Effectiveness of dry needling for the treatment of temporomandibular myofascial pain: A double-blind, randomized, placebo controlled study

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Abstract. Background and objectives: To test the hypothesis that dry needling is more effective than sham dry needling in relieving myofascial pain of the temporomandibular muscles.

Material and method: Fifty-two subjects with established myofascial trigger points were randomized into two groups; study group (N: 26) and placebo group (N: 26). Dry needling was applied using acupuncture needles. Sham dry needling was applied to the placebo group. Pain pressure threshold was measured with pressure algometry, pain intensity was rated using a 10-cm visual analog scale (VAS) and the unassisted jaw opening without pain measurement was performed. Evaluations were done by a physician blinded to the data.

Results: Of 52 patients assigned, 50 completed the study. Mean algometric values were significantly higher in the study group when compared to the placebo group (p values being less than 0.05). There were no differences between the two groups in terms of VAS and unassisted jaw-opening without pain values.

Conclusion: Dry needling appears to be an effective treatment method in relieving the pain and tenderness of myofascial trigger points.

Keywords: Myofascial pain, temporomandibular joint, dry needling, pressure algometry

1. Introduction

Pain in the temporomandibular region appears to be relatively common, occurring in approximately 10% of the adult population whereby muscle pain accounts for a significant portion of the painful complaints [1, 2]. The pathophysiology of muscle pain is not fully understood; however myofascial pain dysfunction syndrome (MPDS) has been proposed as one of the important causes of unilateral temporomandibular joint (TMJ) pain. In general, the syndrome is characterized by palpable muscle tenderness and trigger points, discrete focal tenderness located in a palpable taut band of the skeletal muscle which produces a local twitch in response to snapping palpation of the band [3,4]. The spots are painful on compression and can give rise to characteristic referred pain, referred tenderness, motor and autonomic dysfunction [5]. The clinical scenario may well be accompanied by fatigue, decrease in joint movements and mild muscle weakness [6]. In cases of MPDS nearby the temporomandibular area, the
masseter muscle, followed by the temporalis muscle, is mostly affected. The former is usually described by the patients as jaw pain and the latter as headache. Pain is generally felt in the morning but may increase further as the mandible is used throughout the day [7].

Several treatment modalities including injections have been suggested in the treatment of MPDS. Trigger point injections are carried out by using local anesthetics, corticosteroids, saline, neurolytic agents, chemodenervation and dry needling [8–11]. According to a recent metaanalysis, dry needling is not effective in the treatment of myofascial pain and high quality placebo controlled trials are needed in this area [12]. To the best of our knowledge, the effects of dry needling has not been reported in MPDS involving the TMJ; therefore the aim of our study was to compare the effects of dry needling with sham dry needling in relieving myofascial pain of the temporomandibular muscles.

2. Materials and methods

We conducted a double-blinded, prospective, randomized, placebo-controlled trial. The study was carried out in a Multidisciplinary Temporomandibular Joint Disorders Unit of a University Hospital where patients were evaluated by dentists, plastic surgeons, psychiatrists and physiatrists.

2.1. Patients

A total of 52 subjects (45 females and 7 males) aged between 18 to 57 years were enrolled. Patients having symptoms of at least six weeks and who had two or more myofascial trigger points in the temporomandibular muscles (Fig. 1) were included in the study. A trigger point was diagnosed inside a taut band and exhibiting pain referral after application of 1.5 kg/cm² with a rate of 0.5 kg/s (detected with pressure algometry). Exclusion criteria included presence of any of the followings: TMJ degeneration, reducible or non-reducible disc replacements, TMJ subluxation, TMJ neoplasms, inflammatory diseases involving TMJ, TMJ ankylosis, fracture in the bones forming the TMJ, history of TMJ surgery, radiotherapy to the TMJ region, occlusion anomaly, major anomalies in the mandible, teeth and gums, hypermobility syndrome, blood dyscrasias, trigeminal neuralgia and major psychiatric disorders.

Patients were assigned to the study (N:26) and placebo (N:26) groups by using randomized numbers obtained from QuickCalcs (© GraphPath Software) software.

2.2. Dry needling

In the study group, dry needling therapy with intramuscular stimulation was applied on the trigger points using standard single-use sterile acupuncture needles (0.22 mm × 30 mm) with plastic guide tubes (3 times with 7-day intervals). The needle was inserted to the depth allowed by the guide tube and was stimulated 3 or 5 times [13].

In the placebo group, sham dry needling was applied to areas away from the trigger points in masseter and temporalis muscles with attention not to insert deeper than the subcutaneous stratum. In both groups, all needlings were performed by the same physician using the same needles within a constant time period.

2.3. Evaluation of the patients

Pain-pressure threshold was measured with a pressure algometer. It is a diagnostic instrument used to assess trigger point sensitivity up to 10 kg in kg/cm² [14]. It can be activated with a 1 cm² diameter rubber disc and a metal rod screwed on the tip. The apex of the instrument is placed on the region with maximal sensitivity with a 90° angle. Pressure is continuously applied until the patient starts to complain (indicated verbally in this study). The speed of the algometer movement during compression is very slow (0.5 kg/s in this study). In algometric measurements, high values show that the pain threshold is high, thus the patient has less pain [15,16]. Pressure algometry can measure the pressure force needed for the patient to start feeling the
pain; called “the pain threshold” in kg/cm². Since the
number and the localizations of trigger points varied
among patients, an “algometric mean value”, obtained
by dividing the total algometric value in each patient
by the number of trigger points, was used for making
comparisons.

Pain intensity in a day was rated by using a 10-cm
visual analog scale (VAS) where 0 indicated “no pain at
all” and 10 indicated “the worst pain ever experienced”.
Measurement of unassisted jaw-opening without pain
was done with a ruler as millimeters (mm) before and
after the treatment.

Evaluations were carried out immediately before the
study and one week after the last needling, by another
physician who was blinded to the patients’ groups. Pa-
tients were also not informed about which group they
belonged to. All subjects received an education pro-
gram about TMJ disorders. Oral and written informed
consents were obtained from each participant before
the study and the local ethics committee approved the
study.

2.4. Statistics

SPSS 15.0 statistical software was used for analy-
sis. Paired samples t-test was used for comparing para-
metric variables before and after intervention in each

3. Results

Of 52 patients assigned, 50 completed the study
(Fig. 2). The mean age values of the study and placebo
groups were 33.0 ± 12.7 years and 35.88 ± 9.6 years,
respectively. There were no statistically signifi-
cant differences between groups in terms of age, sex and
educational level (p > 0.05) (Table 1). Among the TMJ
muscles, zones M3 and M1 had the highest incidence
of trigger points (Figs 1 and 3).

There were no significant differences between the
study and placebo groups with respect to mean algo-
metric values, VAS and unassisted jaw-opening with-
out pain in pre-treatment measurements (p > 0.05) (Table
1).

In the study group, mean algometric values increased
and VAS scores decreased after treatment (p values <
0.05). On the other hand, no differences were noted for
unassisted jaw-opening without pain values (Table 2).

Similarly, in the placebo group, mean algometric
values increased and VAS scores decreased after treat-
Table 1
Pre-treatment comparison of the groups

<table>
<thead>
<tr>
<th></th>
<th>Study group (n=25)</th>
<th>Placebo group (n=25)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year) (Mean ± SD)</td>
<td>33.00 ± 12.70</td>
<td>35.88 ± 9.60</td>
<td>0.385</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>22</td>
<td>21</td>
<td>0.687</td>
</tr>
<tr>
<td>Male</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Housewife</td>
<td>10</td>
<td>9</td>
<td>0.470</td>
</tr>
<tr>
<td>Student</td>
<td>6</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Official</td>
<td>1</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Retired</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Mean algometric measure (kg/cm²) (Mean ± SD)</td>
<td>2.64 ± 1.05</td>
<td>2.69 ± 0.38</td>
<td>0.129</td>
</tr>
<tr>
<td>VAS-pain score (Mean ± SD)</td>
<td>6.32 ± 1.54</td>
<td>5.68 ± 1.37</td>
<td>0.828</td>
</tr>
<tr>
<td>Unassisted jaw-opening without pain (mm) (Mean ± SD)</td>
<td>41.20 ± 7.69</td>
<td>39.50 ± 4.72</td>
<td>0.358</td>
</tr>
</tbody>
</table>

VAS: Visual analogue scale, SD: Standard deviation.

Fig. 3. The number of trigger points by zones. (M1, M2, M3: Mandibular zones, T1, T2, T3: Temporal zones).

- A comparison between the study and placebo groups showed a significant difference (p < 0.05) regarding the mean algometric values, in favor of the study group (Table 4). The groups were found to be indifferent concerning VAS and unassisted jaw-opening without pain values (Table 4).

The power value was found to be 0.99 in post-hoc power analysis for algometric measurements.

4. Discussion

In the present study, we evaluated the results of dry needling applied on trigger points in patients with MPDS affecting TMJ muscles. Both the study and placebo groups had favorable changes in algometric measurements, as well as in VAS values following dry needling. An inter-group comparison, on the other hand, yielded significantly better results for the study group with regard to algometric measurements.

Numerous studies investigating the treatment alternatives in myofascial pain have been performed. In a randomized double blind study carried out by Garvey et al., four different treatment modalities; local anesthetics, local anesthetics and steroids, dry needling and acupressure with cold spray were evaluated, and the success rate of the group where dry needling was applied was at least as high as that of the local anesthetic group [17]. In another study on 58 patients with myofascial pain, Hong et al. found that local anesthetic injections and dry needling treatments showed the same effect, but the discomfort felt after the needle was less in
the group where local anesthetic was used [18]. Methods used in the treatment of MPDS can also be combined. When classical acupuncture is compared with dry needling applied on the trigger points, it has been reported that they were almost equally effective on pain and that trigger points correlated 71% with acupuncture points [19,20]. In a study where dry needling was applied on 312 painful spots, rapid analgesia was obtained in 87% of patients and permanent analgesia was obtained in 92 painful zones [15]. On the other hand, there are also studies which either report that these needling therapies used in MPDS are not different from the controls [21] or that they are not effective beyond a placebo [22]. In their study, where VAS and algometric measurements were used in patients with temporomandibular myofascial pain, McMillan et al. [23] compared the effects of local anesthetics and dry needling. They concluded that combined and single uses of local injections and dry needling did not differ from placebo applications.

Dry needling method used in the treatment of myofascial trigger points appears to act by mechanical stimulus of trigger points [15]. Rapid analgesia can occur through the “needle effect” suggested by Lewit [24]. The best analgesia is obtained by injecting the most painful point with a thin needle such as the acupuncture needle. The stimulation caused by the needle appears to act via the central nervous system [25]. It has been also proposed that dry needling of myofascial trigger points acted by decreasing the spontaneous electrical activity seen during the local twitch responses [26]. Melzack suggests that dry needling applied on myofascial trigger points acts through a kind of hyperstimulation analgesia [27] and that the same effect can be obtained with cold-warm compresses and chemical irritation of the skin. In chronic pain, a painful stimulus of short duration can cause long lasting and sometimes permanent relief. Analgesia can be provided via central pathways through the reticular system in the brain stem due to “closing doors”. Prolonged relief may require the dis-

Table 2
Pre- and post-treatment research parameters in the study group (n = 25)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean ± SD</th>
<th>Difference Mean ± SD</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Algometric Measure (kg/cm²)</td>
<td>Pre-treatment</td>
<td>2.64 ± 1.05</td>
<td>−0.57 ± 0.57</td>
</tr>
<tr>
<td></td>
<td>Post-treatment</td>
<td>3.21 ± 1.06</td>
<td></td>
</tr>
<tr>
<td>VAS-pain Score</td>
<td>Pre-treatment</td>
<td>6.32 ± 1.54</td>
<td>2.44 ± 1.73</td>
</tr>
<tr>
<td></td>
<td>Post-treatment</td>
<td>3.88 ± 1.69</td>
<td></td>
</tr>
<tr>
<td>Unassisted jaw-opening without pain (mm)</td>
<td>Pre-treatment</td>
<td>41.20 ± 7.69</td>
<td>1.12 ± 4.79</td>
</tr>
<tr>
<td></td>
<td>Post-treatment</td>
<td>40.08 ± 6.10</td>
<td></td>
</tr>
</tbody>
</table>

VAS: Visual analogue scale, SD: Standard deviation.

Table 3
Pre- and post-treatment research parameters in the placebo group (n = 25)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean ± SD</th>
<th>Difference Mean ± SD</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Algometric Measure (kg/cm²)</td>
<td>Pre-treatment</td>
<td>2.69 ± 0.38</td>
<td>−0.06 ± 0.10</td>
</tr>
<tr>
<td></td>
<td>Post-treatment</td>
<td>2.75 ± 0.35</td>
<td></td>
</tr>
<tr>
<td>VAS-pain Score</td>
<td>Pre-treatment</td>
<td>5.68 ± 1.37</td>
<td>1.88 ± 1.20</td>
</tr>
<tr>
<td></td>
<td>Post-treatment</td>
<td>3.80 ± 1.47</td>
<td></td>
</tr>
<tr>
<td>Unassisted jaw-opening without pain (mm)</td>
<td>Pre-treatment</td>
<td>39.50 ± 4.72</td>
<td>−0.08 ± 0.95</td>
</tr>
<tr>
<td></td>
<td>Post-treatment</td>
<td>39.60 ± 4.18</td>
<td></td>
</tr>
</tbody>
</table>

VAS: Visual analogue scale, SD: Standard deviation.

Table 4
Comparison of the groups

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Study Group (Post-treatment) Mean ± SD</th>
<th>Placebo Group (Post-treatment) Mean ± SD</th>
<th>Type III sum of squares df Mean square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Algometric Measure (kg/cm²)</td>
<td>3.21 ± 1.06</td>
<td>2.75 ± 0.35</td>
<td>3.171</td>
<td>1</td>
<td>19.618</td>
</tr>
<tr>
<td>VAS-pain Score</td>
<td>3.88 ± 1.69</td>
<td>3.80 ± 1.47</td>
<td>0.954</td>
<td>1</td>
<td>0.512</td>
</tr>
<tr>
<td>Unassisted jaw-opening without pain (mm)</td>
<td>40.08 ± 6.10</td>
<td>39.60 ± 4.18</td>
<td>5.645</td>
<td>1</td>
<td>0.688</td>
</tr>
</tbody>
</table>

VAS: Visual analogue scale, SD: Standard deviation.
ruption of reverberatory neural circuits responsible for the “memory” of pain.

Mechanical pressure measurements with algometry and VAS values correlate [28]; however as with other methods which evaluate pain, they are subjective evaluations. On the other hand, because the tenderness exist in muscle motor points for chronic low-back pain: a randomised controlled trial. Acupunct Med 21 (2003), 80-86.

Likewise, it may really be difficult to discern a true treatment effect from a placebo one. Nevertheless, to our best knowledge, our study seems to be the first report showing the beneficial effects of dry needling in comparison with sham needling (applied with strict concern) in temporomandibular MPDS. Herewith, although the results pertaining to VAS and mean algometric measurement were both significant, it is noteworthy that the difference between the pre- and post-treatment VAS values seemed to be clinically relevant.

To conclude, in the light of our first and preliminary findings, deep and point-specific dry needling seems to be more effective than non-point-specific superficial needling in MPDS nearby the TMJ. Further studies with longer follow-up in larger samples are warranted to confirm our results.

References


