Efficacy of specific needling techniques in the treatment of myofascial pain syndrome

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Jeff Norwood

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Dr. Babak Shadgan
Objectives

- To evaluate the efficacy of available invasive dry needling techniques for treatment of persons diagnosed with myofascial pain syndrome (MPS) and/or myofascial trigger points (MTrPs)
- Identify gaps in current research and provide guidance for future studies
- Relate findings to best practice
What is Myofascial Pain Syndrome?

- Myofascial pain syndrome (MPS) is a condition characterized by the presence of myofascial trigger points (MTrP’s)¹
- MTrP’s are hyper-irritable areas located on a taut band of skeletal muscle that illicit pain when stretched or compressed¹
Myofascial Trigger Points

• Exhibit sensory, motor and autonomic phenomenon$^{1,2}$
  - **Sensory**: local tenderness and referral of pain which can lead to peripheral and/or central sensitization
  - **Motor**: disturbed function in muscle of origin and related muscles, muscle weakness, stiffness, restricted ROM, poor coordination, & muscle imbalance
  - **Autonomic**: localized sweating, vasoconstriction/vasodilation, & pilomotor activation
Common Treatment Methods

• **Step 1 = deactivate MTrP\textsuperscript{3,4}**
  - Invasive Techniques:
    • Dry needling, acupuncture, wet needling
  - Non-invasive Techniques:
    • Ischemic compression, spray and stretch, laser, myofascial release

• **Step 2 = correcting or removing the precipitating/predisposing stimuli\textsuperscript{5}**
Dry Needling Techniques

- **Dry Needling (DN)**
  - Simple insertion and removal of an acupuncture type needle following anatomical and biological principles\(^3,4\)

- **Acupuncture**
  - Needling at acupoints along meridians and extrameridians to relieve the associated pain\(^3,4\)

- **Intramuscular Stimulation (IMS)**
  - Manipulation of the inserted needle until a local twitch response is attained\(^3,4\)
Who is affected by MPS and how? (American Pain Foundation, 2007)

- Very common source of musculoskeletal complaints\(^6\)
- Increasing in prevalence\(^8\)
- The estimated cost of chronic pain in America is $100 billion per annum\(^9\)
- Increased morbidity and decreased quality of life in those suffering
Why is this Systematic Review (SR) needed?

- Needling therapies are growing in popularity amongst clinicians, resulting in a need for scientific support\(^{10}\)

- If strong evidence can support a positive effect of needling therapies, they may become accepted as standard form of treatment
Existing Systematic Reviews

- **Evidence Based Practice:**
  - Cummings and White (2001)\(^{11}\)
    - Wet needling therapy not therapeutically superior to dry needling in reduction of pain
    - Inconclusive evidence to support effect of needling therapies beyond placebo
  - Rickards (2006)\(^{12}\)
    - Non-invasive treatment of MPS
    - Unable to provide strong evidence for any treatment interventions
  - Furlan et al (2005)\(^{13}\)
    - Acupuncture or dry needling in treatment of non-specific low back pain
    - No firm conclusions as most studies were of low methodological quality
Database Search

- EMBASE
- MEDLINE
- PubMed
- CINAHL
- PEDro
- Cochrane Library Database of Systematic Reviews
- Hand Searching
Embase Search Strategy

1. myofascial pain syndrome.mp. or Myofascial Pain/
2. trigger points.mp. or Trigger Point/
3. Acupuncture/ or needling therapies.mp.
4. acupuncture.mp.
5. needle therapy.mp.
6. dry needling.mp.
7. intramuscular stimulation.mp.
8. IMS.mp.
9. invasive.mp.
10. needling.mp.
11. 1 or 2
12. 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10
13. 11 and 12
14. from 13 keep 3
15. from 13 keep 10, 14, 21, 23, 35, 54...
16. 14 or 15
Inclusion Criteria

- Adults over 16 years
- Diagnosis of MPS and/or myofascial pain with associated TrP’s
- Clear definition of myofascial pain and/or MTrP
- RCTs, CCTs, or quasi-experimental trials
- Assessment of outcome measures blinded if feasible
- Invasive dry needling technique
- At least one standardized measure of pain, including pre-and post-test values
Exclusion Criteria

- Patients with diagnosed temporomandibular joint dysfunction and/or fibromyalgia

- Patients diagnosed with myofascial pain as a direct result of a surgical procedure

- Wet needling therapies that involve the injection of substance into subject without dry needling comparison group (ie. injection of analgesic/saline/Botox)

- Patients with coexisting cognitive impairment (ie. acute stroke)

- Studies with a PEDro score of < 4
Quality Assessment & Data Extraction

- **PEDro**
  - 11 item quality assessment tool
  - Studies graded by two assessors independently
  - Assigned a grade of excellent, good, fair, poor

- **Data extraction tool**
  - Tool selected due to comprehensiveness and ease of use
  - Includes written description of trial and quantitative results (change in mean and SD)
  - Data extracted by two assessors independently
Results - Selected Studies

- 45 articles selected for full-text review
- 13 trials met the inclusion criteria\textsuperscript{14-26}
  - Needling interventions included: Dry Needling, Intramuscular Stimulation (IMS), Acupuncture (Traditional Chinese and Japanese, superficial and deep), and other variations
  - Subject characteristics:
    - Average age range = 32-79 yrs
    - 9 trials in neck/upper trapezius region, 2 trials in lumbar region, 1 trial in gluteal region, and 1 trial did not specify
  - PEDro quality assessment scores:
    - 8 high quality, 4 moderate quality, and 1 fair quality
Data Synthesis - Effect Sizes

- **Effect Size:**
  - Measure of the strength of relationship between two variables
    - Small effect size: $d = 0.2-0.5$
    - Moderate effect size: $d = 0.5-0.8$
    - Large effect size: $d = 0.8+$

- **Calculated using REVMAN v.5.0**
  - 95% confidence interval
  - Standardized mean difference as effect measure
  - Hedges adjusted $g$

- **Calculated at two time periods:**
  - Baseline to end of treatment
  - Baseline to follow-up
Groupings for Data Synthesis

- Needling Intervention vs Control
- Needling Intervention vs Other Intervention
- Needling Intervention + Adjunct Therapy vs Adjunct Therapy vs Control
- Needling Intervention - no comparison group
Needling Intervention vs Control Group

- Studies comparing DN vs placebo control showed no significant difference at post treatment and follow up\textsuperscript{21, 20} 

- Three of four studies comparing acupuncture with placebo control had results favouring acupuncture at both end of treatment and follow up\textsuperscript{22-24,14} 
Forest Plots

End of Treatment – Pain Scales

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Experimental Mean</th>
<th>SD</th>
<th>Total</th>
<th>Control Mean</th>
<th>SD</th>
<th>Total</th>
<th>Weight</th>
<th>Std. Mean Difference IV, Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birch 1998</td>
<td>7</td>
<td>3.42</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>10.1%</td>
<td>-2.76</td>
<td>[-3.80, -1.72]</td>
</tr>
<tr>
<td>Huguenin 2005 (Glutea)</td>
<td>11</td>
<td>20</td>
<td>29</td>
<td>3</td>
<td>15</td>
<td>11.6%</td>
<td>0.45</td>
<td>[0.07, 0.86]</td>
</tr>
<tr>
<td>Huguenin 2005 (Hams)</td>
<td>4</td>
<td>16</td>
<td>29</td>
<td>11</td>
<td>29</td>
<td>11.6%</td>
<td>-0.29</td>
<td>[-0.81, 0.22]</td>
</tr>
<tr>
<td>Ilcolu 2004 (Activity)</td>
<td>3.71</td>
<td>2.33</td>
<td>20</td>
<td>3.65</td>
<td>2.03</td>
<td>20</td>
<td>11.4%</td>
<td>0.03 [-0.59, 0.65]</td>
</tr>
<tr>
<td>Ilcolu 2004 (Rest)</td>
<td>5.29</td>
<td>2.45</td>
<td>20</td>
<td>5.5</td>
<td>2.24</td>
<td>20</td>
<td>11.4%</td>
<td>-0.08 [-0.71, 0.53]</td>
</tr>
<tr>
<td>Imich 2001</td>
<td>24.1</td>
<td>4.025</td>
<td>34</td>
<td>35.13</td>
<td>4.35</td>
<td>45</td>
<td>11.3%</td>
<td>-3.05 [-3.71, -2.39]</td>
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<tr>
<td>Imich 2002 (CN)</td>
<td>29.2</td>
<td>21.9</td>
<td>33</td>
<td>28.19</td>
<td>36.34</td>
<td>34</td>
<td>11.7%</td>
<td>0.06 [-0.42, 0.54]</td>
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<tr>
<td>Imich 2002 (NLA)</td>
<td>19.1</td>
<td>4.16</td>
<td>34</td>
<td>29.18</td>
<td>36.34</td>
<td>34</td>
<td>11.7%</td>
<td>-0.40 [-0.88, -0.01]</td>
</tr>
<tr>
<td>Itch 2005</td>
<td>27.3</td>
<td>3.13</td>
<td>13</td>
<td>19.6</td>
<td>10.9</td>
<td>11</td>
<td>9.2%</td>
<td>-3.30 [-4.60, -2.00]</td>
</tr>
</tbody>
</table>

Follow up – Pain Scales

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Experimental Mean</th>
<th>SD</th>
<th>Total</th>
<th>Control Mean</th>
<th>SD</th>
<th>Total</th>
<th>Weight</th>
<th>Std. Mean Difference IV, Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birch 1998</td>
<td>9</td>
<td>3.42</td>
<td>15</td>
<td>18</td>
<td>2.5</td>
<td>15</td>
<td>13.5%</td>
<td>-2.92 [-3.89, -1.85]</td>
</tr>
<tr>
<td>Huguenin 2006 (Glutea)</td>
<td>9</td>
<td>31</td>
<td>29</td>
<td>6</td>
<td>24</td>
<td>30</td>
<td>18.3%</td>
<td>0.11 [0.40, 0.63]</td>
</tr>
<tr>
<td>Huguenin 2006 (Hams)</td>
<td>11</td>
<td>24</td>
<td>29</td>
<td>11</td>
<td>34</td>
<td>30</td>
<td>18.3%</td>
<td>0.00 [0.51, 0.51]</td>
</tr>
<tr>
<td>Ilcolu 2004 (Activity)</td>
<td>4.24</td>
<td>2.93</td>
<td>20</td>
<td>4.22</td>
<td>3.06</td>
<td>20</td>
<td>17.4%</td>
<td>0.01 [0.61, 0.63]</td>
</tr>
<tr>
<td>Ilcolu 2004 (Rest)</td>
<td>2.59</td>
<td>2.18</td>
<td>20</td>
<td>2.80</td>
<td>2.63</td>
<td>20</td>
<td>17.4%</td>
<td>-0.12 [0.74, 0.65]</td>
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<tr>
<td>Itch 2006</td>
<td>49.5</td>
<td>18.8</td>
<td>13</td>
<td>68.3</td>
<td>11.4</td>
<td>11</td>
<td>15.2%</td>
<td>-1.14 [-2.02, -0.27]</td>
</tr>
</tbody>
</table>
Needling Intervention vs Other Intervention

• Comparison of two DN techniques:
  - Study by Fu (2007)\textsuperscript{17} showed no significant difference between treatment groups (no follow up measure)

• Comparison of two acupuncture techniques:
  • Study by Birch & Jamison (1998)\textsuperscript{14} favoured relevant Japanese acupuncture over irrelevant acupuncture at both post treatment and follow up
  • Study by Ceccherelli et al (2002)\textsuperscript{15} compared superficial and deep acupuncture
    - No significant difference between groups post treatment but favoured deep acupuncture at follow up

• Comparison of DN technique and acupuncture technique:
  - Study by Irnich et al (2002)\textsuperscript{22} favoured acupuncture over DN for reduction of motion related pain at end of treatment
Needling Intervention vs Other Intervention

- Comparison of DN and Wet Needling techniques:
  - Results of studies by Kamanli et al (2005) and Hong (1994) favoured lidocaine injection over DN at post treatment (for reduction of pain scores and increase in PPT)
  - Study by Hong (1994) retained significant treatment effect at follow up (for reduction of pain scores)
  - Ga et al (2007) favoured IMS over lidocaine injection for increase in PPT at follow up
Needling Intervention vs Other Intervention

• Comparison of acupuncture and conventional massage:
  - Study by Irnich et al (2001)\textsuperscript{23} showed significant difference in favour of acupuncture for reduction in motion related pain post treatment (no follow up)

• Comparison of DN and laser therapy:
  - Study by Ilbuldu et al (2004)\textsuperscript{21} showed significant difference in favour of laser therapy post treatment, but was not retained at follow up (VAS at rest, VAS with activity, PPT)
Forest Plots - End of Treatment

Pain Scales

### Experimental vs. Other Treatment

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Experimental Mean</th>
<th>SD</th>
<th>Total</th>
<th>Other Treatment Mean</th>
<th>SD</th>
<th>Total</th>
<th>Std. Mean Difference</th>
<th>IV, Random, 95% CI</th>
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</thead>
<tbody>
<tr>
<td>Ga 2007</td>
<td>4.54</td>
<td>1.62</td>
<td>22</td>
<td>3.9</td>
<td>2.17</td>
<td>21</td>
<td>12.8%</td>
<td>0.32 [-0.38, 0.92]</td>
</tr>
<tr>
<td>Hong 1994</td>
<td>1</td>
<td>1.46</td>
<td>15</td>
<td>0.42</td>
<td>0.49</td>
<td>26</td>
<td>12.7%</td>
<td>0.59 [-0.05, 1.24]</td>
</tr>
<tr>
<td>Ilbuldu 2004 (Activity)</td>
<td>5.29</td>
<td>2.45</td>
<td>20</td>
<td>2.85</td>
<td>1.95</td>
<td>20</td>
<td>12.7%</td>
<td>1.08 [0.41, 1.76]</td>
</tr>
<tr>
<td>Ilbuldu 2004 (Rest)</td>
<td>3.71</td>
<td>2.39</td>
<td>20</td>
<td>2.05</td>
<td>1.43</td>
<td>20</td>
<td>12.7%</td>
<td>0.84 [0.10, 1.40]</td>
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<tr>
<td>Imich 2001</td>
<td>24.1</td>
<td>4.825</td>
<td>34</td>
<td>47.49</td>
<td>4.275</td>
<td>43</td>
<td>12.1%</td>
<td>-5.11 [6.08, -4.17]</td>
</tr>
<tr>
<td>Imich 2002</td>
<td>29.2</td>
<td>21.9</td>
<td>33</td>
<td>19.1</td>
<td>19.11</td>
<td>34</td>
<td>12.9%</td>
<td>0.52 [0.03, 1.01]</td>
</tr>
<tr>
<td>Kamaril 2005 Botox</td>
<td>5.12</td>
<td>2.94</td>
<td>10</td>
<td>2.68</td>
<td>1.04</td>
<td>19</td>
<td>12.0%</td>
<td>1.03 [0.00, 2.01]</td>
</tr>
<tr>
<td>Kamaril 2005 Lidocaine</td>
<td>5.12</td>
<td>2.94</td>
<td>10</td>
<td>1.95</td>
<td>1.67</td>
<td>10</td>
<td>12.0%</td>
<td>1.27 [0.23, 2.25]</td>
</tr>
</tbody>
</table>

### Std. Mean Difference

- **Favours experimental**
- **Favours other treatment**

**PPT**
**Forest Plots - Follow up**

**Pain Scales**

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
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<th>Other Treatment</th>
<th>Std. Mean Difference</th>
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</tr>
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<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Total</td>
<td>Mean</td>
</tr>
<tr>
<td>Ga 2007</td>
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<td>22</td>
<td>3.46</td>
</tr>
<tr>
<td>Hong 1994</td>
<td>4.93</td>
<td>1.44</td>
<td>15</td>
<td>0.86</td>
</tr>
<tr>
<td>Ilbuldu 2004 (Activity)</td>
<td>4.24</td>
<td>2.93</td>
<td>20</td>
<td>3.35</td>
</tr>
<tr>
<td>Ilbuldu 2004 (Rest)</td>
<td>2.59</td>
<td>2.18</td>
<td>20</td>
<td>2.12</td>
</tr>
</tbody>
</table>

**PPT**

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Experimental</th>
<th>Other Treatment</th>
<th>Std. Mean Difference</th>
<th>Std. Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Total</td>
<td>Mean</td>
</tr>
<tr>
<td>Ga 2007</td>
<td>1.27</td>
<td>0.88</td>
<td>22</td>
<td>1.71</td>
</tr>
<tr>
<td>Hong 1994</td>
<td>-3.71</td>
<td>0.47</td>
<td>15</td>
<td>-3.69</td>
</tr>
<tr>
<td>Ilbuldu 2004</td>
<td>-2.24</td>
<td>0.73</td>
<td>20</td>
<td>-2.26</td>
</tr>
</tbody>
</table>
Needling Intervention + Adjunct Therapy vs Adjunct Therapy vs Control

- Comparison of superficial DN + stretching vs stretching vs control (Edwards & Knowles, 2003):¹⁶
  - No significant difference between groups immediately post treatment
  - Superficial DN + stretch favoured at follow up for increase in PPT
Needling Intervention without Control Group

- Effects of traditional Chinese acupuncture over 3 week course of treatment (Kung et al, 2001):\textsuperscript{26}
  - Paired t-test analysis showed significant reduction in VAS pain scale at end of treatment
Discussion - Needling Intervention vs Control

- Studies that had a large effect size in favour of needling interventions shared a common trait of multiple needling treatments (at least 1x/week for 3 weeks)

- Birch & Jamison (1998)\textsuperscript{14} identified a high correlation between previous acupuncture treatments and reduction in VAS scores

- Many studies had design flaws which introduced confounding variables (i.e., attrition bias, additional non-controlled treatments, variable diagnoses)
Discussion - Needling vs Needling Intervention

- No trends seen due to heterogeneity of studies
  - Study by Irnich et al (2002)\textsuperscript{22} found acupuncture to be significantly more effective than DN
  - Ceccherelli et al (2002)\textsuperscript{15} found deep acupuncture to be more effective than superficial acupuncture
  - Birch & Jamison (1998)\textsuperscript{14} found relevant acupuncture to be more effective than irrelevant acupuncture

- Future studies comparing needling techniques are needed to determine the most effective technique
Discussion - Needling vs Other Intervention

- Studies which favoured lidocaine injection over DN techniques involved only one treatment session
- Study by Ga et al (2007)\textsuperscript{18} which favoured IMS over lidocaine injection had 3 treatments over 3 weeks
- The form of dry needling may play a role in treatment efficacy
- Study by Ilbuldu et al (2004)\textsuperscript{21} favoured laser over DN, but subjects received a greater number of laser treatments
Limitations of this Review

- **Publication bias**
  - Translation of foreign studies not feasible, timing of literature search
- **Quality assessment tool**
  - High quality studies had serious design flaws
- **Heterogeneity of studies**
  - Difficult to perform meaningful meta-analysis
- **Manipulation of data**
  - Interpretation of some data by reviewers led to increased risk of translation error
- **Diagnostic criteria of MPS**
  - Not all studies based on Travell & Simon’s criteria¹
Implications for Research

• Need for additional high quality studies
• Standardization of research and treatment methods
• Real-life treatment plans incorporated into study designs (ie. 2 treatments per week for 4 weeks)
• Consistent timing of outcome measures (including end of treatment and long-term follow up measures)
Implications for Practice

• Best practice involves a structured interdisciplinary approach including physical and cognitive behavioral strategies.

• The national institute of health (USA) consensus statement on acupuncture (1997) concluded that it may be useful as an adjunct treatment\(^{27}\).

• This review indicates a need for future investigation of dry needling therapies as part of a comprehensive program.
Conclusions

- No clear evidence that Dry Needling techniques are more efficacious than placebo, sham, or alternative treatment techniques

- No clear recommendations can be made regarding the most effective needling technique or optimal length and frequency of treatment

- Results suggest that multiple treatment sessions are more effective on pain outcomes than single treatment sessions

- Level of evidence does not exceed moderate
Thank you! 😊

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References


