Council on Chiropractic Guidelines and Practice Parameters

Chiropractic Management of Myofascial Trigger Points and Myofascial Pain Syndrome: A Systematic Review of the Literature

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Abstract

Objectives: Myofascial pain syndrome (MPS) and myofascial trigger points (MTrPs) are important aspects of musculoskeletal medicine, including chiropractic. The purpose of this study was to review the most commonly used treatment procedures in chiropractic for MPS and MTrPs.

Methods: The Scientific Commission of the Council on Chiropractic Guidelines and Practice Parameters (CCGPP) was charged with developing literature syntheses, organized by anatomical region, to evaluate and report on the evidence base for chiropractic care. This article is the outcome of this charge. As part of the CCGPP process, preliminary drafts of these articles were posted on the CCGPP Web site www.ccgpp.org (2006-8) to allow for an open process and the broadest possible mechanism for stakeholder input. PubMed, Excerpta Medica Database, Cumulative Index to Nursing and Allied Health Literature, and databases for systematic reviews and clinical guidelines were searched. Separate searches were conducted for (1) manual palpation and algometry, (2) chiropractic and other manual therapies, and (3) other conservative and complementary/alternative therapies. Studies were screened for relevance and rated using the Oxford Scale and Scottish Intercollegiate Guidelines Network rating system.

Results: A total of 112 articles were identified. Review of these articles resulted in the following recommendations regarding treatment: Moderately strong evidence supports manipulation and ischemic pressure for immediate pain relief at MTrPs, but only limited evidence exists for long-term pain relief at MTrPs. Evidence supports laser therapy (strong), transcutaneous electrical nerve stimulation, acupuncture, and magnet therapy (all moderate) for MTrPs and MPS, although the duration of relief varies among therapies. Limited evidence supports electrical muscle stimulation, high-voltage galvanic stimulation, interferential current, and frequency modulated neural stimulation in the treatment of MTrPs and MPS. Evidence is weak for ultrasound therapy.

Conclusions: Manual-type therapies and some physiologic therapeutic modalities have acceptable evidentiary support in the treatment of MPS and TrPs. (J Manipulative Physiol Ther 2009;32:14-24)

Key Indexing Terms: *Myofascial Pain Syndromes; Myofascial Trigger Points; Chiropractic; Musculoskeletal Manipulations*

Ever since the seminal work of Travell and Rinzler[1] in 1952, the role of myofascial trigger points (TrPs) in myofascial pain syndrome (MPS) has become an accepted part of musculoskeletal clinical practice. Along with Simons,[2] Travell first identified the importance of myofascial pain and its localization in what they termed *trigger points*, providing the first classification of diagnostic criteria for TrPs. They also provided detailed maps of the pain referral patterns from TrPs in all the muscles of the body. Myofascial pain syndrome is currently thought to be the leading diagnosis among pain management specialists[3] and the leading diagnosis in pain patients reporting to general practitioners.[4]

Interest in myofascial tenderness extends throughout the history of chiropractic. It might be said that local paraspinal tenderness, as part of the manifestations of the "subluxation," was a central feature of chiropractic thinking from its inception. Arguably, the work of Ray Nimmo[5-7] represents

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Paper submitted April 29, 2008; in revised form May 14, 2008; accepted June 1, 2008.

0161-4754/$34.00

doi:10.1016/j.jmpt.2008.06.012

the earliest and perhaps still most established thinking on this topic among chiropractors. Cohen and Gibbons[8] describe his work as "a conceptual leap from moving bones to working with muscles that move bones." Schneider[9,10] has provided a collection and review of all of Nimmo's works. Nimmo's explanations in the 1950s of the pathophysiology of TrPs are still regarded as accurate and highly sophisticated.

Other chiropractic authors who have written on this topic include Schneider,[9-12] Perle,[13,14] Hains,[15,16] and Hammer,[17] whose seminal textbook is now in its third printing. There are also numerous case reports and technical reports relating to various soft tissue techniques in chiropractic. In the field of MPS, chiropractic is generally regarded as one of the complementary and alternative medical (CAM) therapies. The CAM therapies are quite commonly used in the treatment of myofascial pain and TrPs,[18] and there is considerable overlap between chiropractic approaches and CAM therapies in this field.

Fig 1. *Rating scales for included studies.*

A. The Oxford Rating Scale.[19,20]

1a: Systematic review, with homogeneity of RCT's.
1b: Individual RCT with narrow confidence interval.
1c: All or none.
2a: Systematic review, with homogeneity of cohort studies.
2b: Individual cohort study (including low quality RCT; eg <80% follow-up).
2c: "Outcomes Research"; Ecological studies.
3a: Systematic review with homogeneity of case-control studies.
3b: Individual case-control study.
4: Case-series (and poor quality cohort and case-control studies).
5: Expert opinion without explicit critical appraisal, or based on physiology, bench research or "first principles".

B. The SIGN Checklist.

1. ++ = All or most methodological criteria have been fulfilled/bias has been maximally reduced.
2. + = Some of the criteria have been fulfilled/bias has been somewhat reduced.
3. − = Few or no criteria fulfilled/bias is clearly present.

Methods

The search strategy for this review was constrained by the need to identify only those studies of chiropractic treatments (manual therapy and other conservative therapies) that were not directed at clinical complaints associated with any of the specific body regions that have been designated as other reviews in the Council on Chiropractic Guidelines and Practice Parameters (CCGPP) process. In other words, no study was selected of the effect of a chiropractic treatment specifically indicated for back pain, neck pain, upper limb pain (shoulder, elbow, wrist), and lower limb pain (hip, knee, ankle, and foot) of any kind (ie, for any category of diagnosis). Only studies of chiropractic treatments for MPS and TrPs were considered. Therefore, the inclusion criteria for this search were as follows: manual therapies, trigger points, myofascial pain syndrome (MeSH headings: musculoskeletal manipulations, myofascial pain syndrome [not exploded to temporomandibular joint]), conservative therapies, laser, acupuncture, ultrasound (US), electrotherapy, naturopathy; 1965 to 2007; English, German; human studies.

After the primary search was conducted, a number of secondary searches were conducted based upon "related links," especially emphasizing systematic or clinical reviews, randomized clinical trials, and conservative treatments (vs musculoskeletal manipulations only), as well as searches of additional works by the authors identified in the primary search. Finally, citation reviews were conducted manually to identify any additional suitable studies.

This search was conducted in the PubMed; Cumulative Index to Nursing and Allied Health Literature; Index to Chiropractic Literature (ICL); Manual, Alternative, and Natural Therapy System (MANTIS); Excerpta Medica Database; National Guidelines Clearinghouse; Database of Abstracts of Reviews of Effects; and Turning Research Into Practice databases. Selected publications were rated on the Oxford Rating Scale[19,20] as well as the Scottish Intercollegiate Guidelines Network (SIGN) Checklist (Fig 1).

This review accepted all levels of published evidence for narrative description: clinical guidelines, systematic reviews, clinical trials, cohort or case series, case studies, and clinical reviews. For evidence rating, recommendations were constructed and rated according to the Oxford Rating Scale[19,20] as follows:

Consistent level 1 studies
Consistent level 2 or 3 studies or extrapolations from level 1 studies
Level 4 studies or extrapolations from level 2 or 3 studies
Level 5 studies or troublingly inconsistent or inconclusive studies at any level

Results

Manual Therapies

Systematic Reviews of Manual Therapies. Two completed systematic reviews were identified.[21,22] These reviews were rated (Oxford Scale) as 1a evidence with a 2+ quality rating on the SIGN Checklist.

Fernandez de las Penas et al[21] used the following selection criteria for acceptable studies:

> "clinical or randomized controlled trials in which some form of manual therapy (strain/counterstrain, ischemic compression, transverse friction massage, spray and stretch, muscle energy technique) was used to treat (myofascial trigger points) MTrPs" (p29).

Mobilization and manipulation were apparently not explicitly included. It should be noted that the criterion applied to the "clinical category" in this search was "MTrPs," although MPS was referenced later in their review. No

additional, more specific criteria related to clinical complaints in any of the body regions (ie, back pain, neck pain, limb pain, etc) were used. It would appear that this search strategy is consistent with the one devised for this review, as other CCGPP reviews dealt with the chiropractic management of pain complaints specific to these body regions.

Fernandez de las Penas et al[21] identified 7 acceptable trials (SIGN = 2+/Oxford Scale ratings = 1b), 4 of which obtained a sufficiently high quality score (>5/10 on the Physiotherapy Evidence Database Scale).

- Gam et al[23] (Physiotherapy Evidence Database score = 6/10)
- Jaeger and Reeves[24] (2/10)
- Hanten et al[25] (3/10)
- Hong et al[26] (6/10)
- Hou et al[27] (5/10)
- Hanten et al[28] (5/10)
- Dardzinski et al[29] (1/10)

The interventions used in these studies were as follows (number of studies in parentheses): spray and stretch (2), soft tissue massage (2), ischemic compression (2), occipital release exercises (1), strain/counterstrain (SCS) (1), and myofascial release (1). An important finding was:

> "Only 2 studies ... test(ed) the specific efficacy (efficacy beyond placebo) of various manual therapies in the treatment of MPS (Gam et al[23] [massage] and Hanten et al[25] [occipital release]). These studies found no difference between interventions" (p30).[21]

Another important issue from this group of studies is the duration of treatment. Most of these studies (4) investigated only the immediate effects on pain and tenderness.[24,26-28] One study investigated the short-term treatment effects of ischemic compression vs exercises over 5 treatments,[25] whereas 2 investigated longer-term effects (6 months) of a course of, in one case, massage added to US therapy[23] and, in the other case, SCS in addition to exercises.[29] In both of the latter studies of a course of therapy, the manual therapy used (massage or SCS) was included among other therapies, making it impossible to identify the distinct contribution of the manual therapy to the reported outcomes.

Fernandez de las Penas et al[21] conclude that there are very few randomized controlled studies (RCTs) of any type of manual therapy in the treatment of MTrP (MPS) and, as a result, "the hypothesis that manual therapies have specific efficacy beyond placebo in the management of MPS caused by MTrPs is neither supported or refuted by the research to date" (p33). They do acknowledge that there is some evidence for improvement in some groups within these trials and that this warrants further research.

In Rickards'[22] review, the inclusion criteria included RCTs of a conservative (in this section: manual only) therapy for active TrPs, not latent TrPs, in which a patient-related pain outcome was used and in which an explicit diagnosis of TrP was made including at least local tenderness and a taut muscle band. Studies were rated on a 20-point scale; however, no cutoff score was used for inclusion. Rickards included the following studies: Chatchawan et al,[30] Fernandes de las Penas et al,[31] Hanten et al,[28] Hou et al,[27] and Edwards and Knowles.[32]

For the purposes of the present review, the following comments apply to this group of studies: (1) The study of Chatchawan et al[30] of massage therapies clearly identified the target group as chronic low back pain and would be included in the CCGPP review on low back pain. (2) The study of Fernandez de las Penas[31] is included below. (3) The studies of Hanten et al and Hou et al are included in the review by Fernandez de las Penas et al above. (4) Edwards and Knowles' trial[32] did not include a manual therapy (only active stretching and dry needling were investigated). Therefore, for manual therapies, Rickards' review does not add anything substantial to the present review.

A Cochrane Collaboration Protocol entitled "Non-invasive physical treatments of myofascial pain" (Kilkenny et al[33]) was identified. This protocol currently contains no results. However, it was used as a source of additional references, particularly on published clinical trials and systematic reviews.

Practice Guidelines on Manual Therapy. The following practice guidelines were identified:

> Institute for Clinical Systems Improvement (ICSI). *Assessment and management of chronic pain*. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2005 Nov. 77 p. No recommendation for physical (manual) therapies in the treatment of MPS or TrPs.
> Work Loss Data Institute. *Pain (chronic)*. Corpus Christi (TX): Work Loss Data Institute; 2006. 261 p. *Myofascial pain syndrome, physical therapy: 14-21 days*.

RCTs of Manual Therapy. In addition to Fernandez de las Penas et al,[23] our search identified 3 RCTs (Oxford Scale rating = 1b or 2b) of the effect of spinal manipulation on local paraspinal muscular tenderness in the dorsal spine (Terret and Vernon[34] [2+/2b]), cervical spine (Vernon et al[35] [2+/2b]), and lumbopelvic area (Cote et al[36] [2+/2b]). All 3 studies investigated only the immediate effect of the interventions on local muscular pain thresholds (electrical stimulus in Terret and Vernon[34] and pressure stimulus in Vernon et al[35] and Cote et al[36]). Immediate and statistically significant increases in pain thresholds were found for spinal manipulation as compared with mobilization in the cervical and dorsal paraspinal muscles, but not in the lumbopelvic soft tissues.

Vicenzino et al[37] (2+/1b) reported on the immediate effect of a cervical mobilization on pressure pain threshold (PPT) of tender points on the lateral epicondyle in patients with "tennis elbow." Only the mobilization (described as "manipulation" in this study) resulted in statistically significant increases in lateral epicondyle PPTs vs placebo and control conditions.

Greene et al[38] (2+/1b) investigated the effect of 4 different treatments given 3 times over 3 days on skin resistance

levels. Subjects with thoracic TrPs were randomized to receive osteopathic manipulative treatment (OMT), laser treatment, OMT plus laser, and sham laser. No significant differences in effects were noted between these groups.

Atienza Meseguer et al[39] (2+/1b) studied 54 subjects with trapezius TrP treated with classic SCS, modified SCS, and control. Both treatment groups showed immediate improvement in PPT vs controls, but not vs each other.

Fryer and Hodgson[40] (2+/1b) compared manual pressure release to sham myofascial release in 37 subjects with upper trapezius myofascial TrPs. A statistically significant increase in PPT was obtained immediately after the intervention in the manual pressure group vs controls that was found to be due to a change in tissue sensitivity.

Fernandez-de-las-Penas et al[31] (2+/1b) compared ischemic compression to transverse friction massage in 40 subjects with myofascial TrPs in the upper trapezius muscle. Both groups obtained significant improvement in PPT within 2 minutes. No difference was found between the groups.

Conclusion: RCTs

A total of 14 RCTs were retrieved. Quality scores ranged widely for the 7 trials reviewed by Fernandes de las Penas et al.[21] Ten of 14 trials we identified involved only immediate changes in TrP or tender point ratings. Two other trials reported outcomes for short courses of treatments over 3 to 5 days,[25,38] whereas 2 others reported outcomes at 6 months.[23,29] The outcomes of the "immediate" trials can be summarized as demonstrating effectiveness in reducing tenderness for spinal manipulation (2 of 3 trials), spray and stretch (2 trials), ischemic compression (3 trials), transverse friction massage (1 trial), and SCS (1 trial). One trial of mobilization failed to show any significant changes in tenderness scores vs controls. It would appear that there is moderately strong evidence to support the use of some manual therapies in the immediate relief of TrP tenderness.

The 2 trials of short-term effects (3-5 days) demonstrated the effectiveness of osteopathic manipulation and ischemic compression, respectively, in reducing TrP tenderness. One long-term trial reported that SCS demonstrates clinically important changes in TrP tenderness and general pain over 6 months, whereas the other showed that massage produced limited effect. It would appear that there is only limited evidence to support the use of manual therapies over longer courses of treatments in the management of TrPs and MPS.

Case Reports of Manual Therapy. Twenty-six case reports in the chiropractic literature were identified from ICL or MANTIS (Appendix A). These reports covered TrP treatments in patients with hand pain, low back pain due to a TrP in the quadratus lumborum muscle, wrist pain, fibromyalgia, upper quarter syndrome, MPS, and general TrPs.

Clinical Reviews of Manual Therapy. Up-to-date clinical reviews[41-46] by noted experts in the field of myofascial pain have endorsed the use of a variety of manual therapies in the treatment of TrPs and MPS. These are classed as level 5 (Oxford Rating) evidence.

Harden[45] notes that the principle aims of therapy for MPS are relief of pain and inflammation, prevention of further injury, reducing spasm, correcting abnormal postures, and improving circulation. He endorses the following therapeutic modalities for accomplishing these aims:

- In the acute stage:
  - Ice
  - Iontophoresis
  - US
  - splinting
- Postural and ergonomic education
- Massage
- Myofascial release
- Exercises and postural correction
- Laser therapy: efficacy undetermined
- Acupuncture: efficacy undetermined

Hong[41] recommends that the first principle of treatment of MPS is the identification and treatment of the presumed primary lesion (section 1). Only after this has been done, and if there is persistence of pain from the active TrPs, should direct treatment to the TrPs be performed. Hong suggests that, at this point in the therapeutic process, release of muscle tightness is the first objective. He identifies 7 steps in the treatment process for the active TrPs themselves:

i. Pain recognition: treating the active TrPs and not the latent ones.
ii. Identify the key TrP: Among active TrPs, one will be the most painful and most provocative of referred pain.
iii. Conservative vs aggressive treatment: This principle applies to the treatment of the primary lesion as well as the key TrP. Treatment should begin with what he describes as "non-invasive treatment including physiotherapy" and progress toward more invasive forms of therapy.
iv. Acute vs chronic TrPs: Distinguishing these helps guide therapy in the acute vs chronic stages of pain.
v. Superficial vs deep TrPs: Different therapeutic modalities are needed the more deeply located is the TrP.
   a. Superficial: deep pressure massage.
   b. Deep: stretch, US, laser, acupuncture, acupressure, or local injection.
vi. Individual preference: Each patient may have levels of comfort and familiarity with various forms of treatment that should then be tailored to this need.
vii. Other considerations: cost, time, etc.

Hong places considerable importance on manual therapies for TrPs. He indicates the following as important aspects of manual therapy (p40):

- Stretching of shortened muscles (or taut band)
- Improving local circulation

- Counterirritation
- Other reflex effects

Gerwin[42] also endorses the treatment protocol that separately addresses therapies for the local TrP vs therapies for the perpetuating factors. In the former category, he specifically endorses manual TrP compression for focal TrP release, followed by myofascial release techniques for local stretching and then "therapeutic stretch" for the longer-range elongation of the body segments. In the case of perpetuating factors, he includes correction of postural faults as well as joint dysfunction. This should be followed by an active program of physical conditioning, stretching, and endurance, including preventative strategies. Unfortunately, no studies were provided as evidence for this approach.

Simons[44] reviews the mechanisms of TrP formation and perpetuation to guide the appropriate treatment approach. The therapies endorsed in his review are as follows:

- Postisometric relaxation and release
- Trigger point (manual) pressure release
- Combinations of the above 2 therapies
- Trigger point massage

Only the work of Lewit[47] is cited as support for this approach. Other noninvasive therapies that Simons merely mentions as additional to the approach described above include facilitatory techniques, acupuncture, SCS, microcurrent, US, and laser.

Alvarez and Rockwell's[43] review only provides a list of noninvasive treatment modalities that include acupuncture, osteopathic manual medicine techniques [sic], massage, acupressure, US, heat, ice, diathermy, transcutaneous electrical nerve stimulation (TENS), and "spray and stretch" techniques. For these modalities, no clinical trial evidence was provided. The only support was a reference to the authoritative work described in Travel and Simons'[2] manual.

Lavelle et al[46] endorse the following treatments as efficacious: spray and stretch, TENS, physical therapy, and massage.

Critique of Clinical Reviews

Manual Therapies. All 6 reviews from within the last 5 years endorsed manual therapies for TrP treatment in MPS. None of these reviews provided a single reference to a clinical trial to support this position. None of the 11 trials reviewed above was cited in any of these reviews. As such, there is discordance, even at the level of renowned experts' reviews, between the apparent consensus on the use and types of manual therapies in treating TrPs vs the evidence from the published literature.

Other therapies. Only Harden[45] cites the clinical trial of Esenyel et al[48] (US + stretching vs dry needling + stretching vs stretching alone) and the case series of Simunovic et al[49] (laser therapy) as clinical studies of these sorts of therapies as well as the review of laser therapy by Gam et al.[23] The other reviews provide no support in the form of any clinical study for their recommendation on noninvasive therapies for TrPs.

Table 1. *Literature review: all studies*

Study type	Oxford level	Number
Systematic reviews	1a	2
Systematic review protocols		1
Practice guidelines	1a	2
RCTs	1b	11
RCTs	2b	3
Case series	4	3 (Grobli; Anderson; Crawford)
Case reports	5	17
Clinical reviews (selected: 2000-2005)	5	6

Evidence Synthesis of Manual Therapies. Tables 1 and 2 summarize the literature retrieved in this review.

Clinical Practice Recommendations of Manual Therapies

1. There is moderately strong evidence to support the use of some manual therapies in providing immediate pain relief at TrPs. The evidence level is B.
2. There is only limited evidence to support the use of manual therapies over longer courses of treatment in the management of TrPs and MPS. The evidence level is C.

Other Conservative Therapies

Systematic Reviews of Other Conservative Therapies. Two published reviews were identified for treatment methods other than manual therapies.[22,50] In Rickards'[22] review, the inclusion criteria included RCTs of a conservative therapy for active TrPs, not latent TrPs, in which a patient-related pain outcome was used and in which an explicit diagnosis of TrP was made including at least local tenderness and a taut muscle band. Studies were rated on a 20-point scale; however, no cutoff score was used for inclusion. It should be noted that no trials for acupuncture were included in this review (below). A total of 18 trials were included in this review (Tables 3-6). Rickards'[22] conclusions were based on the following schema:

- Significant evidence: consistent findings in multiple high-quality RCTs
- Moderate evidence: consistent findings in multiple lower-quality evidence and/or a single high-quality RCT
- Limited evidence: a single low-quality RCT
- Unclear evidence: inconsistent or conflicting results from multiple RCTs
- No evidence: no evidence identified
- Evidence of adverse effect: RCTs with lasting negative changes

Table 2. *Literature review: randomized clinical trials of manual therapy for MPS or TrPs (all rated as Oxford 1b, unless otherwise noted as 2b)*

RCT	Time	Manual therapy	Outcome
Terret and Vernon, 1986 (2b)	Immediate	Spinal manipulation	Spinal manipulation > mobilization
Jaeger and Reeves, 1986	Immediate	Spray and stretch	Significant intragroup effects
Greene et al, 1990	3 d	Osteopathic manipulative therapy	No difference between OMT with or without laser and vs control
Vernon et al, 1992 (2b)	Immediate	Spinal manipulation	SMT > control
Hong et al, 1993	Immediate	Spray and stretch, deep manual pressure	Deep pressure massage was more effective than comparison modalities.
Cote et al, 1994 (2b)	Immediate	Spinal manipulation	Spinal manipulation = control
Hanten et al, 1997	Immediate	Manual mobilization	No significant differences between mobilization, exercise, and control
Gam et al, 1998	6 mo	Massage	No significant differences between massage with real or sham US or control
Hanten et al, 2000	5 d	Ischemic compression	Ischemic compression > exercise for pain and tenderness
Dardzinski et al, 2000	6 mo	SCS	Clinically important intragroup changes
Hou et al, 2002	Immediate	Ischemic compression	Ischemic compression > control
Fryer and Hodgson, 2005	Immediate	Manual pressure release vs sham control	Manual pressure release > control
Fernandez-de-las Penas et al, 2006	Immediate	Ischemic compression and transverse friction massage	Ischemic compression = transverse friction massage
Atienza Meseguer et al, 2006	Immediate	SCS	SCS > control

SMT, Spinal manipulation therapy.

Table 3. *Studies of laser therapy from Rickards[22] (n = 6 studies)*

Study	Treatments	Outcomes
Gur et al[51]	Laser vs placebo	Laser > placebo
Snyder-Mackler et al[52]	Laser vs placebo	Laser > placebo
Ceccherelli et al[53]	Laser vs placebo	Laser > placebo
Hakguder et al[54]	Laser and stretching vs placebo and stretching	Laser > placebo
Ilbuldu et al[55]	Laser vs dry needling vs placebo	Laser > dry needling Laser > placebo
Altan et al[56]	Laser + exercise + stretching vs placebo + exercise + stretching	Laser = placebo (other treatments thought to contribute to improvement)

Rickards' conclusions for each therapy were as follows:

Laser: Significant evidence that laser may be effective in the short term. Type, dose, and frequency of treatments require additional research.

TENS: Evidence (unqualified?) that TENS may be effective in providing immediate relief at TrPs.

Other electrotherapies: Limited evidence for the effectiveness of frequency modulated neural stimulation (FREMS), high-voltage galvanic stimulation (HVGS), electrical muscle stimulation (EMS), and interferential current (IFC).

US: Moderate evidence that US is no more effective than placebo.

Magnets: Preliminary evidence that magnets may be effective.

It was noted that most trials involved either immediate or short-term effects and that much more research, especially on the longer-term effects, was needed.

Cummings and White[50] reviewed all trials up to 2000 of "Needling Therapies" for myofascial pain. Three of these trials involved what could be described as "standard" acupuncture typical of the type used by some chiropractors. This is distinguished from deep dry needling and any injection-type therapies that would not be standard chiropractic treatment approaches. For the present review, any trials that specifically identified one of the regional complaint areas in the CCGPP (ie, low back pain, neck pain) without specifying the treatment of TrPs were

Table 4. *Studies of electrotherapy from Rickards[22] (n = 5 studies)*

Study	Treatments	Outcomes
Graff-Radford et al[57]	A: TENS mode A B: TENS mode B C: TENS mode C D: TENS mode D E: Placebo TENS	B > C, D > A, E (B = 100 Hz)
Farina et al[58]	FREMS vs TENS	FREMS = TENS
Hsueh et al[59]	A : Placebo electrotherapy B : TENS C : EMS	TENS > EMS, placebo
Ardic et al[60]	A: TENS + stretching B: EMS + stretching C: Stretching	A = B > C
Tanrikut et al[61]	A: HVGS + exercise B: Placebo HVGS + exercise C: Exercise	A > B, C

Table 5. *Studies of magnet therapy form Rickards[22] (n = 3 studies)*

Study	Treatments	Outcomes
Brown et al[62]	Magnets vs placebo	Magnets > placebo
Smania et al[63]	A: RMS B: TENS C: Placebo US	A > B > C
Smania et al[64]	A: RMS B: Placebo RMS	A > B

RMS, Repetitive magnetic stimulation.

Table 6. *Studies of US therapy from Rickards[22] (n = 4 studies)*

Study	Treatments	Outcomes
Gam et al[23]	A: US + massage + exercise B: Placebo US + massage + exercise C: Control	A = B = C
Maljesi et al[65]	A: High-power US B: Conventional US	A > B
Lee et al[66]	A: Placebo US B: US C: Electrotherapy D: US + electrotherapy	C > A
Esenyel et al[48]	A: US + stretching B: TrP injection + stretching C: Stretching	A, B > C

Table 7. *Studies of acupuncture therapy from Cummings and White[50] (n = 3)*

Study	Treatments	Outcomes
Birch and Jamison[67] (neck pain)	A: Superficial acupuncture + heat B: Wrong point superficial acupuncture C: NSAID	At 3 mo: A > B, C
Johansson et al[68] (facial pain or headache)	A: Acupuncture B: Occlusal splint C: No treatment control	At 3 mo: A = B > C
Kisiel and Lindh[69] (neck pain)	A: Manual acupuncture B: Physiotherapy	At 6 mo: A = B

IP, ;NSAID, nonsteroidal anti-inflammatory drug.

excluded (Table 7). Cummings and White[50] concluded that marked improvements were demonstrated in most treatment groups. However, dry needling techniques alone did not appear to be superior to other treatments in the treatment of myofascial TrPs. As well, they could not find evidence for a specific efficacy of these techniques beyond placebo. They called for more placebo-controlled trials.

A Cochrane Collaboration Protocol entitled "Non-invasive physical treatments of myofascial pain" (Kilkenny et al[33]) was identified. This protocol currently contains no results. However, it was used as a source of additional references, particularly on published clinical trials and systematic reviews.

RCTs of Other Conservative Therapies. Both Rickards[22] and Cummings and White[50] used specific inclusion and exclusion criteria that resulted in the exclusion of numerous studies, either because they were not RCTs or for various methodologic reasons. These excluded trials will not be listed or reviewed here, as that would both duplicate and undermine the methods and conclusions of these reviews. Several trials have been identified in the present search that either have been published since these reviews or were not identified at all in these reviews (probably because of the inclusion of MANTIS and ICL databases in the present search) in the following areas:

Acupuncture. There is some additional evidence that a course of deep acupuncture to TrPs is effective in the treatment of myofascial pain for up to 3 months (Table 8).

Laser. The study of Greene et al[38] of laser vs osteopathic manipulation (OMT) alone vs OMT + laser vs sham laser to thoracic paraspinal muscle TrPs over 3 days involved measuring only local skin resistance. No measures of pain or tenderness response were made. This study would not have qualified for Rickards' review and does not, as well, for the present review.

Olavi et al[75] compared infrared laser to placebo laser over various active TrPs located throughout the body. Pressure pain thresholds were measured immediately after and then 15 minutes after treatment. A statistically significant difference favoring the laser group was found, especially at 15 minutes.

Table 8. *Additional acupuncture trials*

Study	Treatments	Outcomes
Ceccherelli et al[70] (neck pain)	A: Somatic acupuncture B: Somatic acupuncture + auricular acupuncture	At 1 and 3 mo: A = B (both = positive effect on pain)
Itoh et al[71] (low back pain)	A: Acupuncture at traditional points B: Superficial acupuncture at TrPs C: Deep acupuncture at TrPs	At 3 mo: A > B, C (not statistically significant)
Ceccherelli et al[72] (low back pain)	A: Superficial acupuncture to TrP B: Deep acupuncture to TrP	At 3 mo: B > A
Goddard et al[73] (jaw pain)	A: Acupuncture B: Sham acupuncture	Immediately: A = B
Ceccherelli et al[74] (shoulder)	A: Superficial acupuncture to TrP B: Deep acupuncture to TrP	At 1 and 3 mo: B > D

Table 9. *Literature review: all studies of other conservative therapies*

Study type	Oxford level	Number
Systematic reviews	1a	2
Systematic review protocols		1
Practice guidelines	1a	2
RCTs	1b	29

Electrotherapy. No additional studies were retrieved.

Exercise. No additional studies not already included in Rickards[22] under "physical therapies" were retrieved.

Spray and stretch. The study of Hou et al[27] was included in section 3 and was included in the reviews of both Fernandes de las Penas et al[21] and Rickards[33] under the category of manual therapy. This is because most treatment groups received ischemic compression with or without a variety of other physiologic therapies. One of these therapies was spray and stretch, making Hou et al[27] the only published clinical trial to investigate this therapy. Hou et al found that the addition of spray and stretch to ischemic compression provided immediate benefit in reducing TrP sensitivity. There are no other published clinical trials of spray and stretch therapy for management of pain from TrPs. Notwithstanding this, it is often cited by clinical experts as a valuable treatment of TrPs.

Ultrasound. Srbely and Dickey[76,77] applied therapeutic-intensity vs low-intensity US to trapezius TrPs in 44 subjects. Pressure pain thresholds over trapezius TrPs increased 44% (14.2%) in the first group, whereas no increase was obtained in the second group.

Evidence Synthesis of Other Conservative Therapies. Table 9 summarizes the evidence retrieved in this review.

Clinical Practice Recommendations

1. *Laser*: There is substantial evidence that laser therapy is effective in the treatment of TrPs and MPS. The evidence level is A.
2. *TENS*: There is moderately strong evidence that TENS may be effective in providing immediate relief at TrPs. The evidence level is B.
3. There is limited evidence for the effectiveness of other forms of electrotherapy: FREMS, HVGS, EMS, and IFC. The evidence level is C.

Table 10. *Summary of recommendations*

Topic	Conclusion and strength of evidence rating
Manipulation/ mobilization	Rating B: short-term relief There is moderately strong evidence to support the use of some manual therapies (manipulation, ischemic pressure) in providing immediate relief of pain at MTrPs. Rating C: long-term relief There is limited evidence to support the use of some manual therapies in providing long-term relief of pain at MTrPs.
Conservative nonmanipulation	Rating A: laser therapies There is strong evidence that laser therapy (various types of lasers) is effective in the treatment of MTrPs and MPS. Rating B: TENS, magnets, and acupuncture There is moderately strong evidence that TENS is effective in the short-term relief of pain at MTrPs. There is moderately strong evidence that magnet herapy is effective in the relief of pain at MTrP and in MPS. There is moderately strong evidence that a course of deep acupuncture to MTrPs is effective in the treatment of MTrPs and MPS for up to 3 mo. Rating C: electrotherapies, US There is limited evidence for the effectiveness of EMS, HVGS, IFC, and FREMS in the treatment of MTrPs and MPS. There is conflicting evidence that US is no more effective than placebo or is somewhat more effective than other therapies in the treatment of MTrPs and MPS.

4. *US*: There is conflicting evidence as to whether US is no more effective than placebo or is somewhat more effective than other therapies in the treatment of TrPs and MPS. The evidence level is C.
5. *Magnets*: There is some evidence that magnets may be effective in the treatment of TrPs and MPS. The evidence level is B.
6. *Acupuncture*: There is some evidence that a course of deep acupuncture to TrPs is effective in the treatment of myofascial pain for up to 3 months. The evidence level is B.

Conclusion

The published evidence for the treatment of MPS and TrPs by common chiropractic treatments has been reviewed. Although publications ranging from systematic reviews and clinical trials to clinical reviews were included in the review, the evidence ratings were developed only on the basis of the clinical trial evidence. Manual-type therapies and some physiologic therapeutic modalities have acceptable evidentiary support in the treatment of MPS and TrPs (Table 10).

Practical Applications

- There is evidence that manual therapies are useful in short-term relief of TrP pain.
- There is evidence that laser and acupuncture are useful in the short- and long-term relief of MPS.

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Appendix A. Reference list of case studies of conservative treatments of MPS/TrPs

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