindications

Treatment of myofascial pain requires attention to toxic and metabolic factors that impact muscle function (Gerwin, 2001). Generalized side effects include what is interpreted as being a post-treatment detoxification reaction, that may begin approximately 90 min after treatment and may last for 6–24 h. Symptoms may include slight-to-moderate nausea, flu-like aching, and a low incidence of increased pain. Side effects can usually be moderated by the consumption of 2 qt of water in the first 3 h following treatment, and the use of a supplement (Oxygenics and Adva Clear, Metagenics, Inc.) which provides phase one and phase two liver detoxification pathway substrates (Bland et al., 1995). In the author's clinical experience, the reaction becomes less pronounced after the third or fourth visit, possibly due to compensatory increases in liver detoxification pathway enzymes.

The usual cautions and contraindications for microcurrent must be observed, including restriction of use through the eye, or through a pregnant uterus, or on patients with demand-type pacemakers.

Negative side-effect examples

In overall clinical experience since 1996, in the treatment of a variety of patient groups, there have been very few examples of negative side effects.

- One patient who had a cervical fusion with a spinal stimulator installed reported muscle spasm after the application of microcurrent, even in the absence of spinal stimulator use.
- Another patient who had a confirmed history of Agent Orange exposure, experienced similar muscle spasms when microcurrent treatment was attempted.
- One individual, a dehydrated habitual smoker, was unable to tolerate any electrical modality, including TENS.
- A patient who had previously sustained spinal cord injuries progressed from numbness to sensory hyperesthesia, after brief exposure to microcurrent at a cervical site.
- Temporary side effects have been reported with the application of inappropriate frequencies. For example when fibrosis-specific frequencies were applied to freshly healing tissue, increased pain resulted, and there appeared to be a delay in progression to full healing.

Achieving optimum results requires a thorough understanding of both the methodology and the conceptual basis for microcurrent use, and a thorough appreciation of musculoskeletal disorders of the lumbar spine (Lauder, 2002). Furthermore, consistency in trigger point identification in patients with low back pain is challenging (Nice et al., 1992). For these reasons, a formal course of training is highly recommended for practitioners who are interested in frequency-specific microcurrent as a treatment approach.

Conclusion

The observations from this study, while promising, must be analyzed with caution:

- These observations were not derived from a randomized group.
- The patient population was refractory to other treatment techniques, and had been led to expect a positive outcome by referring physicians.
- The absence of a control group, or sham treatment, precludes direct comparison between treatment and non-treatment groups, and the refractory patients served as their own controls.
- Other complementing treatment modalities were not used consistently in these patients, and their contribution to the results cannot be systematically assessed.

However, even with these confounding elements, the microcurrent treatment was the single factor that made the most consistent, immediate and substantial difference in muscle tissue status and pain. It may however be speculated that nutritional support, exercise and manipulation therapy, most probably acted as contributory factors to the rate of recovery, and duration of pain relief.

Since the educational programs for teaching of this treatment modality began in 1997, numerous chiropractors, medical and osteopathic physicians, physical therapists and naturopathic physicians, have adopted use of microcurrent in clinical practice. These encouraging results have therefore now been reproduced over thousands of patient

visits, in a number of clinics, by a variety of practitioners. This report of the early success of this treatment contributes to the observational trends in treatment therapies for low back pain of myofascial origin, and is further evidence that rigorously designed clinical trials are warranted.

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