Comparing Trigger Point Dry Needling and Manual Pressure Technique for the Management of Myofascial Neck/Shoulder Pain: A Randomized Clinical Trial

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ABSTRACT

Objective: The aim of this study was to investigate short-term and long-term treatment effects of dry needling (DN) and manual pressure (MP) technique with the primary goal of determining if DN has better effects on disability, pain, and muscle characteristics in treating myofascial neck/shoulder pain in women.

Methods: In this randomized clinical trial, 42 female office workers with myofascial neck/shoulder pain were randomly allocated to either a DN or MP group and received 4 treatments. They were evaluated with the Neck Disability Index, general numeric rating scale, pressure pain threshold, and muscle characteristics before and after treatment. For each outcome parameter, a linear mixed-model analysis was applied to reveal group-by-time interaction effects or main effects for the factor “time.”

Results: No significant differences were found between DN and MP. In both groups, significant improvement in the Neck Disability Index was observed after 4 treatments and 3 months \( (P < .001) \); the general numerical rating scale also significantly decreased after 3 months. After the 4-week treatment program, there was a significant improvement in pain pressure threshold, muscle elasticity, and stiffness.

Conclusion: Both treatment techniques lead to short-term and long-term treatment effects. Dry needling was found to be no more effective than MP in the treatment of myofascial neck/shoulder pain. (J Manipulative Physiol Ther 2017;40:11-20)

Key Indexing Terms: Neck Pain; Trigger Points; Myofascial Pain Syndromes

INTRODUCTION

Neck/shoulder pain is a common musculoskeletal complaint that is more frequent in women \(^1\) and affects 45% to 54% of the general population. \(^1\) Jobs involving prolonged static postures and/or repetitive upper limb movements, such as office work, may lead to the development of myofascial neck pain. \(^6,9\)

Myofascial pain can be diagnosed by the presence of one or more myofascial trigger points (MTrPs), defined as a hyperirritable spot in a palpable taut band of skeletal muscle fibers. \(^10-12\) Myofascial trigger points can be clinically classified as active or latent. An active MTrP causes spontaneous pain or pain during movement, stretch, or compression, whereas latent MTrPs are usually asymptomatic, with pain or discomfort provoked by compression only. \(^10-12\) The pathophysiology of MTrPs is poorly understood, but it is hypothesized that sustained postures and/or repetitive low-level tasks lead to the development of MTrPs. \(^8,13,14\)

Typical symptoms associated with MTrPs are local and referred pain, muscle weakness, and restricted range of motion. \(^10\) A combination of these symptoms could have a large impact on the quality of life, mood, and health status. \(^15\)

Treatment of myofascial pain is based on inactivating the MTrPs, mostly by a manual pressure (MP) technique or dry needling (DN). \(^16-18\) In the MP technique, the physiotherapist applies increasing pressure directly on the MTrP. \(^19\) There are two types of DN: superficial DN, which penetrates only the skin and superficial muscle, and deep DN, which involves the insertion of a solid filiform needle directly into the MTrP. \(^20-22\) Precise needling of the MTrP provokes a local twitch response (LTR), a brief muscle contraction, which should be elicited for successful therapy. \(^24\) The needle is moved up and down with or without withdrawal from the muscle tissue to elicit LTRs. \(^25\)
Several recent studies\textsuperscript{19,22,26-39} and a systematic review\textsuperscript{40} reported evidence for the use of MP and DN in the treatment of patients with neck and shoulder pain. They reported a decrease in pain intensity,\textsuperscript{26-33,40} a higher pressure pain threshold (PPT)\textsuperscript{19,22,31-34,40,41} improvement in functionality,\textsuperscript{30,32,35,36,40} increase in range of motion,\textsuperscript{27,28,31,33,37,40} reduction of stiffness,\textsuperscript{38} and improvement of muscle strength\textsuperscript{10,28,39} after DN and/or MP. These studies often compared DN or MP with a placebo or other treatment techniques, but studies comparing treatment effects between DN and MP and evaluating effects in the long term for both treatment techniques are lacking.\textsuperscript{40}

Therefore, the aim of this study was to investigate whether both treatment techniques lead to short-term and/or long-term treatment effects, with our primary goal to determine if DN has a better effect than MP on disability, pain intensity (primary outcome measures), PPT, and muscle characteristics which involve muscle tone, elasticity, and stiffness (secondary outcome measures) in female office workers with neck/shoulder pain of myofascial origin. We hypothesized that both treatment techniques will lead to short-term and long-term treatment effects, but with significantly larger effects in the DN group than in the MP group.

\section*{Methods}

\subsection*{Study Population}

Female office workers with neck and/or shoulder pain related to MTrPs in neck and shoulder muscles were recruited from several workplaces with predominantly computer-based tasks from September to November 2014. It was opted to include only women, as myofascial neck/shoulder pain is typically more prevalent among women and to avoid the influence of sex differences on outcome. They had to be performing at least 20 hours of computer work a week and had to have neck/shoulder complaints for at least 3 months and a Neck Disability Index (NDI) score \textgtrq 10/50 to be included. Subjects were excluded for the following reasons\textsuperscript{1}:

1. if they were diagnosed with neurologic problems, a systemic disease, or an injury caused by trauma\textsuperscript{2};
2. if they were in therapy for their actual complaints at the time of the study;
3. if they were pregnant. All subjects signed an informed consent, and the study was approved by the local ethics committee of Ghent University Hospital. This study was registered at ClinicalTrials.org PRS under Registration No. 2013/ 903 NCT02301468.

\subsection*{General Study Design}

The general study design is illustrated in a flowchart (Fig 1). Before testing, participants had to complete an online questionnaire on demographic features, work, and current complaints together with the NDI. During the first meeting, subjects were asked to rate their general pain intensity on a numeric rating sale (NRS). In addition, a clinical examination of the neck and shoulder region was performed by an experienced physiotherapist to identify the 4 most painful MTrPs. Subjects were then evaluated for PPT and muscle characteristics at these MTrPs (see below). These measures were repeated after the first treatment (post 1) and together with the NDI after 4 treatments (post 2). The NDI and general pain score were repeated again after 3 months (post 3). Subjects underwent 4 treatment sessions (once a week), consisting of MP or DN to the 4 MTrPs identified as most painful. During the 4-week treatment period, participants were not allowed to have any other treatment for their neck/shoulder complaints. Treatments were performed at the clinical practice of 1 of 2 experienced physiotherapists participating in this study. Outcome measures were evaluated before and after treatment by the same assessors, who were blinded to the treatment allocation. Statistical analysis was performed by an independent researcher.

\subsection*{Testing Protocol}

\subsubsection*{Primary Outcome Measures}

\textbf{Disability.} Disability was evaluated using the NDI. The NDI (Dutch-language version) is a valid questionnaire to measure self-reported neck pain-related disability.\textsuperscript{42} A score between 5 and 14 represents a mild disability, whereas a score between 15 and 24 is interpreted as a moderate disability. Neck Disability Index scores \textgtrq 25 reflect a severe disability.\textsuperscript{43}

\textbf{General NRS.} The NRS was used to measure general pain experience (neck/shoulder pain during the past week). Subjects had to score their pain on a scale from 0 (no pain) to 10 (worst pain).\textsuperscript{44}

\textbf{Secondary Outcome Measures}

\textbf{Pressure Pain Threshold.} First, pressure pain sensitivity was determined by deep palpation of 6 anatomical MTrP locations on the left and right sides: upper and middle trapezius, levator scapulae, infraspinatus, and supraspinatus (medial and lateral MTrPs). After identification of a taut band, a pressure of 50 N was applied with the thumb to the most sensitive tender spot/nodule. Subjects were asked to rate their pain on an NRS from 0 to 10, for each MTrP location.

On the basis of this rating, the 4 most painful points were selected for evaluation of PPT using a Wagner FPX Digital Algometer. The examiner applied an increasing pressure of 1 N/s on the MTrPs until the patient indicated that the feeling of pressure changed into a feeling of pain. The pressure at that moment was determined as the PPT (expressed in N). Each of the selected MTrPs was evaluated consecutively, and this procedure was repeated 3 times with a 30-second break in between. The use of pressure algometry has been found to be a reliable technique for determining PPT.\textsuperscript{45}

\textbf{Muscle Characteristics.} The MyotonPRO was used to measure muscular mechanical properties (tone, elasticity,
and stiffness) of the upper trapezius. Both sides were measured 2 consecutive times at the midpoint between the spinous process of C-7 and the acromion. Oscillation frequency, expressed in Hertz (Hz), characterizes muscle tone in the resting state. Logarithmic decrease in the natural oscillation of a muscle indicates the elasticity, which represents the ability of a muscle to recover its shape after contraction. Elasticity is inversely proportional to the decrement. Dynamic stiffness, expressed in newtons per meter, represents the resistance of the muscle to contraction. The intrarater reliability of the MyotonPRO has been reported to be high in measuring mechanical properties of the quadriceps muscle, but psychometric properties on the upper trapezius are currently lacking.

**Intervention**

Participants were randomly allocated to either the MP or DN group using block randomization. They were asked to choose a card from an envelope (group A: MP, group B: DN). A block size of 10 was consecutively used with the allocation of 5 subjects to each group. This was performed by an independent researcher. Manual pressure and DN were both applied to the 4 most painful MTrPs, which were determined as mentioned before. The therapist localized the MTrP within a taut band of the muscle and performed the treatment precisely on the MTrP. This procedure was repeated consecutively for each MTrP, and each patient was treated once a week for 4 weeks.

**MP Technique.** Patients were asked to sit on a chair with their hands resting on the thighs to relax the neck/shoulder muscles. Manual pressure was performed with a wooden cone; the apex of the cone was placed on the MTrP. The therapist slowly increased the pressure at 10 N/s until the subjects reported their highest tolerable level. This pressure was maintained for 60 seconds.

**Dry Needling.** Patients were asked to lie in a prone position with the arms next to the body. Dry needling was performed with a 0.30 x 30-mm J-type acupuncture needle with a guiding tube. The therapist palpated the MTrPs and then inserted the needle through the skin. Consecutively, the taut band was needled forward and backward until the

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*Fig 1. Flowchart of general study design and number of participants during each phase of the study. DN, dry needling; MP, manual pressure technique; MTrPs, myofascial trigger points; n, number of participants; NDI, neck disability index; NRS, numeric rating scale; PPT, pressure pain threshold.*
The exact position of the MTrP was reached. Precise needling of the MTrP elicited a brief contraction followed by relaxation of the muscle fibers; this is known as an LTR. Needling of the MTrP was repeated until LTRs were extinct.

Statistical Analysis

Data were analyzed using SPSS Statistics for Windows, Version 22.0 (IBM, Armonk, NY, USA). Descriptive statistics (means ± standard deviation) were calculated for all parameters. For each outcome parameter, a linear mixed-model analysis was applied with the factors “time” (pre, post 1, post 2, and post 3) and “treatment” (MP and DN) to determine if there were significant differences between different time points and treatment modalities. The residuals of the linear mixed models were checked for normal distribution. Post hoc pairwise comparisons were performed when required using a Bonferroni correction. Only group-by-time interaction effects or a main effect for the factor “time” was further interpreted. Because we were interested only in differences between different time points, the main effect for the factor “treatment” was not further interpreted. Statistical significance was accepted at an α level of 0.05.

A total sample size of at least 36 subjects had to be recruited based on an a priori power analysis (G*Power 3.1.5). This power analysis was performed for the within-between interaction in a repeated-measures analysis of variance with 2 groups, 3 measurements (baseline, measurements after 4 interventions, and measurements after 3 months), a minimum power of 0.90, an effect size of 0.25, and an α level of 0.05.

RESULTS

Subjects

Forty-two female office workers (age range, 24-54 years) participated in this study. Twenty-two subjects were allocated to the MP group, whereas 20 subjects were included in the DN group. Demographic features of both treatment groups are summarized in Table 1. As there was no imbalance in demographic data, no covariates were included for data analysis. One patient in the MP group and 3 patients in the DN group dropped out during the course of the study (Fig 1). The majority of MTrPs were found in the left (14%) and right (16%) upper trapezius, right levator scapulae (11%), and right middle trapezius (11%). Of all participants, 71.4% had had complaints for more than 12 months. Apart from some minor side effects reported after treatment, such as postneedling soreness in the DN group, no adverse events were reported.

Primary Outcome Measures

Descriptive statistics of primary outcome measures are shown in Table 2. The linear mixed-model analysis revealed no significant group-by-time interaction effects for NDI and general NRS (P > 0.05).

Neck Disability Index. The linear mixed-model analysis revealed a significant main effect for time in the NDI (P < 0.001) (Table 3). Post hoc tests revealed significantly decreased NDI scores after 4 weeks of treatment (P = .001) and after 3 months (P < .001) compared with baseline.

General NRS. A significant main effect for time was observed for the general NRS (P = .001) (Table 3). Post hoc tests revealed a significant decrease in general pain scores after 3 months (P = .001).

Secondary Outcome Measures

Descriptive statistics of secondary outcome measures are shown in Table 2. No significant group-by-time interaction effects were observed for PPT and muscle characteristics (P > .05).

Pressure Pain Threshold. Significant main effects for time were observed for all MTrPs (MTrPs 1, 3, 4: P < .001; MTrP 2: P = .004; Table 3). Post hoc tests revealed a significant increase in PPT after 4 weeks of treatment compared with baseline for all MTrPs (MTrPs 1, 3: P < .001; MTrP 2: P = 0.022; MTrP 4: P = .001).

Muscle Characteristics. No main effects were observed for muscle tone (Table 3).

Significant main effects for time were observed for left (P = .003) and right (P = .006) elasticity (Table 3). Post hoc tests revealed a significant decrease in decrement after 4 treatments in comparison with baseline measurements (left: P = .017; right: P = .030).

A significant main effect for time was observed for right stiffness (P = .009; Table 3). After the 4-week treatment program, post hoc tests revealed a significant decrease in muscle stiffness on the right side compared with baseline measurements (P = .012).

DISCUSSION

The primary aim of this study was to determine whether DN is better than MP in treating myofascial neck/shoulder pain with respect to effects on disability, pain, and muscle characteristics. The secondary aim of this study was to
investigate whether both techniques lead to short-term and/or long-term treatment effects.

It was hypothesized that both techniques would lead to short-term and long-term treatment effects, but with larger effects in the DN group than in the MP group. This because we hypothesized, based on clinical experience, that treatment with DN is more local and specific because of the smaller contact point and the possibility of accessing deeper muscles and provoking LTRs more easily, compared with MP. On the basis of the results, DN seems to be no more effective than MP. Improvements after treatment with MP or DN were found in the short term for NDI, PPT, muscle elasticity, and stiffness and in the long term for both NDI and general NRS.

Both interventions resulted in a significant decrease in NDI scores in the short and long terms. The improved functionality may be a consequence of the decrease in pain and improvement in muscle tone and elasticity after treatment. Despite these statistically significant results, the observed changes are lower than the minimal clinical important difference for the NDI, which requires a decrease of 17 points to obtain a patient-perceived change (Table 3). Llamas-Ramos and colleagues investigated the effect on pain intensity and PPT in patients with myofascial pain in the upper trapezius muscle. They observed similar improvements in pain intensity and PPT after treatment.

Table 2. Descriptive Statistics of NDI, General NRS, PPT, and Muscle Characteristics of Each Group at Different Time Points

<table>
<thead>
<tr>
<th>Primary Outcome Measures</th>
<th>Group</th>
<th>Baseline</th>
<th>After 4 Treatments</th>
<th>After 3 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDI MP</td>
<td>13.14 ± 4.60</td>
<td>10.95 ± 4.63</td>
<td>9.09 ± 4.35</td>
<td></td>
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<tr>
<td>NDI DN</td>
<td>11.00 ± 5.12</td>
<td>7.71 ± 4.66</td>
<td>8.06 ± 5.08</td>
<td></td>
</tr>
<tr>
<td>NDI DN</td>
<td>5.86 ± 1.36</td>
<td>4.19 ± 1.97</td>
<td>3.59 ± 2.06</td>
<td></td>
</tr>
<tr>
<td>NDI MP</td>
<td>4.70 ± 1.81</td>
<td>4.70 ± 1.81</td>
<td>4.70 ± 1.81</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Secondary Outcome Measures</th>
<th>Group</th>
<th>Baseline</th>
<th>After 1 Treatment</th>
<th>After 4 Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPT MTrP 1 MP</td>
<td>16.20 ± 5.96</td>
<td>16.59 ± 6.87</td>
<td>21.47 ± 8.18</td>
<td></td>
</tr>
<tr>
<td>PPT MTrP 1 DN</td>
<td>19.69 ± 7.25</td>
<td>18.04 ± 7.93</td>
<td>23.50 ± 9.35</td>
<td></td>
</tr>
<tr>
<td>PPT MTrP 1 DN</td>
<td>20.01 ± 9.14</td>
<td>16.68 ± 7.15</td>
<td>23.71 ± 12.14</td>
<td></td>
</tr>
<tr>
<td>PPT MTrP 1 DN</td>
<td>19.50 ± 8.59</td>
<td>18.87 ± 8.13</td>
<td>25.54 ± 7.89</td>
<td></td>
</tr>
<tr>
<td>PPT MTrP 1 DN</td>
<td>20.63 ± 8.48</td>
<td>17.70 ± 6.91</td>
<td>25.68 ± 10.68</td>
<td></td>
</tr>
<tr>
<td>PPT MTrP 1 DN</td>
<td>18.07 ± 7.64</td>
<td>18.78 ± 7.46</td>
<td>26.20 ± 10.73</td>
<td></td>
</tr>
<tr>
<td>PPT MTrP 1 DN</td>
<td>21.34 ± 8.38</td>
<td>18.06 ± 7.35</td>
<td>28.07 ± 11.31</td>
<td></td>
</tr>
<tr>
<td>Tone left MP</td>
<td>19.29 ± 2.12</td>
<td>19.69 ± 2.10</td>
<td>19.18 ± 2.00</td>
<td></td>
</tr>
<tr>
<td>Tone left DN</td>
<td>18.61 ± 2.83</td>
<td>18.80 ± 2.57</td>
<td>18.44 ± 3.11</td>
<td></td>
</tr>
<tr>
<td>Tone right MP</td>
<td>19.33 ± 1.79</td>
<td>19.04 ± 1.74</td>
<td>18.79 ± 1.47</td>
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</tr>
<tr>
<td>Tone right DN</td>
<td>19.21 ± 2.81</td>
<td>19.28 ± 2.97</td>
<td>18.86 ± 3.55</td>
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</tr>
<tr>
<td>Elasticity left MP</td>
<td>1.28 ± 0.19</td>
<td>1.29 ± 0.17</td>
<td>1.23 ± 0.14</td>
<td></td>
</tr>
<tr>
<td>Elasticity left DN</td>
<td>1.24 ± 0.22</td>
<td>1.24 ± 0.19</td>
<td>1.17 ± 0.15</td>
<td></td>
</tr>
<tr>
<td>Elasticity right MP</td>
<td>1.26 ± 0.18</td>
<td>1.29 ± 0.19</td>
<td>1.22 ± 0.15</td>
<td></td>
</tr>
<tr>
<td>Elasticity right DN</td>
<td>1.21 ± 0.16</td>
<td>1.21 ± 0.16</td>
<td>1.14 ± 0.14</td>
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</tr>
<tr>
<td>Stiffness left MP</td>
<td>398.32 ± 61.69</td>
<td>410.30 ± 60.58</td>
<td>390.02 ± 65.81</td>
<td></td>
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<tr>
<td>Stiffness left DN</td>
<td>382.30 ± 81.82</td>
<td>386.55 ± 71.07</td>
<td>365.66 ± 90.61</td>
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<tr>
<td>Stiffness right MP</td>
<td>401.86 ± 56.07</td>
<td>394.55 ± 52.42</td>
<td>380.11 ± 49.47</td>
<td></td>
</tr>
<tr>
<td>Stiffness right DN</td>
<td>402.28 ± 83.82</td>
<td>403.68 ± 84.18</td>
<td>385.24 ± 102.80</td>
<td></td>
</tr>
</tbody>
</table>

Values are expressed as the mean ± standard deviation. Descriptive statistics calculated prior to the linear mixed-model analysis.

DN, dry needling; MP, manual pressure; MTrP, myofascial trigger point; NDI, neck disability index; NRS, numeric rating scale; PPT, pressure pain threshold.

did not observe significant changes in NDI scores, probably because of a low mean baseline score (8.63/50). In this study, the mean baseline score was higher (12.1/50) so there was more potential for improvement.

A significant decrease in general NRS after treatment with MP or DN was observed in the long term. Despite this significant difference, the decrease in NRS was lower than the minimal clinical important difference of 1.5 points, which is required to obtain a small detectable patient-perceived change (Table 3). Llamas-Ramos and colleagues also investigated the effect on pain intensity and PPT in patients with myofascial pain in the upper trapezius muscle. In line with our findings, they also observed a similar decrease in pain intensity after both interventions. In contrast, Ziaifar and colleagues compared DN with MP and observed a significantly larger decrease in pain scores after DN. Several other studies also observed an improvement in pain intensity after treatment with either DN or MP, compared with other control interventions.

Cagnie and colleagues observed a significantly higher decrease in pain scores after MP and DN, respectively, compared with a control group without intervention. Rayegani et al investigated the effect of DN on pain intensity and PPT in patients with myofascial pain in the upper trapezius muscle. They observed similar improvements in pain intensity and PPT after treatment. Napravnik and colleagues found a greater improvement in pain...
Table 3. Within-Group Differences for Primary and Secondary Outcome Measures: Main Effects for Time

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Time Point</th>
<th>Mean ± Standard Deviation</th>
<th>Within-Group Differences Compared With Baseline</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary outcome measures</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NDI (0-50)*</td>
<td>Baseline</td>
<td>12.07 ± 0.73</td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>After 4 treatments</td>
<td>9.37 ± 0.74</td>
<td>-2.70 ± 0.74 (-4.51, -0.88)</td>
<td>.001</td>
</tr>
<tr>
<td></td>
<td>After 3 months</td>
<td>8.64 ± 0.76</td>
<td>-3.43 ± 0.76 (-5.29, -1.57)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>General NRS (0-10)b</td>
<td>Baseline</td>
<td>5.29 ± 0.28</td>
<td></td>
<td>.001</td>
</tr>
<tr>
<td></td>
<td>After 3 months</td>
<td>3.88 ± 0.29</td>
<td>-1.40 ± 0.37 (-2.16, -0.65)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td><strong>Secondary outcome measures</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPT 1</td>
<td>Baseline</td>
<td>17.87 ± 1.13</td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>After 1 treatment</td>
<td>16.58 ± 1.13</td>
<td>-1.29 ± 1.13 (-4.07, 1.48)</td>
<td>.772</td>
</tr>
<tr>
<td>PPT 2</td>
<td>Baseline</td>
<td>18.29 ± 1.38</td>
<td></td>
<td>.004</td>
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<td></td>
<td>After 1 treatment</td>
<td>17.41 ± 1.38</td>
<td>-0.88 ± 1.28 (-4.00, 2.25)</td>
<td>.999</td>
</tr>
<tr>
<td>PPT 3</td>
<td>Baseline</td>
<td>20.04 ± 1.31</td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>After 1 treatment</td>
<td>18.31 ± 1.31</td>
<td>-1.73 ± 0.99 (-4.15, 0.70)</td>
<td>.257</td>
</tr>
<tr>
<td>PPT 4</td>
<td>Baseline</td>
<td>19.66 ± 1.37</td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>After 1 treatment</td>
<td>18.47 ± 1.37</td>
<td>-1.19 ± 1.94 (-5.90, 3.52)</td>
<td>.999</td>
</tr>
<tr>
<td>Frequency (tone)</td>
<td>Left</td>
<td>Baseline</td>
<td>18.95 ± 0.38</td>
<td></td>
</tr>
<tr>
<td></td>
<td>After 1 treatment</td>
<td>19.25 ± 0.38</td>
<td>0.31 ± 0.26 (-0.33, 0.94)</td>
<td>.739</td>
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<tr>
<td></td>
<td>Right</td>
<td>Baseline</td>
<td>19.27 ± 0.38</td>
<td></td>
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<tr>
<td></td>
<td>After 1 treatment</td>
<td>19.16 ± 0.38</td>
<td>-0.11 ± 0.20 (-0.61, 0.39)</td>
<td>.999</td>
</tr>
<tr>
<td>Decrement (elasticity)</td>
<td>Left</td>
<td>Baseline</td>
<td>1.26 ± 0.03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>After 1 treatment</td>
<td>1.27 ± 0.03</td>
<td>0.01 ± 0.02 (-0.04, 0.05)</td>
<td>.999</td>
</tr>
<tr>
<td></td>
<td>Right</td>
<td>Baseline</td>
<td>1.24 ± 0.03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>After 1 treatment</td>
<td>1.25 ± 0.03</td>
<td>0.01 ± 0.02 (-0.04, 0.06)</td>
<td>.999</td>
</tr>
<tr>
<td>Stiffness</td>
<td>Left</td>
<td>Baseline</td>
<td>390.23 ± 11.19</td>
<td></td>
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<tr>
<td></td>
<td>After 1 treatment</td>
<td>398.52 ± 11.29</td>
<td>8.30 ± 7.82 (-10.83, 27.42)</td>
<td>.876</td>
</tr>
<tr>
<td></td>
<td>Right</td>
<td>Baseline</td>
<td>402.20 ± 11.25</td>
<td>.009</td>
</tr>
<tr>
<td></td>
<td>After 1 treatment</td>
<td>399.03 ± 11.25</td>
<td>-3.17 ± 6.14 (-18.17, 11.84)</td>
<td>.999</td>
</tr>
</tbody>
</table>

Values are expressed as the mean ± standard deviation (95% confidence interval). Significant differences are presented in boldface. Main effects for time for each outcome parameter are underlined. Statistical analyses were performed using linear mixed-model analyses. Post-hoc pairwise comparisons for the different time points were performed using Bonferroni correction.

NDI, neck disability index; NRS, numeric rating scale; PPT, pressure pain threshold.

* Score from 0 (no disability) to 50 (complete disability).

b Score from 0 (no pain) to 10 (worst pain).

intensity after a combination of MP techniques, compared with muscle energy techniques. It should be noted that only 1 study also evaluated treatment outcome in the long term.19

Pressure pain threshold was measured at the most painful trigger points, which were present mainly in the upper trapezius, middle trapezius, and levator scapulae muscles. Pressure pain threshold increased significantly for all 4 most painful MTrPs, after 4 weeks of treatment with MP or DN. This is in line with the findings of Ziaeifar et al, who observed a similar increase in PPT after treatment with DN and MP.50 On the contrary, Llamas-Ramos et al observed a higher increase in PPT after DN, compared with MP, in patients with chronic neck pain.33 Other studies have also reported an increase in PPT after either MP19,51 or DN,31,52 compared with other control interventions. Cagnie et al19 and Mejuto-Vazquez et al31 observed higher PPTs after treatment with MP and DN respectively, compared with no intervention. In the latter study, they found higher PPTs at distant locations from the MTrP, which may represent reduced widespread pain sensitivity.31 Oliveira-Campelo et al reported better effects on PPT 24 hours and 1 week after MP, compared with other control interventions. Cagnie et al19 and Mejuto-Vazquez et al31 observed higher PPTs after treatment with MP and DN respectively, compared with no intervention. In the latter study, they found higher PPTs at distant locations from the MTrP, which may represent reduced widespread pain sensitivity.31
Needle stimulation of the MTrP may lead to increased blood flow and a reduction in nociceptive substances. Dry needling may also stimulate Aδ fibers and activate inhibitory pain systems. Additionally, pain relief from MP may result from reactive hyperemia and a spinal reflex mechanism resulting in a release of muscle spasm.

A significant improvement in bilateral elasticity and stiffness on the right side was observed. To our best knowledge, this is one of the first studies investigating changes in muscle characteristics after DN or MP. In a preliminary study, Maher et al investigated changes in shear modulus by means of ultrasound shear wave elastography. They observed a significant reduction in shear modulus, which may indicate a reduction in muscle stiffness. Although the exact underlying mechanisms are unclear, several hypotheses may explain the improvement in muscle characteristics observed in the present study. A release of muscle spasm by MP may explain improvements in muscle elasticity and stiffness. Furthermore, eliciting LTRs by DN may interrupt motor endplate noise and relax actin-myosin filaments in tight muscle fibers.

The present study has several strengths. A novelty of this study was the use of the MyotonPro device, which is an easily applicable and noninvasive tool used to obtain information on muscle tone, stiffness, and elasticity. These muscle characteristics are rarely investigated in the field of myofascial pain and may be of added value in evaluating treatment effects of DN and MP.

This study also aimed at evaluating pain intensity and disability in the long term, because most studies on DN or MP limited the follow-up period to maximally 4 weeks, and no long-term treatment effects could be evaluated. In contrast to our study, in which several neck/shoulder muscles were treated during multiple treatment sessions, the majority of previous research involved treatment of only 1 muscle, mostly the upper trapezius. Treatment was also often limited to 1 session. The present study emphasizes the need for the investigation of other neck and shoulder muscles during multiple treatment sessions and with long-term follow-up evaluation. To our best knowledge, this is also one of the first studies comparing DN and MP, two myofascial release techniques frequently used in clinical practice.

The lack of differences between the DN and MP groups may be explained by the fact that all treated muscles are superficial muscles so they are all easily accessible for both techniques. This could be interesting for clinical practice, as MP could serve as an effective alternative for the treatment of myofascial pain, in case of needle phobia of the patient or limited DN skills of the physiotherapist.

Study Limitations

When interpreting the results of this study, some limitations have to be taken into account. First, patients and therapists could not be blinded for intervention, inherent to the techniques that were used. However, the assessors of the outcome measures were blinded to the treatment allocation, and the statistical analysis was performed by an independent researcher. Second, treatments were performed by 2 different therapists. To minimize differences in outcome, both therapists practiced the treatment protocol together to optimize uniformity. Third, additional treatments were not allowed in the study protocol to evaluate the specific treatment effects of MP and DN. This is, however, not a reflection of the actual clinical practice, which may also explain the rather low treatment effect in both groups. In addition, treated MTrPs were individually determined and were consequently not equal in all participants, which made interpretation more difficult. On the other hand, this way of handling patients in a more individualized manner is more equal to clinical practice. Fourth, because of the absence of a control group, improvements could be attributed to nonspecific intervention effects or the passage of time. Finally, these results may not be generalizable to all neck pain patients because only women in a specific age category (working population) and culture were included in the present study. On the other hand, variability in outcome with respect to sex, cultural, or age differences could be ruled out.

Future studies should include multiple treatment sessions of multiple muscles and evaluate treatment effects in the long term. In addition, a control group should be included to evaluate treatment effects of DN and MP.

CONCLUSION

Dry needling was found to be no more effective than MP in the treatment of neck/shoulder pain of myofascial origin in female office workers. After both treatments, reduced disability was observed in the short and long terms, and general NRS improved in the long term. After the 4-week treatment program, there was improvement in PPT, muscle elasticity, and stiffness.

Practical Applications

- Dry needling and MP technique both have positive short-term and long-term effects on disability, pain, and muscle characteristics in people with myofascial neck/shoulder pain.
- Dry needling was no more effective in the treatment of myofascial pain than MP technique.
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