

# Needling Therapies in the Management of Myofascial Trigger Point Pain: A Systematic Review

T. Michael Cummings, MB, ChB, Adrian R. White, BM, BCh

**ABSTRACT.** Cummings TM, White AR. Needling therapies in the management of myofascial trigger point pain: a systematic review. *Arch Phys Med Rehabil* 2001;82:986-92.

**Objective:** To establish whether there is evidence for or against the efficacy of needling as a treatment approach for myofascial trigger point pain.

**Data Sources:** PubMed, Ovid MEDLINE, Ovid EMBASE, the Cochrane Library, AMED, and CISCOS databases, searched from inception to July 1999.

**Study Selection:** Randomized, controlled trials in which some form of needling therapy was used to treat myofascial pain.

**Data Extraction:** Two reviewers independently extracted data concerning trial methods, quality, and outcomes.

**Data Synthesis:** Twenty-three papers were included. No trials were of sufficient quality or design to test the efficacy of any needling technique beyond placebo in the treatment of myofascial pain. Eight of the 10 trials comparing injection of different substances and all 7 higher quality trials found that the effect was independent of the injected substance. All 3 trials that compared dry needling with injection found no difference in effect.

**Conclusions:** Direct needling of myofascial trigger points appears to be an effective treatment, but the hypothesis that needling therapies have efficacy beyond placebo is neither supported nor refuted by the evidence from clinical trials. Any effect of these therapies is likely because of the needle or placebo rather than the injection of either saline or active drug. Controlled trials are needed to investigate whether needling has an effect beyond placebo on myofascial trigger point pain.

**Key Words:** Acupuncture; Injections; Myofascial pain syndromes; Randomized controlled trial; Rehabilitation; Trigger points, myofascial.

© 2001 by the American Congress of Rehabilitation Medicine and the American Academy of Physical Medicine and Rehabilitation

**M**YOFASCIAL TRIGGER POINT PAIN is defined, for our purposes, as pain arising from 1 or more myofascial trigger points, which are hyperirritable spots in skeletal muscle that are associated with hypersensitive palpable nodules in taut bands. The spots are painful on compression and can give rise to characteristic referred pain, referred tenderness, motor dysfunction, and autonomic phenomena.<sup>1</sup>

Myofascial trigger point pain is commonly diagnosed. Trigger points were the primary source of pain in 74% of 96 patients with musculoskeletal pain seen by a neurologist in a community pain medical center,<sup>2</sup> and in 85% of 283 patients consecutively admitted to a comprehensive pain center.<sup>3</sup> Fifty-five percent of 164 patients referred to a dental clinic for chronic head and neck pain were found to have active myofascial trigger points as the cause of their pain,<sup>4</sup> as were 30% of those from a consecutive series of 172 patients presenting with pain to a university primary care internal medicine group practice.<sup>5</sup> A study of musculoskeletal disorders in villagers from rural Thailand found that myofascial pain was the primary diagnosis in 36% of 431 subjects with pain during the previous 7 days.<sup>6</sup>

These epidemiologic studies suggest that myofascial trigger point pain is an important source of morbidity in the community. However, trigger points are still the focus of some controversy.<sup>7-9</sup> Attempts to establish agreement between examiners on the presence or absence of trigger points in patients in a reliable and reproducible manner have proved difficult,<sup>10-13</sup> but, with uniform examination techniques established by a short period of training, experienced clinicians have shown interrater reliability.<sup>13</sup> Further work is underway in this area.<sup>14</sup>

Myofascial trigger points causing pain and dysfunction are commonly treated by injection or dry needling,<sup>15</sup> which are considered by many to be equally effective. In 1979, Lewit<sup>16</sup> emphasized the needle effect as distinct from that of the injected substance. A variety of noninvasive methods are also used, ranging from physical therapies, such as heat and massage, to mud baths<sup>17</sup> or magnetic fields.<sup>18</sup> Hey and Helewa<sup>19</sup> concluded, from a review of the literature on myofascial pain syndrome, that no reported treatment, including trigger point injections, had been more efficacious than control interventions. In a review of injection therapy for trigger and tender points, Borg-Stein and Stein<sup>20</sup> concluded that trigger point injections seem to be effective as a general approach, but none of the 5 randomized controlled trials included in the review provided evidence for the efficacy of injection therapy beyond placebo in myofascial trigger point pain. To establish whether needling therapies have specific efficacy in the management of myofascial pain (ie, efficacy beyond placebo) and to update the literature to include recent papers, we undertook a systematic review.

## METHODS

### Data Sources

Computerized literature searches were performed for controlled trials and reviews of needling therapies for myofascial trigger point pain, using the following databases: PubMed (from 1966), Ovid MEDLINE (from 1966), Ovid EMBASE (from 1988), the Cochrane Library (from inception), AMED (from inception), and CISCOS (from inception), all to July 1999. Search terms used were *myofascial pain* or *trigger point*, and *acup\**, *needl\**, *inject\**, *block\**, *\*caine*, or *tox\**. We also included the clinical diagnosis of whiplash in the word search because we believed that some authors may use this term to

From the British Medical Acupuncture Society, London (Cummings); and Department of Complementary Medicine, Schl of Postgraduate Medicine and Health Sciences, University of Exeter, Exeter (White), England.

Accepted in revised form September 7, 2000.

No commercial party having a direct financial interest in the results of the research supporting this article has or will confer a benefit upon the author(s) or upon any organization with which the author(s) is/are associated.

Reprint requests to T. Michael Cummings, MB, ChB, 5 Lime Ter, London W7 3HE, UK, e-mail: [msjc@waitrose.com](mailto:msjc@waitrose.com).

0003-9993/01/8207-6340\$35.00/0

doi:10.1053/apmr.2001.24023

define a population of patients suffering predominantly from myofascial pain without mentioning trigger points or myofascial pain in the paper. When database facilities permitted, searches were limited to controlled trials and reviews.

### Study Selection

Papers were included if they described randomized controlled trials in which some form of needling therapy was used to treat clinical pain or dysfunction of the human musculoskeletal system. Pain or dysfunction had to be described as myofascial or arising from muscular trigger points, or to be, in our opinion, likely to have resulted predominantly from myofascial trigger points (eg, typical whiplash syndrome but not chronic back pain). Comparative trials were included if at least 1 group had a form of needling therapy. The reference lists of all papers identified were searched for further articles, as were the references from relevant musculoskeletal medicine textbooks.

### Data Extraction

Data were extracted independently by both authors using a specially designed form. Differences were resolved by discussion. For each study the following details were extracted: inclusion and exclusion criteria, design, randomization, description of dropouts and blinding, outcome measures, details of the interventions used, and results.

**Quality assessment.** A methods quality score, that was graded using the principles of Jadad,<sup>21</sup> considered randomization, blinding, and description of dropouts. A study that was described as randomized was awarded 1 point; if the method of randomization was described and appropriate, a second point was awarded; if the method was inappropriate (eg, alternation), 1 point was deducted. We awarded 2 points for blinding if the assessor was blind and subjects were blind, using an appropriate method. Another point was awarded if dropouts and withdrawals were described. Trials that gained 3 or more points, from the maximum score of 5, were considered of higher quality.

### Data Synthesis

**Exclusions.** The searches revealed 61 potentially relevant papers, 38 of which<sup>22-59</sup> were subsequently excluded (table 1).

**Description of included trials.** The 23 trials that met the inclusion criteria of the review described 38 comparisons between different interventions that were relevant to the review. It became clear that the trials could be divided into 4 categories: (1) direct wet needling, in which an injection is aimed directly at the trigger point; (2) direct dry needling, in which a hypodermic needle (a hollow, bevelled needle used for injection) or a solid needle (an acupuncture needle) is aimed directly at the trigger point; (3) indirect dry needling, in which the needle was placed superficially or deep into classical acupuncture points but no clear attempt was made to needle a trigger point directly; and (4) indirect wet needling, in which an injection was placed in the skin or subcutaneous tissue over a trigger point. Direct wet needling was investigated in 14 trials, direct dry needling in 5, and there were 3 trials in each of the 2 indirect categories. Two trials were included in both direct-dry and direct-wet categories because they contained comparisons relevant to the assessment of the efficacy of each.

The clinical conditions addressed were chronic in 10 of the trials,<sup>60-69</sup> mixed duration in 7,<sup>70-76</sup> and acute in 3.<sup>77-79</sup> In the remaining 3, the duration of the condition was not specified.<sup>80-82</sup> Many different parts of the body were repre-

**Table 1: Excluded Papers Describing Needling Therapies for Myofascial Pain**

Study	Reason for Exclusion
Macdonald et al <sup>22</sup>	Not predominantly myofascial pain
Petri et al <sup>23</sup>	Not predominantly myofascial pain
Petri and Langley <sup>24</sup>	Not predominantly myofascial pain
Berry et al <sup>25</sup>	Not predominantly myofascial pain
Crockett et al <sup>26</sup>	No needling intervention included
Dacre et al <sup>27</sup>	Not predominantly myofascial pain
Dorigo et al <sup>28</sup>	Not RCT
Fischer <sup>29</sup>	Not RCT
Fox et al <sup>30</sup>	Not predominantly myofascial pain
Freund and Schwartz <sup>31</sup>	Not RCT
Frost et al <sup>32</sup>	Same as trial in Frost et al <sup>77</sup>
Gallacchi et al <sup>33</sup>	Not predominantly myofascial pain
Gnatz <sup>34</sup>	Not RCT
Gunn et al <sup>35</sup>	Not predominantly myofascial pain
Hay <sup>36</sup>	Not RCT
Hendler et al <sup>37</sup>	Not RCT
Heuser <sup>38</sup>	Not randomized
Hollingworth et al <sup>39</sup>	Not predominantly myofascial pain
Hong and Hsueh <sup>40</sup>	Same intervention in each group
Jacob <sup>41</sup>	Not RCT
Jaeger and Skootsky <sup>42</sup>	Abstract only, no data or statistics
Kopp and Wenneberg <sup>43</sup>	Not predominantly myofascial pain
Kopp et al <sup>44</sup>	Not predominantly myofascial pain
Kovacs et al <sup>45</sup>	Not predominantly myofascial pain
Li et al <sup>46</sup>	Not predominantly myofascial pain
Loy <sup>47</sup>	Not predominantly myofascial pain
Mameli et al <sup>48</sup>	Not available from British Library
McMillan and Blasberg <sup>49</sup>	Not randomized
Mencke et al <sup>50</sup>	Not available from British Library
Padamsee et al <sup>51</sup>	Not predominantly myofascial pain
Petrie and Hazleman <sup>52</sup>	Not predominantly myofascial pain
Phero et al <sup>53</sup>	Not RCT
Pullen <sup>54</sup>	Not RCT
Raustia <sup>55</sup>	Not predominantly myofascial pain
Salim <sup>56</sup>	Not randomized
Tsumura and Hoshiga <sup>57</sup>	Not RCT
Vecchio et al <sup>58</sup>	Not predominantly myofascial pain
Withrington et al <sup>59</sup>	Not predominantly myofascial pain

Abbreviation: RCT, randomized control trial.

sented, and the trials were performed in 6 different countries. Twenty trials were parallel arm, and 3 used a crossover design.

**Quality of included trials.** Four papers gained the maximum score of 5 points,<sup>72,76-78</sup> 3 scored 4 points,<sup>65,66,68</sup> 6 scored 3 points,<sup>61,69,71,75,79,82</sup> and the remaining 10 scored 2 points or less. One paper,<sup>63</sup> described as double blind, was not considered blinded for the outcome relevant to this review; it was given 1 point.

### Outcomes

Table 2 summarizes the details of the 14 trials that investigated direct wet needling. Wet needling with different substances was compared in 10 studies, 8 of which found that the

Table 2: Direct Wet Needling of Trigger Points, Papers Ranked by Methods Quality Score

Study	Methods (score/design)	Diagnosis	n	Intervention/Control	Outcome Measures	FU	Result
Fine et al <sup>72</sup>	5/crossover	Myofascial pain (location not specified)	16	A: Bupivacaine .25% TPI, saline 1mL IV; B: Bupivacaine .25% TPI, naloxone 1mL (10mg) IV	Verbal pain scale, presence of taut bands and allodynia, and restricted ROM	48h	A superior to B, pain ( $p < .002$ ); ROM ( $p < .05$ ); taut bands and allodynia ( $p < .05$ )
Frost et al <sup>77</sup>	5/parallel	Myofascial pain (location not specified)	60	A: Mepivacaine 0.5% TPI; B: Physiologic saline TPI	Subjective assessment of pain by patient	4d	B superior to A after 1st and 3rd TPJs ( $p < .05$ ); A equal to B after 2nd TPI
Garvey et al <sup>78</sup>	5/parallel	LBP with single trigger point despite 4wk conservative treatment	63	A: Lidocaine 1% 1.5mL TPI; B: Lidocaine 1% .75mL plus steroid. .75mL (Aristospan 20mg/mL) TPI; C: Dry needling (hypodermic); (D: Ethyl chloride spray and acupressure, not included in review)	Pain scale	2wk	No significant difference between interventions, but trend in favor of C
Tschopp et al <sup>76</sup>	5/parallel	Myofascial pain syndrome of the head and neck	107	A: Bupivacaine .25% TPI (0.3mL IC and .7mL TPI) B: Lignocaine 1% TPI (as A); C: Saline 0.9% TPI (as A)	Subjective assessment of benefit by patient	1wk	A equal to B equal to C; overall 78% had relief of pain
Wheeler et al <sup>68</sup>	4/parallel	Refractory, unilateral, cervicothoracic, paraspinal, myofascial pain syndrome	33	A: Botulinum toxin type A 50U in 2mL NS TPI; B: Botulinum toxin type A 100U in 2mL NS TPI; C: 2mL NS TPI	Neck pain and disability VAS, pressure algometer scores	4mo	A equal to B equal to C; all 3 groups improved significantly
Drewes et al <sup>71</sup>	3/parallel	Chronic myofascial pain (location not specified)	38	A: Prednisolone 25mg in 1mL plus saline 0.9% 1mL TPI; B: Diclofenac 50mg in 2mL TPI	Verbal pain questionnaire, physician's evaluation, global evaluation	2wk	A equal to B; 84% improved overall
McMillan et al <sup>75</sup>	3/parallel	Craniofacial pain of myogenous origin	30	A: Procaine TPI plus supf dry needling; B: Dry needling plus supf saline injection; C: Supf saline injection plus supf dry needling	Pain VAS, pain unpleasantness, grey board visual stimulus, pressure pain thresholds with algometer	24hr	A equal to B equal to C; all 3 groups showed significant subjective improvement
Tfelt-Hansen et al <sup>79</sup>	3/parallel	Acute common migraine	50	A: Lignocaine 1.5% TPI; B: Saline TPI	Pain VAS	70min	A equal to B; excellent response for 28/50.
Cheshire et al <sup>62</sup>	2/parallel	Chronic myofascial pain syndrome involving the cervical paraspinal and shoulder girdle muscles	6	A: Botulinum toxin type A TPI (TPI) 50U in 4mL; B: Saline TPI 4mL	Pain VAS, palpable muscle firmness, pressure pain threshold	8 wk	A superior to B ( $p < .05$ ) at 2-4wk; A equal to B at 8wk.
Frost et al <sup>80</sup>	2/parallel	Myofascial pain (location not specified)	65	A: Isotonic saline 8mL TPI $\times$ 3 over 6-12d; B: Isotonic saline 2mL TPI $\times$ 3 over 6-12d; C: Isotonic saline 1mL plus methyl prednisolone acetate (40mg) 1mL TPI $\times$ 3 over 6-12d	Pain VAS	2mo	A equal to B equal to C; overall 84% registered a positive effect from treatment after 2mo
Frost <sup>73</sup>	2/parallel	Myofascial pain of the neck, shoulder, back or gluteal region	35	A: Diclofenac 50mg 2mL TPI; B: Lidocaine 1% 2mL TPI	Pain VAS	5hr	A superior to B at 4hr only ( $p < .05$ ); A equal to B otherwise
Hameroff et al <sup>64</sup>	2/crossover	Myofascial syndrome with lumbar or cervical trigger points	15	A: Bupivacaine 0.5% TPI; B: Etidocaine 1% TPI. C: Physiologic saline TPI	Patient responses in 6 pain related categories	1wk	A and B generally preferred over C
Ferrante et al <sup>63</sup>	1(3)/crossover	Myofascial pain of the head, neck and shoulders	23	A: SPGB 4% lidocaine, 1% lidocaine TPI, SPGB saline at 1-wk intervals; B: SPGB saline, TPI, SPGB 4% lidocaine	Pain VAS intensity and pain relief	1wk	SPGB 4% lidocaine equal to SPGB saline; TPI superior SPGB ( $p < .05$ )
Ready et al <sup>81</sup>	1/crossover	Myofascial pain with 1-5 distinct trigger points	22	A: Lidocaine 1% 0.5mL TPI with 25 or 22-gauge needle; B: Lidocaine 1% 0.5mL TPI with jet injector (no needle)	Verbal pain score, score for discomfort of treatment	10min	A equal to B; B caused significantly less discomfort than A ( $p < .001$ )

Abbreviations: FU, follow-up; TPI, trigger point injection; IV, intravenous; ROM, range of motion; LBP, low back pain; IC, intracutaneous; NS, normal saline; VAS, visual analog scale; supf, superficial; SPGB, sphenopalatine ganglion block.

Table 3: Direct Dry Needling of Trigger Points, Papers Ranked by Methods Quality Score

Study	Methods (score/design)	Diagnosis	n	Intervention/Control	Outcome Measures	FU	Result
Garvey et al <sup>78</sup>	5/parallel	LBP with single trigger point despite 4-wk conservative treatment	63	A: Lidocaine 1% 1.5mL TPI; B: Lidocaine 1% .75mL plus steroid .75mL (Aristospan 20mg/mL) TPI; C: Dry needling (hypodermic) TPI; (D: Ethyl chloride spray 10s and acupressure 20s with sheath of 21 gauge needle, not included)	Pain scale	2wk	No significant difference between groups, but trend in favor of C
Hesse et al <sup>65</sup>	4/parallel	Migraine for at least 2yr	85	A: Acupuncture dry needling of trigger points plus placebo tablets daily; B: Sham needling plus metoprolol 100mg daily 6 to 8 treatments over 17wk	Headache diary, global rating scale	17wk	Both groups, reduction in attack frequency ( $p < .01$ ); A equal to B for frequency and duration; B superior to A on global rating scale ( $p < .05$ )
Hong <sup>66</sup>	4/parallel	Myofascial pain syndrome of the upper trapezius	58	A: Lidocaine 0.5% TPI; B: Dry needling (27-gauge hypodermic)	Pain score, pain threshold with algometer, ROM with goniometer	2wk	A equal to B; less postneedling soreness with A
McMillan et al <sup>75</sup>	3/parallel	Craniofacial pain of myogenous origin	30	A: Procaine TPI plus supf dry needling (placebo dry needling); B: Dry needling plus superficial saline injection (placebo TPI); C: Supf saline injection plus supf dry needling (double placebo)	Pain VAS, pain unpleasantness, grey board visual stimulus, pressure pain thresholds with algometer	24hr	A equal to B equal to C; all 3 groups showed significant subjective improvement
Chu <sup>70</sup>	1/parallel	Myofascial pain syndromes due to cervical nerve root irritation	296	A: Dry needling of trigger point; B: Dry needling at unselected point (dry needling = EMG needling)	Pain relief questionnaire including VAS of average pain (52% replied)	2wk	A superior to B claimed, but reported statistics are unclear and 48% did not return questionnaires

Abbreviation: EMG, electromyographic.

effect was independent of the injected substance. All 7 of the higher quality trials came to the same conclusion. Table 3 summarizes the details of the 5 trials that investigated direct dry needling. Three of those compared dry to wet needling, and they all found no difference between the groups. One was a double-dummy study that found that dry needling had a similar effect to a therapy that is of known efficacy in migraine prophylaxis, oral metoprolol. The other compared dry needling at correct and incorrect sites but was not correctly randomized and suffered major loss to follow-up. Table 4 summarizes the details of the 3 trials that compared indirect dry needling with various interventions. Needling alone did not appear to be superior, although these trials were of poor quality. Table 5 summarizes the details of the 3 trials that investigated indirect wet needling. Overall, these suggest that sub- or intracutaneous injection of water or saline over trigger points is ineffective.

Two trials attempted to test the specific efficacy (ie, efficacy beyond placebo) of needling in the treatment of myofascial trigger point pain.<sup>70,75</sup> The dropout rate was 48% in the trial by Chu,<sup>70</sup> and the study was neither blinded nor correctly randomized. McMillan et al<sup>75</sup> used potentially active interventions in the control group, stimulating the same cutaneous receptive field as the test intervention. Thus, from a neurophysiologic view, all 3 groups in the McMillan trial were needled or injected in a similar place, and all improved significantly.

## DISCUSSION

### Findings

The principal findings of the present review are that, when treating myofascial trigger point pain with trigger point injec-

tion, the nature of the injected substance makes no difference to the outcome, and that wet needling is not therapeutically superior to dry needling. These conclusions are supported by all the high-quality trials in the review. The original trials were performed over an 18-year period, in many independent centers, and cover various manifestations of myofascial trigger point pain. The review did not find any rigorous evidence that needling therapies have an effect beyond placebo in myofascial trigger point pain.

### Limitations

Inclusion and exclusion of certain trials resulted from the judgment of the authors regarding the predominance of myofascial trigger point pain in the study population. We included 4 trials<sup>61,65,79,82</sup> that did not specify that the study population suffered predominantly from myofascial trigger point pain. Exclusion of these trials would not alter the overall conclusions.

Simons et al<sup>1</sup> recommend that the minimum acceptable criteria for diagnosing a myofascial trigger point are the combination of spot tenderness in a palpable band of skeletal muscle and subject recognition of the pain, although palpation of a taut band depends on the accessibility of the muscle. A potential limitation of the present review is that only 8 of the 23 trials included described these or similar minimum criteria.<sup>60,62,63,66,68,71,72,81</sup> Furthermore, it was suggested in 1 of the included papers that trigger point needling is more likely to be effective if it produces a local twitch response.<sup>66</sup> Local twitch responses were not reported in any other study.

Simons<sup>1</sup> commented that saline for injection commonly includes 0.9% benzyl alcohol as a bacteriostatic agent, which has some local anesthetic properties. Only 2 of the included tri-

Table 4: Indirect Dry Needling of Trigger Points

Study	Methods (score/design)	Diagnosis	n	Intervention/Control	Outcome Measures	FU	Result
Birch and Jamison <sup>60</sup>	2/parallel	Chronic myofascial neck pain	46	A: Superficial acupuncture, IP cords, heat; B: Wrong point supf acupuncture, sham IP cords, sham heat; C: NSAID	CPEQ, SF-MPQ, pain intensity rating, SF-36, SCL-90-R, medication diary, physiologic measures	3mo	A superior to B or C ( $p < .05$ ) for change in average hourly pain ratings and SF-MPQ total global rating
Johansson et al <sup>67</sup>	2/parallel	Chronic facial pain or headache of muscular origin	45	A: Acupuncture to local points plus LI-4; B: Occlusal splint; C: No treatment control	Pain VAS, subjective dysfunction score, clinical dysfunction score	3mo	A and B superior to C ( $p < .01$ ); A equal to B
Kisiel and Lindh <sup>74</sup>	1/parallel	Myofascial pain in the neck and shoulders	19	A: Manual acupuncture; B: Physical therapy	Pain VAS, questionnaire on length and intensity of pain	6mo	A equal to B

Abbreviations: IP cords, thin, flexible, ensheathed copper wires; NSAID, nonsteroidal anti-inflammatory drug; CPEQ, Comprehensive Pain Evaluation Questionnaire; SF-MPQ, McGill Pain Questionnaire–Short Form; SF-36, Medical Outcomes Study Short-Form Health Survey; SCL-90R, Symptom Checklist-90–Revised.

als<sup>64,68</sup> reported the use of saline without preservative. This could clearly be a limitation if injection of saline was otherwise an inactive control. It has already been noted that dry needling alone has a similar effect to local anesthetic injection, so whether the preservative in saline has a significant local anesthetic effect or not, the conclusions of this review are not affected.

### Other Reviews

The main conclusion of this review is consistent with that of Hey and Helewa.<sup>19</sup> However, the present review was performed systematically and included quality assessment.

Borg-Stein and Stein<sup>20</sup> state that trigger point injections “appear to be effective,” as 1 of 8 conclusions. However, this statement is not supported by rigorous evidence from cited trials, and their review is narrative rather than systematic. We confirmed in the present review that all groups investigated, in whom trigger points were directly needled, showed marked improvement in their symptoms (the findings are less clear for indirect treatments). It appears, therefore, that direct trigger point needling is effective. However, the important question

about health interventions is whether they can be shown to be superior to placebo.

### Implications for Treatment and Further Research

Although the present review does not provide proof of efficacy for any individual technique, it clearly shows that no difference exists between trigger point injections with different substances, or between dry and wet needling. Because no technique is better than any other, we recommend that the method safest and most comfortable for the patient should be used.

The most urgent requirement for further research is to establish the efficacy beyond placebo of trigger point needling in the treatment of myofascial trigger point pain. This research will require the use of a credible yet inactive placebo for the needle. For years, clinical acupuncture research has struggled with the concept of an adequate control for the needle.<sup>15</sup> Promising solutions are now emerging, such as a blunted needle with telescopic handle.<sup>83,84</sup> This device appears to pierce the skin and has been shown to be a valid placebo.<sup>83</sup> Such developments should be applied to test the efficacy of trigger point needling beyond placebo.

Table 5: Indirect Wet Needling of Trigger Points

Study	Methods (score/design)	Diagnosis	n	Intervention/Control	Outcome Measures	FU	Result
Byrn et al <sup>61</sup>	3/parallel	Typical whiplash syndrome	40	A: Subcutaneous water injection over trigger point; B: Subcutaneous saline injection over trigger point	Pain VAS, ROM with goniometer	8mo	A superior to B ( $p < .0002$ ) for patient self-assessment at 3mo; A equal to B at 8mo
Sand et al <sup>82</sup>	3/crossover	Cervicogenic headache	10	A: Intracutaneous 0.3mL SWI over trigger points; B: As A using 0.9% saline	Pain VAS, ROM with digital inclinometer	13d	A equal to B; no effect in VAS or ROM
Wreje and Brorsson <sup>69</sup>	3/parallel	Chronic myofascial pain syndromes in upper quadrants of body > 3mo	117	A: Sub- and intracutaneous SWI forms blister over trigger point; B: As A with PSI	Pain VAS, subjective assessment by questionnaire	2wk	A equal to B; no significant change in symptoms; SWI more painful than PSI

Abbreviations: SWI, sterile water injection; PSI, physiologic saline injection.

## CONCLUSION

The hypothesis that needling therapies have specific efficacy (ie, efficacy beyond placebo) in the treatment of myofascial trigger point pain is neither supported nor refuted by the research to date. However, the present review suggests that any effect these therapies may have is likely due to the needle or placebo, rather than to the injection, whether it be of liquid in general or a particular substance. Because marked improvements occurred in all groups in which trigger points were directly needled, further research is required to investigate whether trigger point needling has an effect beyond placebo, with emphasis on the use of an adequate control for the needle.

**Acknowledgments:** The authors thank Thomas Lundeberg and Edzard Ernst for their helpful comments on the text.

## References

1. Simons DG, Travell JG, Simons PT. Travell and Simons' myofascial pain and dysfunction: the trigger point manual. Vol 1. Upper half of body. Baltimore: Williams & Wilkins; 1999.
2. Gerwin RD. A study of 96 subjects examined both for fibromyalgia and myofascial pain [abstract]. *J Musculoskel Pain* 1995;3 (Suppl 1):121.
3. Fishbain DA, Goldberg M, Meagher BR, Steele R, Rosomoff H. Male and female chronic pain patients categorized by DSM-III psychiatric diagnostic criteria. *Pain* 1986;26:181-97.
4. Friction JR, Kroening R, Haley D, Siegert R. Myofascial pain syndrome of the head and neck: a review of clinical characteristics of 164 patients. *Oral Surg Oral Med Oral Pathol* 1985;60:615-23.
5. Skootsky SA, Jaeger B, Oye RK. Prevalence of myofascial pain in general internal medicine practice. *West J Med* 1989;151:157-60.
6. Chaiamnuay P, Darmawan J, Muirden KD, Assawatanabodee P. Epidemiology of rheumatic disease in rural Thailand: a WHO-ILAR COPCORD study. Community Oriented Programme for the Control of Rheumatic Disease. *J Rheumatol* 1998;25:1382-7.
7. Bohr TW. Problems with myofascial pain syndrome and fibromyalgia syndrome. *Neurology* 1996;46:593-7.
8. Bohr TW. Fibromyalgia syndrome and myofascial pain syndrome: do they exist? *Neurol Clin* 1995;13:365-84.
9. Quintner JL, Cohen ML. Referred pain of peripheral nerve origin: an alternative to the "myofascial pain" construct. *Clin J Pain* 1994;10:243-51.
10. Wolfe F, Simons DG, Friction J, Bennett RM, Goldenberg DL, Gerwin R, et al. The fibromyalgia and myofascial pain syndromes: a preliminary study of tender points and trigger points in persons with fibromyalgia, myofascial pain syndrome and no disease. *J Rheumatol* 1992;19:944-51.
11. Nice DA, Riddle DL, Lamb RL, Mayhew TP, Rucker K. Intertester reliability of judgments of the presence of trigger points in patients with low back pain. *Arch Phys Med Rehabil* 1992;73:893-8.
12. Njoo KH, Van der Does E. The occurrence and inter-rater reliability of myofascial trigger points in the quadratus lumborum and gluteus medius: a prospective study in non-specific low back pain patients and controls in general practice. *Pain* 1994;58:317-23.
13. Gerwin RD, Shannon S, Hong CZ, Hubbard D, Gevirtz R. Inter-rater reliability in myofascial trigger point examination. *Pain* 1997;69:65-73.
14. Russell IJ. Reliability of clinical assessment measures for the classification of myofascial pain syndrome. *J Musculoskel Pain* 1999;7:309-24.
15. Filshie J, Cummings TM. Western medical acupuncture. In: Ernst E, White AR, editors. *Acupuncture: a scientific appraisal*. Oxford: Butterworth Heinemann; 1999. p 31-59.
16. Lewit K. The needle effect in the relief of myofascial pain. *Pain* 1979;6:83-90.
17. Pratsel HG, Eigner UM, Weinert D, Limbach B. [The analgesic efficacy of sulfur mud baths in treating rheumatic diseases of the soft tissues. A study using the double-blind control method] [Russian]. *Vopr Kurortol Fizioter Lech Fiz Kult* 1992;3:37-41.
18. Vallbona C, Hazlewood CF, Jurida G. Response of pain to static magnetic fields in postpolio patients: a double-blind pilot study. *Arch Phys Med Rehabil* 1997;78:1200-3.
19. Hey LR, Helewa A. Myofascial pain syndrome: a critical review of the literature. *Physiother Can* 1994;46:28-36.
20. Borg-Stein J, Stein J. Trigger points and tender points: one and the same? Does injection treatment help? *Rheum Dis Clin North Am* 1996;22:305-22.
21. Jadad AR, Moore RA, Carroll D, Jenkinson C, Reynolds DJ, Gavaghan DJ, et al. Assessing the quality of reports of randomized clinical trials: is blinding necessary? *Control Clin Trials* 1996;17:1-12.
22. Macdonald AJ, Macrae KD, Master BR, Rubin AP. Superficial acupuncture in the relief of chronic low back pain. *Ann R Coll Surg Engl* 1983;65:44-6.
23. Petri M, Dobrow R, Neiman R, Whiting-O'Keefe Q, Seaman WE. Randomized, double-blind, placebo-controlled study of the treatment of the painful shoulder. *Arthritis Rheum* 1987;30:1040-5.
24. Petrie JP, Langley GB. Acupuncture in the treatment of chronic cervical pain. A pilot study. *Clin Exp Rheumatol* 1983;1:333-6.
25. Berry H, Fernandes L, Bloom B, Clark RJ, Hamilton EB. Clinical study comparing acupuncture, physiotherapy, injection and oral anti-inflammatory therapy in shoulder-cuff lesions. *Curr Med Res Opin* 1980;7:121-6.
26. Crockett DJ, Foreman ME, Alden L, Blasberg B. A comparison of treatment modes in the management of myofascial pain dysfunction syndrome. *Biofeedback Self Regul* 1986;11:279-91.
27. Dacre JE, Beeney N, Scott DL. Injections and physiotherapy for the painful stiff shoulder. *Ann Rheum Dis* 1989;48:322-5.
28. Dorigo B, Bartoli V, Grisillo D, Beconi D. Fibrositic myofascial pain in intermittent claudication. Effect of anesthetic block of trigger points on exercise tolerance. *Pain* 1979;6:183-90.
29. Fischer L. Myofasziale Triggerpunkte und Neutraltherapie nach Huneke. *Erfahrungsheilkunde* 1998;47:117-26.
30. Fox EJ, Melzack R, Villanueva R. Modes of action of various aspects of analgesia by stimulation. *Ann Anesth Fr* 1978;19:435-8.
31. Freund B, Schwartz M. The use of botulinum toxin for the treatment of temporomandibular disorder. *Oral Health* 1998;88:32-7.
32. Frost FA, Jessen B, Siggaard-Andersen J. [Myofascial pain treated with injections. A controlled double-blind trial] [Danish]. *Ugeskr Laeger* 1980;142:1754-7.
33. Gallacchi G, Muller W, Plattner GR, Schnorrenberger CC. [Acupuncture and laser treatment in cervical and lumbar syndrome] [German]. *Schweiz Med Wochenschr* 1981;111:1360-6.
34. Gnatz SM. Referred pain syndromes of the head and neck. *Phys Med Rehabil* 1991;5:585-96.
35. Gunn CC, Milbrandt WE, Little AS, Mason KE. Dry needling of muscle motor points for chronic low-back pain: a randomized clinical trial with long-term follow-up. *Spine* 1980;5:279-91.
36. Hay KM. The treatment of pain trigger areas in migraine. *J R Coll Gen Pract* 1976;26:372-6.
37. Hendler N, Fink H, Long D. Myofascial syndrome: response to trigger-point injections. *Psychosomatics* 1983;24:990-9.
38. Heuser MK. [Comparison study of treatment of myofascial pain syndrome with bite plates, Huneke's neurotherapy, and acupuncture] [German]. *Quintessenz* 1989;40:531-42.
39. Hollingworth GR, Ellis RM, Hattersley TS. Comparison of injection techniques for shoulder pain: results of a double blind, randomised study. *Br Med J* 1983;287:1339-41.
40. Hong CZ, Hsueh TC. Difference in pain relief after trigger point injections in myofascial pain patients with and without fibromyalgia. *Arch Phys Med Rehabil* 1996;77:1161-6.
41. Jacob AT. Myofascial pain. *Phys Med Rehabil* 1991;5:573-83.
42. Jaeger B, Skootsky SA. Double blind, controlled study of different myofascial trigger point injection techniques [abstract]. *Pain* 1987;4(Suppl):S292.
43. Kopp S, Wenneberg B. Effects of occlusal treatment and intra-articular injections on temporomandibular joint pain and dysfunction. *Acta Odontol Scand* 1981;39:87-96.
44. Kopp S, Wenneberg B, Haraldson T, Carlsson GE. The short-term effect of intra-articular injections of sodium hyaluronate and cor-

- ticosteroid on temporomandibular joint pain and dysfunction. *J Oral Max Surg* 1985;43:429-35.
45. Kovacs FM, Abreira V, Pozo F, Kleinbaum DG, Beltran J, Mateo I, et al. Local and remote sustained trigger point therapy for exacerbations of chronic low back pain. A randomized, double-blind, controlled, multicenter trial. *Spine* 1997;22:786-97.
  46. Li J, Chenard JR, Marchand S, Charest J, Lavignolle B. [Acupuncture points and trigger points: reactivity to pressure and skin response in patients with chronic low back pain] [French]. *Rumatologie* 1994;46:11-9.
  47. Loy TT. Treatment of cervical spondylosis. Electroacupuncture versus physiotherapy. *Med J Aust* 1983;2:32-4.
  48. Marni S, Pili A, Melis R, Gungui P, Marchi A, Cocco M. Trattamento del dolore miofasciale con tens ed elettroagopuntura. *Gionale Ital Riflessoter Agopunt* 1995;7:11-6.
  49. McMillan AS, Blasberg B. Pain-pressure threshold in painful jaw muscles following trigger point injection. *J Orofac Pain* 1994;8:384-90.
  50. Mencke VM, Wieden TE, et al. [Acupuncture of shoulder pain and low back pain: two double-blind studies] [German]. *Akupunktur Theor Prax* 1988;16:204-15.
  51. Padamsee M, Mehta N, White GE. Trigger point injection: a neglected modality in the treatment of TMJ dysfunction. *J Pedod* 1987;12:72-92.
  52. Petrie JP, Hazleman BL. A controlled study of acupuncture in neck pain. *Br J Rheumatol* 1986;25:271-5.
  53. Phero JC, Raj PP, McDonald JS. Transcutaneous electrical nerve stimulation and myoneural injection therapy for management of chronic myofascial pain. *Dent Clin North Am* 1987;31:703-23.
  54. Pullen S. Myofascial pain: a review. *S Afr J Physiother* 1992;48(3):37-9.
  55. Raustia AM. Diagnosis and treatment of temporomandibular joint dysfunction. Advantages of computed tomography diagnosis. Stomatognathic treatment and acupuncture—a randomized trial. *Proc Finn Dent Soc* 1986;82 Suppl 9-10:1-41.
  56. Salim M. Myofascial pain—trigger point injection vs transcutaneous electrical nerve stimulation (TENS). *J Pak Med Assoc* 1992;42:244.
  57. Tsumura Y, Hoshiga T. Subarachnoidal injection therapy in chronic cases of the so-called whiplash syndrome. *Acta Anaesthesiol Scand* 1971;15:61-4.
  58. Vecchio PC, Hazleman BL, King RH. A double-blind trial comparing subacromial methylprednisolone and lignocaine in acute rotator cuff tendinitis. *Br J Rheumatol* 1993;32:743-5.
  59. Withrington RH, Girgis FL, Seifert MH. A placebo-controlled trial of steroid injections in the treatment of supraspinatus tendinitis. *Scand J Rheumatol* 1985;14:76-8.
  60. Birch S, Jamison RN. Controlled trial of Japanese acupuncture for chronic myofascial neck pain: assessment of specific and nonspecific effects of treatment. *Clin J Pain* 1998;14:248-55.
  61. Byrn C, Olsson I, Falkheden L, Lindh M, Hosterey U, Fogelberg M, et al. Subcutaneous sterile water injections for chronic neck and shoulder pain following whiplash injuries. *Lancet* 1993;341:449-52.
  62. Cheshire WP, Abashian SW, Mann JD. Botulinum toxin in the treatment of myofascial pain syndrome. *Pain* 1994;59:65-9.
  63. Ferrante FM, Kaufman AG, Dunbar SA, Cain CF, Cherukuri S. Sphenopalatine ganglion block for the treatment of myofascial pain of the head, neck, and shoulders. *Reg Anesth Pain Med* 1998;23:30-6.
  64. Hameroff SR, Crago BR, Blitt CD, Womble J, Kanel J. Comparison of bupivacaine, etidocaine, and saline for trigger-point therapy. *Anesth Analg* 1981;60:752-5.
  65. Hesse J, Mogelvang B, Simonsen H. Acupuncture versus metoprolol in migraine prophylaxis: a randomized trial of trigger point inactivation. *J Intern Med* 1994;235:451-6.
  66. Hong CZ. Lidocaine injection versus dry needling to myofascial trigger point. The importance of the local twitch response. *Am J Phys Med Rehabil* 1994;73:256-63.
  67. Johansson A, Wenneberg B, Wagersten C, Haraldson T. Acupuncture in treatment of facial muscular pain. *Acta Odontol Scand* 1991;49:153-8.
  68. Wheeler AH, Goolkasian P, Gretz SS. A randomized, double-blind, prospective pilot study of botulinum toxin injection for refractory, unilateral, cervicothoracic, paraspinal, myofascial pain syndrome. *Spine* 1998;23:1662-6.
  69. Wreje U, Brorsson B. A multicenter randomized controlled trial of injections of sterile water and saline for chronic myofascial pain syndromes. *Pain* 1995;61:441-4.
  70. Chu J. Does EMG (dry needling) reduce myofascial pain symptoms due to cervical nerve root irritation? *Electromyogr Clin Neurophysiol* 1997;37:259-72.
  71. Drewes AM, Andreason A, Poulsen LH. Injection therapy for treatment of chronic myofascial pain: a double-blind study comparing corticosteroid versus diclofenac injections. *J Musculoskel Pain* 1993;1:289-94.
  72. Fine PG, Milano R, Hare BD. The effects of myofascial trigger point injections are naloxone reversible. *Pain* 1988;32:15-20.
  73. Frost A. Diclofenac versus lidocaine as injection therapy in myofascial pain. *Scand J Rheumatol* 1986;15:153-6.
  74. Kisiel C, Lindh C. Smartlindring med fysikalisk terapi och manuell akupunktur vid myofasciella nackoch skuldersmator. *Sjukgymnasten* 1996;12 Suppl:24-31.
  75. McMillan AS, Nolan A, Kelly PJ. The efficacy of dry needling and procaine in the treatment of myofascial pain in the jaw muscles. *J Orofac Pain* 1997;11:307-14.
  76. Tschopp KP, Gysin C. Local injection therapy in 107 patients with myofascial pain syndrome of the head and neck. *ORL J Otorhinolaryngol Relat Spec* 1996;58:306-10.
  77. Frost FA, Jessen B, Siggaard-Andersen J. A control, double-blind comparison of mepivacaine injection versus saline injection for myofascial pain. *Lancet* 1980;1:499-500.
  78. Garvey TA, Marks MR, Wiesel SW. A prospective, randomized, double-blind evaluation of trigger-point injection therapy for low-back pain. *Spine* 1989;14:962-4.
  79. Tfelt-Hansen P, Lous I, Olesen J. Prevalence and significance of muscle tenderness during common migraine attacks. *Headache* 1981;21:49-54.
  80. Frost FA, Toft B, Aaboe T. [Isotonic saline and methylprednisolone acetate in blockade treatment of myofascial pain: a clinical controlled study] [Danish]. *Ugeskr Laeger* 1984;146:652-4.
  81. Ready LB, Kozody R, Barsa JE, Murphy TM. Trigger point injections vs. jet injection in the treatment of myofascial pain. *Pain* 1983;15:201-6.
  82. Sand T, Bovim G, Helde G. Intracutaneous sterile water injections do not relieve pain in cervicogenic headache. *Acta Neurol Scand* 1992;86:526-8.
  83. Streitberger K, Kleinhenz J. Introducing a placebo needle into acupuncture research. *Lancet* 1998;352:364-5.
  84. Park J, White AR, Lee H, Ernst E. Development of a new sham needle. *Acupunct Med* 1999;17:110-2.